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PERFORMANCE OF SEQUENCING BATCH REACTORS FOR NUTRIENT REMOVAL USING SALSNES FLTER FINE MESH SIEVES AS A PRIMARY TREATMENT

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JUNE 2013

ABSTRACT

This study investigated the performance of sequencing batch reactors (SBR) for nitrification and denitrification. Bench scale Salsnes Filter (SF) was used as a primary treatment to provide wastewater with different organic fractions to assess its impact on denitrification. Tests were performed using activated sludge seed and municipal primary wastewater from two different municipal wastewater treatment plants located around Oslo-Norway. Three batch reactors were used; the first one used unfiltered wastewater, the second one used wastewater filtered through 1.2µm, and the third one used wastewater filtered through 18µm SF fine mesh sieve without filter mat formation. Characterization of the influent and effluent was performed. The results showed that the performance of the three reactors were similar, with 94.84% TSS removed for Reactor 1, 92.73% for Reactor 2 and 81.95% for Reactor 3. The percentage of NH_4-N removed was also similar: 98.78% for Reactor 1, 96.09% and 98.22% for Reactor 2 and 3 respectively. The denitrification rate was found to be higher for Reactor 1, however there was no significant difference between the three reactors.

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NOMENCLATURE

(AS) Activated sludge
(BOD) Biological Oxygen Demand
(BNR) Biological Nutrient Removal
(BRA) Bekkelaget Wastewater Treatment Plant
(COD) Chemical Oxygen Demand
(EU) European Union
(HRT) Hydraulic Retention Time
(MBBR) Moving Bed Biofilm Reactor
(MBR) Membrane Bioreactor
(MLE) Modified Ludzack-Ettinger
(MLSS) Mixed Liquor Suspended Solids
(N) Nitrogen
(NFR) Nordre Follo Reseanlegg Sewage Treatment Plant
(N_2) Nitrogen gas
(NH_3) Ammonia
(NH_4) Ammonium
(NH_4-N) Ammonium Nitrogen
(NO_2^-) Nitrite
(NO_2-N) Nitrite Nitrogen
(NO_3^-) Nitrate
(NO_3-N) Nitrate Nitrogen
(P) Phosphorous
(pCOD) Particulate COD
(PO_4^{-3}) Phosphates
(PO_4-P) Orthophosphate
(PSD) Particle Size Distribution
(RAS) Return Activated Sludge
(RBCOD) Readily Biodegradable Chemical Oxygen Demand
(RBS) Rotating Belt Screen
(SBCOD) Slowly Biodegradable Chemical Oxygen Demand
(SBR) Sequencing Batch Reactor
(sCOD) Soluble COD
(SF)Salsnes Filters
(SOP) Standard Operating Procedure
(SRT) Sludge Retention Time
(SS) Suspended Solids
(T) Temperature
(TCOD) Total COD
(TKN) Total Kjeldahl Nitrogen
(TN) Total Nitrogen
(TS)Total Solids
(TSS) Total Suspended Solids
(VFA) Volatile Fatty Acids
(VSS) Volatile Suspended Solids
(ww) Wastewater
(wwtp) Wastewater Treatment Plant

I. INTRODUCTION AND OBJECTIVES

1.1 INTRODUCTION

The use of fine mesh sieves for primary treatment in biological wastewater (ww) treatment is becoming increasingly common. In Norway, fine mesh sieves are undergoing intensive development, decreasing space requirements and investment costs in comparison with other primary treatment processes (Rusten,Lundar,2006). Salsnes Filter AS, is one of the companies which has a patented technology for filtration using fine mesh sieves, and that has been widely used as a primary treatment before the downstream process (Rusten,Ødegaard,2006).

Biological wastewater treatment is one of the methods that remove nutrients (nitrogen and phosphorus). Untreated wastewater rich in nitrogen (N) and other nutrients such as phosphorous (P), if discharged into water bodies, causes eutrophication resulting in undesired consequences on water quality and human health.

Biological N removal from ww is usually accomplished by aerobic nitrification and anoxic denitrification (Bassin *et al.*,2012). These two processes can be done in one single reactor, the sequencing batch reactor (SBR). The use of SBR for nutrient removal has been reported in literature since the mid-1980s (Chang,Hao,1996). The SBR is a fill and draw activated sludge (AS) treatment system that includes five stages: feed, react, settle, draw and idle.

In biological N removal, the quantity of electron donors determines the success of the process. For this reason, the chemical oxygen demand (COD) plays an important role in the process (Gerardi,2002). Large amounts of organic COD in the influent are found in particulate forms, which must be broken down into smaller compounds prior to uptake by microorganisms (Henze *et al.*,2008). Due to this requirement, excess removal of particulate COD (pCOD) with Salsnes filters (SF) might affect the biological process with regards to N removal, as this needs sufficient biodegradable material to be available in order to proceed (Razafimanantsoa *et al.*,2013).

Determining the correct mesh size of SF sieve for nutrient removal without removing excess pCOD, the energy supply in the biological reactor for aerobic degradation of the organic material can be minimized, the overall operating costs can be reduced and the

amount production of biogas produced from the matter collected during the process can be increased.

1.2 OBJECTIVES

This study investigated nitrogen removal of municipal wastewater, using sequencing batch reactors (SBR). Municipal wastewater prior to primary treatment with and without filtration through SF was used as a feed. The overall objective is to determine how denitrification is affected by solids removal using two different mesh sizes (1.2 µm and 18µm) using bench scale SF. The specific objectives of this study were to:

1. Set up an experimental method with three different conditions (unfiltered ww, filter after 18 µm and ww filter after 1.2 µm) and evaluate the performance of SBRs for long term denitrification process.
2. Investigate the effect of removal of organic material prior to biological nutrient removal process.
3. Compare nitrification rates for different size of SF mesh sieves.

II. LITERATURE REVIEW

This chapter reviews the state of the art and previous research done in nitrogen removal using sequencing batch reactors and Salsnes Filters. The first part gives a review of the parameters of interest for this study; the second and third part reviews literature regarding wastewater characteristics and biological nitrogen removal respectively, and the final part gives an overview about Salsnes filters and biological treatment systems for nitrogen removal including the sequencing batch reactor used in this study.

2.1 PARAMETERS OF INTEREST

The parameters of interest in this study were:

2.1.1 Chemical Oxygen Demand

The chemical oxygen demand (COD) test is extensively used in the analysis of industrial and domestic wastewaters. It allows measurement of a wastewater in terms of the total quantity of oxygen required for oxidation to carbon dioxide and water. It is helpful to indicate toxic conditions and the presence of biologically resistant organic substances and it is based on the fact that most organic compounds can be oxidized by the action of strong oxidizing agents under acidic conditions (Sawyer,MCarty,1987).

Dold *et al.* (1980) and Ekama *et al.* (1986) COD has been adopted as the main parameter to quantify organic carbon. Particle size is an integral component of COD fractionation. In wastewater characterization, one particle size (0.45 µm membrane or 1.2 µm glass fiber filter size) is commonly used to roughly differentiate soluble and particulate ranges (Tas *et al.*,2009). Dulekgurgen *et al.* (2006) reported that for domestic sewage most of the COD appears at the size ranges above 0.45µm and only a small portion is at the soluble range. Nieuwenhuijzen (2000) showed that only 21% COD in wastewater was above the 63 µm size, calling it settleable; and 27% COD was in the 5-63% µm range, calling it suspended.

2.1.2 Nitrogen (N)

Nitrogen is of interest because of its presence in the atmosphere and in the life processes of all plants and animals which can be summarized with the nitrogen cycle shown in Figure 1.

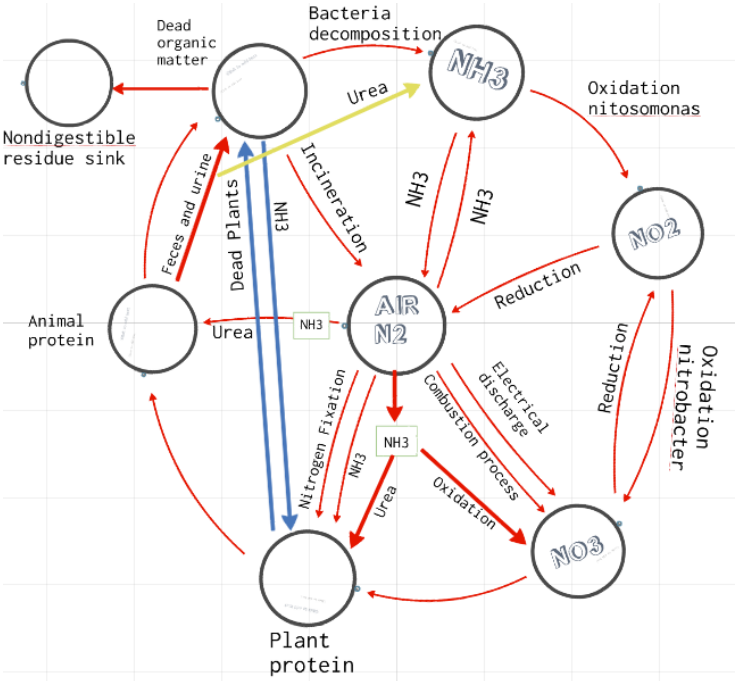


Figure 1. Nitrogen cycle. (Adapted from Sawyer,MCarty (1987))

N is an essential building block for protein synthesis; and its presence is necessary to make ww treatable (Tchobanoglous *et al.*,2003). N has several oxidation states, forms of N in ww with their corresponding oxidation state are ammonia (NH_3-,-III), ammonium (NH_4^+, -III), nitrogen gas (N_2, 0), nitrite ion (NO_2^-, +III) and nitrate ion (NO_3^-, +V) (Tchobanoglous *et al.*,2003).

The forms of N of interest in this study are:

- Ammonium nitrogen (NH_4-N)
- Nitrite nitrogen (NO_2-N)
- Nitrate nitrogen (NO_3-N)

N control is necessary for reasons related to human health and the environment. In 1940 it was found that high NO_3^--N content in drinking waters can cause methemoglobinemia in infants. Another possible harm with high N content is eutrophication in water bodies, since it stimulates algae growth and the discharge of NH_4-N and its subsequent oxidation can reduce the dissolved oxygen levels in rivers and estuaries (Sawyer,MCarty,1987).

2.1.3 Phosphorus

Phosphorus (P) is essential for algae and microorganism growth. Domestic water contains relatively high amounts of P compounds, however, many industrial wastes do not contain enough quantities of P for optimum growth of the organisms used in treatment, therefore addition of inorganic phosphates (PO_4^{-3}) may be needed to supply the deficiency (Sawyer,MCarty,1987).

The P compound of interest in this study is the orthophosphate as PO_4-P.

2.2 WASTEWATER CHARACTERISTICS

Wastewater can have different origins such as industrial, municipal, institutional, infiltration into sewers, storm water, leachate and septic tank ww. This study used municipal ww from a wastewater treatment plant (wwtp) outside Oslo-Norway.

The composition of typical municipal ww is shown in Table 1.

Table 1. Typical composition of municipal wastewater with minor contributions of industrial wastewater. (Adapted from Henze et al. (2008))

Parameter (g/m^3)	High*	Medium	Low**
COD total	1200	750	500
COD soluble	480	300	200
COD suspended	720	450	300
BOD	560	350	230
VFA (as acetate)	80	30	10
N total	100	60	30
NH_4-N	75	45	20
TP	25	15	6
PO_4-P	15	10	4
TSS	600	400	250
VSS	480	320	200

*Concentrated ww represent cases with low water consumption and/or infiltration

**Diluted ww, represents high water consumption and/or infiltration

The typical nutrient content for municipal ww is shown in Table 2.

Table 2. Typical nutrient content in municipal wastewater with minor contributions of industrial wastewater. (Adapted from Henze et al. (2008))

Parameter (g/m^3)	High	Medium	Low
N Total	100	60	30
NH_4-N	75	45	20
NO_3 + NO_2-N	0.5	0.2	0.1
Organic N	25	10	15
Total Kjeldahl N	100	60	30
TP	25	15	6
PO_4-P	15	10	4
Organic P	10	5	2

2.3 BIOLOGICAL NITROGEN REMOVAL

Biological Nitrogen (N) removal is achieved in two step process that requires nitrification and denitrification, and it is restricted to pathways using organic compounds as an energy source, these are the assimilatory and dissimilatory pathway.

2.3.1 Nitrification

Nitrification is the biological oxidation of ammonium (NH_4^+) to nitrate (NO_3^-) with nitrite (NO_2^-) formation as an intermediate and takes place in two steps. The microorganisms that carry out the first reaction are the autotrophic species Nitrosomonas; however Nitrosococcus, Nitrospira, Nitrosolobus and Nitrosovibrio are also involved in the process. The second part of the process where the oxidation of NO_2^- to NO_3^- takes place is carried out by the bacteria Nitrobacter (Rodríguez *et al.*,2011a). The first step (oxidation of NH_4^+) is usually the rate-limiting reaction, because of this, nitrification is consider as a single step process mediated by one group of substitute nitrifying autotrophic bacteria (Melcer,2003).

Nitrification is dependent of the presence of nitrifying organisms, which can be inhibited by certain non-ionized forms of N such as free ammonia and nitrous acid which are influenced by pH (Rodríguez *et al.*,2011a). The optimum pH range has been found to be 7.0 to 8.0, most municipal wastewaters are in this range and if not, lime or bicarbonate can be added to maintain the pH at an optimum level (Sedlak,1991).

The growth of nitrifying organisms is dependent on the concentrations of NH_4-N, dissolved oxygen (DO) and pH (Sedlak,1991).

The reactions involved in this process are shown below:

$$NH_4^+ + 1.5O_2 \xrightarrow{AOB\ (ammonia-oxidizing\ bacteria)} NO_2^- + 2H^+ + H_2O$$

$$NO_2^- + 0.5O_2 \xrightarrow{NOB\ (nitrite-oxidizing\ bacteria)} NO_3^-$$

2.3.2 Denitrification

Biological denitrification reduces NO_3-N to nitrogen gas and is the process that is most reliable and effective in terms of operational cost for nitrate removal from ww. (Groffman *et al.*,2006).

The reaction occurred during heterotrophic denitrification is shown below:

$$NO_3^- + soluble\ cBOD \xrightarrow{denitrifiying\ bacteria} N_2 + CO_2 + OH^- + H_2O$$

Denitrification reactions are carried out with the energy that comes from the oxidation of an organic source and is affected by parameters such as temperature (T), pH, Solids Residence Time (SRT), toxic materials, NO_3^- and carbon concentration. This process is carried out by heterotrophic facultative bacteria under anoxic conditions (Abufayed,Schroeder,1986b).

Heterotrophic facultative bacteria utilize NO_3^- instead of oxygen as the final electron acceptor. It has also been shown that this process can occur in the presence of oxygen at anoxic conditions, however fixed film reactors and suspended growth systems consist of aerobic biomass layers and anoxic sub layers so that denitrification and aerobic processes may occur simultaneously (Sedlak,1991).

When primary sludge is used as a carbon source, the rate of denitrification is determined by the release of organic and nitrogenous matter from sludge particles. (Abufayed,Schroeder,1986a). The rate of denitrification is also dependent on the temperature, DO concentration, concentration and biodegradability of the carbon source (Sedlak,1991).

Typical municipal wastewater nitrogenous material content is shown in Table 3.

Table 3. Typical municipal nitrogenous material. (Adapted from Melcer (2003))

Nitrogenous material	Concentrations (g N m^{-3})	Fractions	Fraction Units
Total Kjeldahl nitrogen (TKN)	25-70	-	-
Free and saline ammonia	20-30	0.50 - 0.75	gN/gTKN
Soluble unbiodegradable TKN	0-5	0 – 0.07	gN/gTKN
Biodegradable organically bound TKN	0-10	0 – 0.25	gN/gTKN
Particulate unbiodegradable TKN	2-8	0.03 0.07	gN/g particulate unbiodegradable COD

WW originated from domestic locations usually contains N in the organic form (approximately 60% in fresh sewage) and ammonium form (approximately 40% in fresh sewage), these are produced from protein metabolism in the human body. N can also be added by industrial and commercial activities, ground garbage and storm water, and can be introduced from recycle streams in the treatment process. Typically the soluble organic N remaining in the effluent after the biological treatment is 1 mg N/L (Sedlak,1991).

Two main factors that control the denitrification rate in activated sludge systems are:

- The rate of utilization of readily biodegradable chemical oxygen demand (RBCOD) derived from the influent wastewater
- Once the RBCOD has been consumed , the denitrification rate is controlled by the rate of hydrolysis of slowly biodegradable chemical oxygen demand (SBCOD), this process controls the availability of substrate (Melcer,2003).

If the NO_2-N concentration is less than 0.5 mg/L, the NO_2-N can be neglected and use only the NO_3-N data to calculate denitrification rate. Consequently if NO_2-N accumulation occurs during the denitrification test, the electron equivalents for the oxidation of carbon can be best represented by the following equation (Gu,2010).

$$NO_x - N = NO_3 - N + 0.6NO_2 - N$$

The coefficient 0.6 takes into consideration the stoichiometry of the denitrification reaction.

Both assimilatory and dissimilatory enzyme systems are involved in NO_3^- reduction.

2.3.3 Assimilatory pathway

Assimilatory NO_3^- reduction transforms NO_3-N into NH_4-N, which can be used for biosynthesis. This process will depend on the carbonaceous organic content and the operation conditions of the system; it will occur only when a more reduced N form is unavailable. The N content of the waste activated sludge (AS) will decrease due to endogenous metabolism and it has a significant effect in high-level ammonia removal systems. Depending on the operating conditions, N removal is limited to approximately 2 -5 % of the raw ww biological oxygen demand (BOD). In this process the net growth should be maximized in order to maximize assimilative N removal (Terry L. Krause *et al.*,2010) (Sedlak,1991).

2.3.4 Dissimilatory pathway

Dissimilatory NO_3^- reduction transforms NO_3-N to soluble N gas (N_2), which subsequently may be liberated from solution. It can result in a decrease of total nitrogen (TN) in the system rather than just a transformation in state as in nitrification (Terry L. Krause *et al.*,2010).

2.4 SALSNES FILTER AS

Salsnes Filters (SF) are developed by the company Salsnes Filters AS, a Norwegian company that started in the market in 1998-1999; with its head office located in Namsos, Norway.

Salsnes has a patented filter technology for primary ww treatment and effluent treatment for different industries. It is also an alternative for the primary settling stage for traditional chemical/biological treatment and prevents membrane bioreactor (MBR) fouling (Salsnes Filter,2013).

Newcombe *et al.* (2011) studied the effect of particle size separation implications on COD removal before biological nutrient removal (BNR) using SF. A rotating belt screen (RBS) from SF was installed at the Heyburn WWTP in Idaho after grit removal. A 350 micron mesh sieve was used in the RBS resulting in a 32% removal rate for BOD and 45% removal rate for total suspended solids (TSS). Approximately 4mg/L TKN was

removed by the RBS, which contributed to 17% TN removal. The influent samples were filtered with both 0.45μm and 29μm filters prior to COD analysis. The 0.45μm filter was selected as the typical criteria for sCOD and the 29 micron filter was selected as an approximation of the particle size limit removed by the RBS (Newcombe *et al.*,2011).

Rusten,Lundar (2006), found that at least 20% of the total suspended solids (TSS) in the wastewater should consist of particles larger than 350 microns and the ratio between flocculated COD (FCOD) and total COD (TCOD) should be below 0.4 to be considered suitable for primary treatment with fine mesh sieves. It was found at a full-scale primary treatment plant (Breivika WWTP in Tromsø-Norway) that the SF RBS with 350 microns mesh size fulfilled the European Union (EU) primary treatment requirements for removal of SS and BOD_5, with an average removal efficiency of 90% and 80%, respectively (Rusten,Lundar,2006).

Previous studies using SF in primary treatment has been made, testing the effect of denitrification providing ww with different organic fractions; it showed a removal of pCOD up to 20 to 50% using SF of different mesh sieve sizes, two different influents were used (Test 1 and Test 2); separation of influent SS with 33 μm reduced the first denitrification rate (Test 1) to 20% and 10% for the second rate (Test 2) and using 1.2 μm reduced 6% and 16% for the first and second denitrification respectively. (Razafimanantsoa *et al.*,2013)

2.5 BIOLOGICAL TREATMENT SYSTEMS FOR NITROGEN REMOVAL

There are different process configurations for N removal that can be classified in three categories: single, dual and triple sludge (Terry L. Krause *et al.*,2010).

Some of these configurations are described below. This study will use a SBR which will be explained in more detail.

Wuhrmann and Ludzach-Ettinger approach is typically referred to as post-denitrification. N removals of 29 to 89% have been achieved in bench and pilot scale studies. A diagram of this process can be seen in Figure 2 (Terry L. Krause *et al.*,2010).

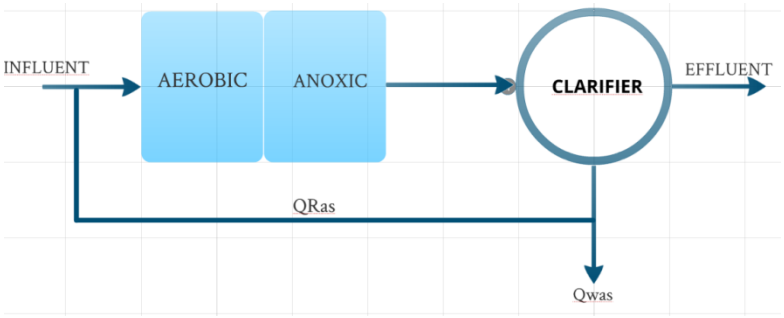


Figure 2. Wuhrmann process for N removal (RAS= return activated sludge) and WAS=waste activated sludge). (Adapted from Terry L. Krause et al. (2010))

Another single sludge process is the Ludzack-Ettinger process which is a variation of the previous process and can be seen in Figure 3. TN removal efficiency in this process is a function of the return activated sludge (RAS) flow rate. An 88% reduction in TN from a 130mg/L using a RAS ratio of 8:1 has been reported (Terry L. Krause *et al.*,2010)

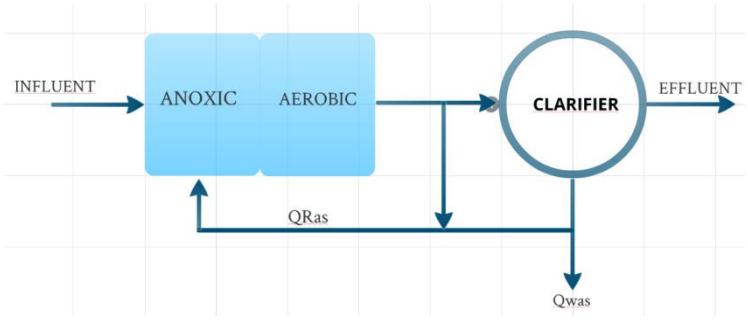


Figure 3. Ludzack-Ettinger process for N removal (RAS= return activated sludge) and WAS=waste activated sludge). (Adapted from Terry L. Krause et al. (2010))

Another configuration was proposed to increase the denitrification rate and overall N removal efficiency, the Modified Ludzack-Ettinger (MLE). This process can be used when nitrification is occurring and denitrification is required to recover alkalinity, lower overall oxygen demand and provide a better sludge settling. MLE configuration can be seen in Figure 4 (Terry L. Krause *et al.*,2010).

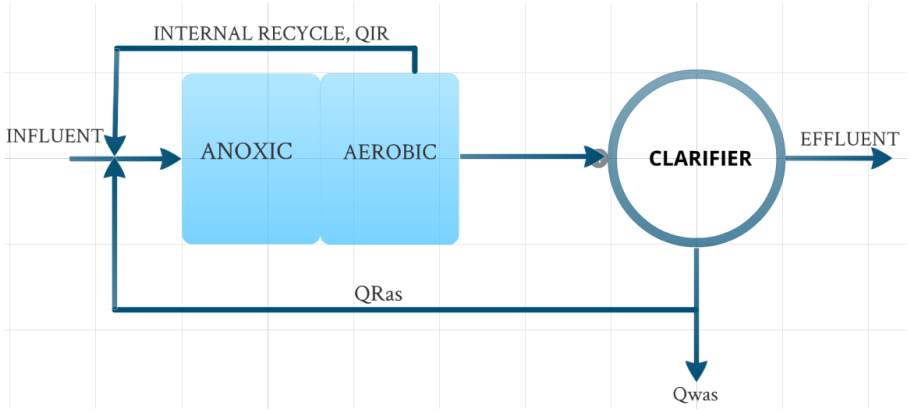
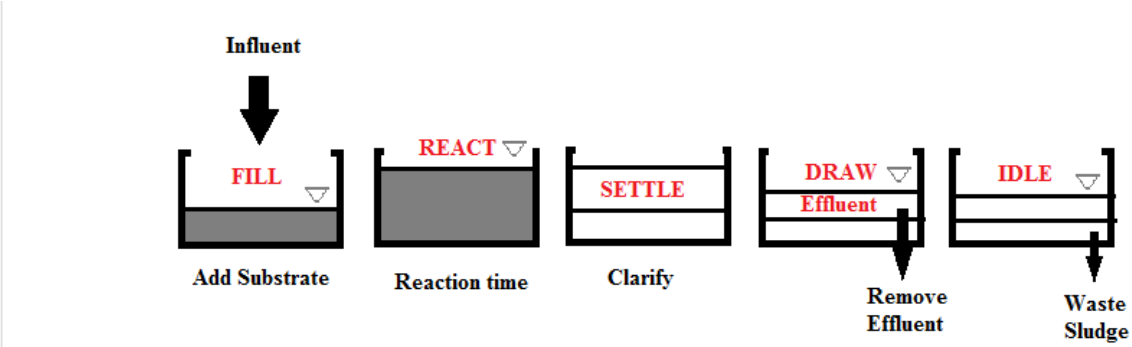


Figure 4. Modified Ludzack-Ettinger process for N removal (RAS=return activated sludge and WAS=waste activated sludge). (Adapted from Terry L. Krause et al. (2010))

Another approach is the Four-Stage Bardenpho™ which has four anoxic and aerobic zones with recycling of mixed liquor from the first aerobic zone to the first anoxic zone, it was proposed to achieve more complete N removal than the one obtained with a two or three stage process (Terry L. Krause *et al.*,2010)

2.5.1 Sequencing Batch Reactor

The sequencing batch reactor (SBR) is a fill and draw reactor with complete mixing during the batch reaction step, the steps of aeration and clarification occur in the same tank, saving costs and energy. It typically incorporates five stages: Fill, react (aeration), settle, draw and idle (Tchobanoglous *et al.*,2003). The typical SBR operation for one cycle is shown in Figure 5 and the description of the operation steps for the SBR is shown in Table 4.



Purpose/Operation	Air On-Off (optional)	Air On-Cycle	Air Off	Air Off	Air On-Off (Optional)
Percent of Maximum Volume	25 to 100	100	100	100 to 35	35 to 25
Percent of Cycle Time	25	35	20	15	5

Figure 5. Typical sequencing batch reactor operation for one cycle. (Adapted from Terry L. Krause et al. (2010))

Table 4. Description of operational steps for the sequencing batch reactor. (Adapted from Tchobanoglous et al. (2003))

Operation Step	Description
Fill	Volume and substrate (raw wastewater or primary effluent) are added to the reactor. It typically allows the liquid level in the reactor to rise from 75% of capacity (at the idle period) to 100%. During fill the reactor may be mixed only or mixed and aerated to promote biological reactions with the influent wastewater
React	The biomass consumes the substrate under controlled environmental conditions
Settle	Solids are allowed to separate from the liquid under quiescent conditions, resulting in a clarified supernatant that can be discharged as effluent
Decant	Clarified effluent is removed
Idle	Is used in a multi-tank system to provide time for one reactor to complete its fill phase before switching to another unit. Because Idle is not a necessary phase , it is sometimes omitted

Some of the advantages of using SBR over other configurations are listed in Table 5.

Table 5. Advantages and disadvantages sequencing batch reactor. (Adapted from Tchobanoglous et al. (2003))

Advantages	Disadvantages
No need for a return activated sludge system (RAS)	Process control more complicated
Nutrient removal can be accomplished by operational changes	High peak flows can disrupt operation
Can be operated as a selector process to minimize sludge bulking potential	Batch discharge may require equalization prior to filtration and disinfection
Quiescent settling enhance solids separation and is applicable for a variety of plant sizes	Higher maintenance skills required for instruments, monitoring devices and automatic valves in comparison with other systems

This system has been studied since the mid-1980s. (Chang,Hao,1996). The configuration of an SBR combines hydrolysis and denitrification in a discontinuous operation, studies on the hydrolysis rate coefficient in batch experiments has been done before, concluding that the values of the hydrolysis rate coefficient obtained in continuous flow experiments are higher than in batch systems. (Eliosov,1995).

A SBR can be used to remove nutrients in one stage; this process can be used to treat the liquid fraction or the effluent coming from the anaerobic digesters (Tilche *et al.*,1999). This process has been studied by several investigators using different techniques and parameters; by aiming for optimization of SBR operating conditions. Studies have been performed mostly using external carbon sources, such as glucose, acetate and mixtures of glucose/acetate. For mixtures of glucose/acetate (50/50) removal of 96% COD, 87% NH_4-N, 81% NO_3-N and 90% PO_4-P has been reported (Kargi,Uygur,2003).

All cycles of operation can be regulated with the aim of producing the required effluent quality. The length of the fill cycle can be controlled to simulate the plug or continuous flow regimes, environmental conditions can also be modified by controlling the cycle length, DO and mixing. Microorganisms settle under zero velocity gradients improving the settling efficiency and by controlling the rate of cell wastage the system can be operated at high solids concentrations in comparison with other systems (Abufayed,Schroeder,1986b).

It has been suggested that once a day batch feeding in an SBR may result in the growth of a nitrifier population different from that in the full scale plant with continuous feed. A study done with 3 different feeding schedules were evaluated (once a day feeding, six time per day feeding and continuous feed for 23 hours), in all cases the nitrification rate values were the same (Melcer,2003).

Data were collected from 19 municipal and private SBR wwtp in the United States. The average effluent TSS ranged from 3.7 to 20.2 mg/L, excluding one plant with and average effluent TSS of 52 mg/L. Removals for TSS ranged from 84.7 to 97.2 %. One plant monitored both influent and effluent TN with an average of 56% TN removal (US EPA,1992)

A study monitoring the removal of N in SBR using ww from the meat industry done in 2010, showed an NH_4^+- N removal of 71%, the transformation of the NH_4^+- N to N_2 was confirmed with the increasing concentration of NO_2^-N and NO_3^-N during the react phase and its decrease in the effluent due to its transformation to N_2 (Rodríguez *et al.*,2011b).

Piggery wastewater with high organic matter, N and P content with 1500 mg/L NH_4-N was used to remove N with a SBR. The SBR was operated with 3 cycles a day at 30°C with a sludge retention time (SRT) of 1 day and hydraulic retention time (HRT) of 11 days, a removal efficiency of 99.7% for N was obtained (Obaja *et al.*,2003).

The operation of a laboratory scale fill and draw SBR system was done at McMaster University, Hamilton , Ontario, Canada by (A.J,1994); the system was initiated with mixed liquor from the Dundas wwtp and received Dundas Raw influent wastewater as a feed, the influent COD showed some fluctuations during the start-up period, followed by an intensive testing, two batches of ww were collected showing an average COD of approximately 330mg/L (Melcer,2003).

Rusten (2004) performed tests using SF at different municipal wastewater treatment plants; during the first test it was seen that if the proper mesh size sieve and filtration rate were used the SS removal efficiency was above 50% for all municipal ww.

III. MATERIALS AND METHODS

This Chapter describes the sample location, materials, equipment and methods used during the experimental part of this study. The first part gives a description of the samples location including flow diagrams; the second part describes the materials and equipment used including the set-up of the experiment and the third part describes the methods used for characterization and analysis of samples including the experimental design of the SBR.

3.1 WASTEWATER SAMPLE LOCATION

3.1.1 Bekkelaget Wastewater treatment plant

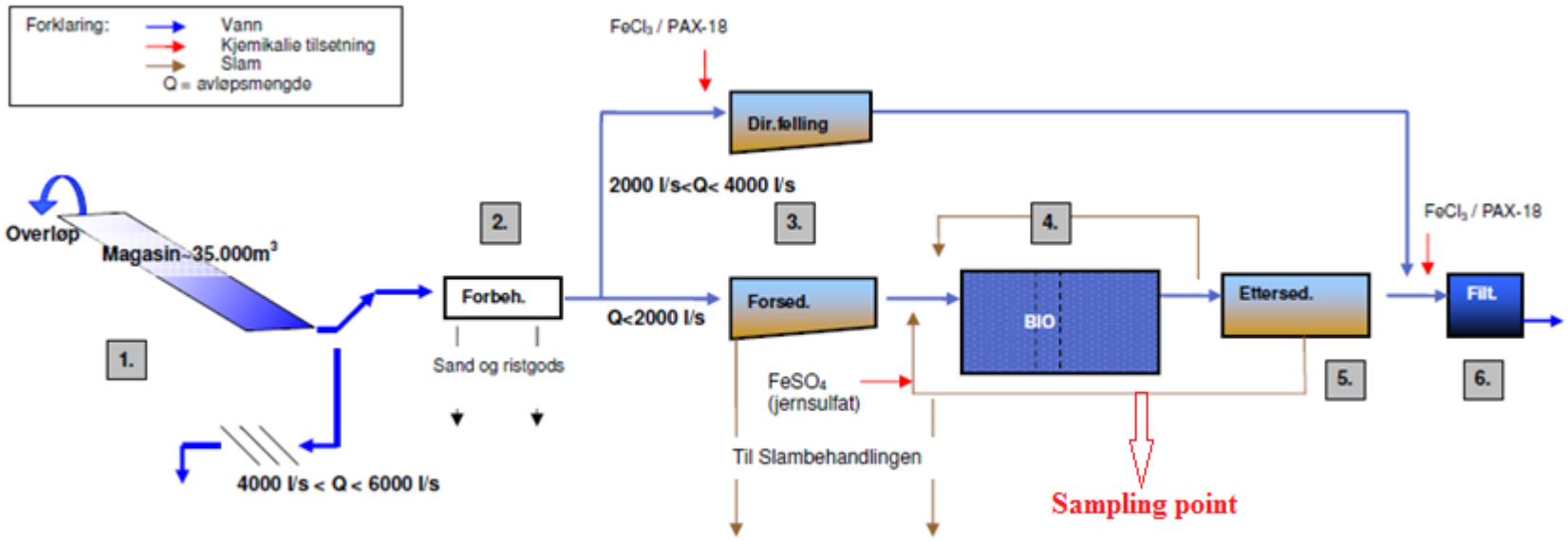
Bekkelaget wastewater treatment plant (BRA) is the second largest wwtp in Oslo. It has biological treatment with N removal. Some of the effluents from the municipalities Oppegård and Nittedal are treated at BRA. It has a capacity of 4000 L/s, about 42 million m^3 of ww are treated annually. (Bekkelaget Vann AS,2013)

The flow diagram of the process is shown in the Figure 6.

3.1.2 The Nordre Follo Renseanlegg wastewater treatment plant

The Nordre Follo Reseanlegg sewage treatment plant (NFR) is located 30 km south of Oslo-Norway treats sewage from the municipalities of Ski, Oppegård and Ås. The effluent travels by a 1740 m long tunnel until it reaches the plant. After the water has been treated and accomplished the discharge limits it is discharged at approximately 50 m depth in Sjodalen Beach at Bunnerfjord at 350 m from the shore (Nordre Follo Renseanlegg,2013)

The plant was built in 1972 to perform primary treatment. In 1982 the second phase was completed consisting on chemical purification process by flotation, later in 1990 the third phase was built involving sanitation and stabilization of sludge and in 1997 the plant was upgraded with secondary biological ww treatment for N and BOD removal with Kaldnes Moving Bed Biofilm Reactor (MBBR) (Nordre Follo Renseanlegg,2013) The plant has a target of 70% removal of N per year and 90% of BOD removal (Ng,2012). The flow diagram of the process can be observed in Figure 7.



	Process	Purpose	Translation	
1	Tunnel system and overflow	Precipitation and purification overflow	Vann	Water
2	Surface	Coarse material, sand and grease removal	Khemikalie tilsetning	Chemical Additives
3	Primary Settlers	Particle and phosphorus removal	Slam	Slam
4	Biological Treatment	Nitrogen removal	Avløpsmengde	Wastewater flow
5	After sedimentation	Separating the sludge from the wastewater		
6	Filter	Last particles removal		

Figure 6. Schematic of the Bekkelaget wastewater treatment plant, Oslo, Norway.(Adapted from Bekkelaget Vann AS (2013)).

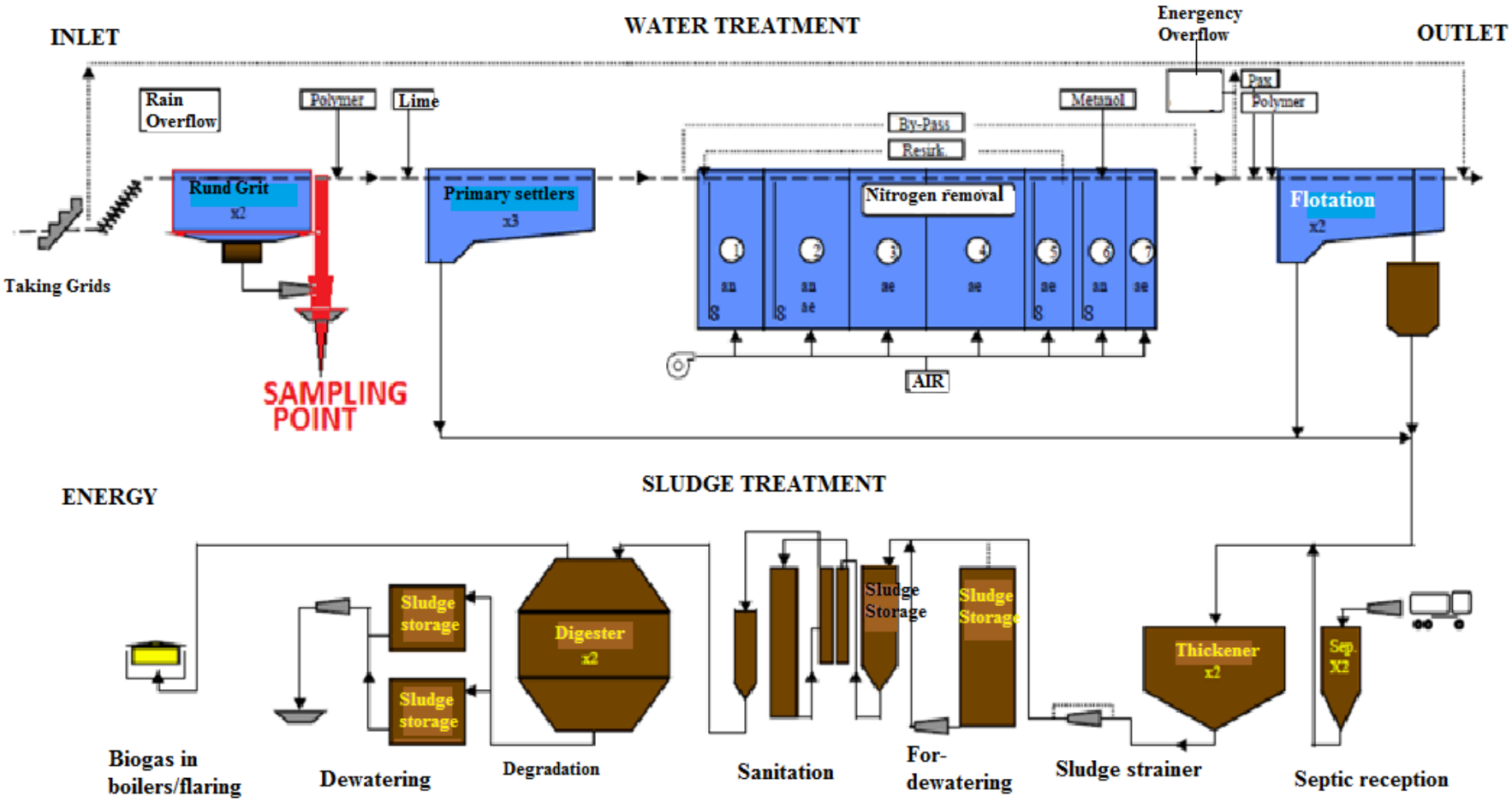


Figure 7. Schematic of the Nordre Follo Renseanlegg wastewater treatment plant, Oslo, Norway. (Adapted from Nordre Follo Renseanlegg (2013))

3.2 EQUIPMENT AND DEVICES

3.2.1 Dr Lange Cuvette tests

Dr Lange Cuvette tests are ready to use reagent packages for photometric analysis (GMBH,2007). The reagents were used to measure: TCOD, soluble COD (sCOD), NH_4-N, NO_3-N, NO_2-N and PO_4-P (GMBH, Dusseldorf, Germany).

The parameters and measuring ranges are described in Table 6.

The Hach Lange Thermostat LT 200 is used for specific digestions. It is pre-programed for all standard digestions; some of them are shown in Table 7 and is ideal to use with the Hach Lange cuvette test. It has two separately controllable heating blocks that enable cuvettes to be digested at different T and time settings. (Lange,2012)
The specifications of the equipment can be seen in the Appendix 1.

Table 6. Parameters and measuring ranges Lange Cuvette test

Kit	Parameter	Measuring Ranges
LCK 514	COD	100-2000 mg/L
LCK 614	COD	5-300 mg/L
LCK 338	Total Nitrogen	20 – 100 mg/L TN
LCK 303	Ammonium	2 – 47 mg/L NH_4-N
LCK 339	Nitrate	0.23 – 13.50 mg/L NO_3-N
LCK 440	Nitrate	5 – 35 mg/L NO_3-N
LCK 341	Nitrite	0.015 – 0.6 mg/L NO_2-N
LCK 349	Orthophosphate	0.05 – 1.50 mg/L PO_4-P
LCK 350	Orthophosphate	2.0 – 20.0 mg/L PO_4-P

Table 7. Standard digestions used during the experiment.

Applications	Temp (°C)	Time (min)
COD	148	120
Total nitrogen (LATON)	100	60
Total phosphorous	100	60

3.2.2 Spectrophotometer DR 5000

The Spectrophotometer Hach Lange DR 5000 was used to scan the measurement for COD, NO_2-N, NO_3-N, PO_4-P, and NH_4-N done with the DR Lange Cuvette test.

This instrument is used for testing visible and ultraviolet wavelengths; it uses a wavelength range of 190 to 1100nm and provides digital readouts in direct concentration units, absorbance or percent transmittance. (Hach-Lange GmbH,2007-2008)

The overview of the equipment can be seen in Table 8.

Table 8. Overview of Hach Lange Photometer DR 5000 for Lange cuvette tests. (Adapted from GMBH (2007))

Parameter	DR 5000
Wavelength; VIS, UV-VIS	UV-VIS 190-1100nm
Optical system, photometer type	Spectral
Scan	Yes
Pre-programmed tests	Approx. 230
User methods programmable	Yes
GLP compliant documentation; barcode reader	Yes
Display with touchscreen	Yes
Protection rating	IP 31
Other	Sipper, cuvette carousel

3.2.3 Bench-scale Salsnes Filter Set up

This apparatus was designed to characterize wastewater to establish design criteria for fine mesh sieves and predict the performance of Salsnes filter fine mesh sieves within a reasonable margin of error (Rusten,Lundar,2006). A simple sketch can be seen in Figure 8 and 9.

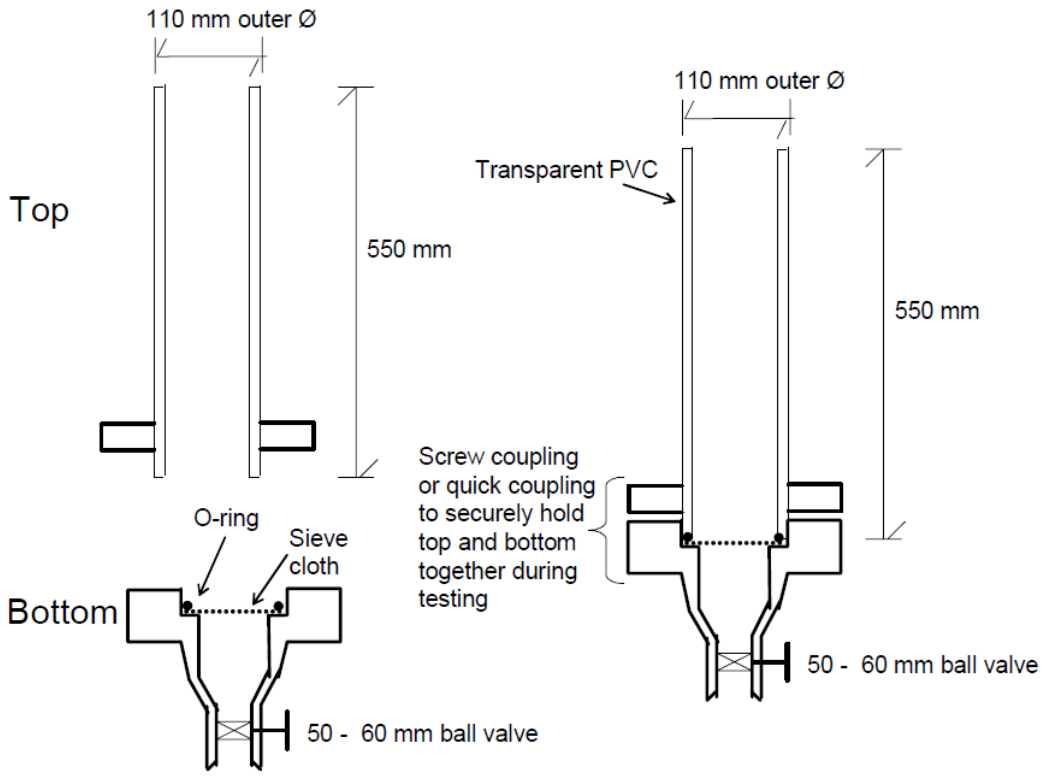


Figure 8. Simplified sketch and dimensions of bench-scale SF. (Adapted from Rusten (2004))

Figure 9. Bench Scale Salsnes Filter setup

3.2.4 Multi-parameter WTW 3420

The multi-parameter WTW 3420 can be used to measure pH, D.O. and conductivity. It has various measurement parameter configurations available, high resolution color display and data transfer via USB-stick (WTW Wissendschaftlich-Technische Werkstätten,2009). The technical data is shown in Appendix 2.

3.2.5 ULTRA-TURRAX® T25 Basic

A T25 basic Ultra-Turrax® (Figure 10) was used to disperse the sample for TCOD test. Its operating range is for volumes from 1 to 2500 ml with speed range from 11000 to 24000 rpm. For this study a sample of 100ml was used, it was dispersed for 1 minute approximately.

Figure 10. T-18 digital Ultra-Turrax®

3.2.6 Experimental Set-up

The experimental setup consists of the following parts shown in Figure 11.

- Three beakers with a capacity of 5 L arranged in parallel with a working volume of 3 L each one (One with unfiltered ww, the second one with filtered ww - 1.2µm, and the third one with filtered ww - 18µm)
- Three magnetic stirrers (Mixing)
- Three diffuser stones with pumps (Aeration)
- Three programmable timer controllers
- Two multi-parameter with pH, temperature and DO probes

- The beakers are submerged in a tank with recirculating water to keep stable the temperature

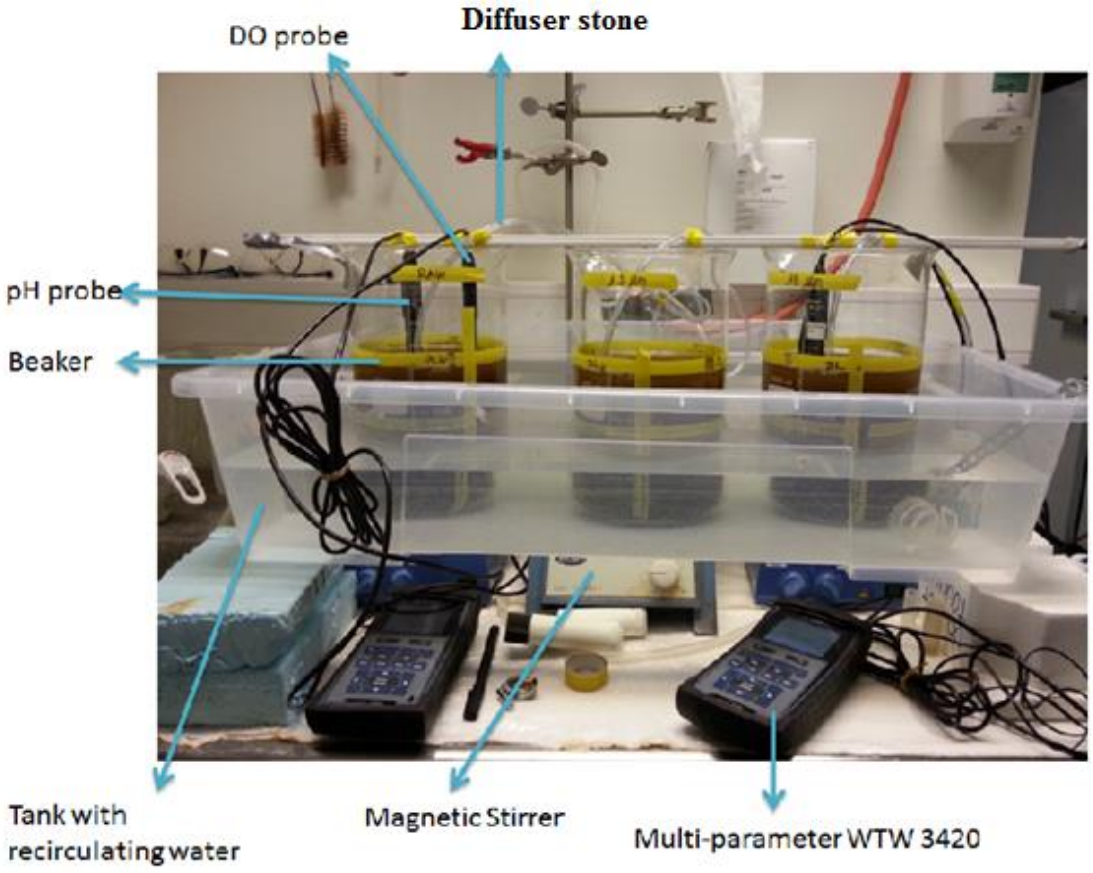


Figure 11. Experimental setup showing sequencing batch reactor for denitrification.

3.3 PARAMETERS

3.3.1 Total Suspended Solids

Total suspended solids (TSS) refers to the portion of Total solids (TS) retained in a filter after the evaporation of a sample and its subsequent drying in an oven at a defined temperature, in this case 105°C.

TSS was measured according to the procedure 2540 D. in the Standard Methods for the examination of water and wastewater described in the Appendix 3 (AWWA,1999).

0.45µm glass microfiber filters were used for solid tests (TSS and VSS), these filters are produced by Whatman Ltd. and it is necessary to pretreat them before the corresponding test.

To prepare the glass filters the following procedure was done: the disk was inserted with the wrinkled side up in the filtration apparatus, vacuum was applied meanwhile distilled water was added (approximately 100 ml); when all traces of water were removed the vacuum was turned off and the disk was removed from the apparatus and placed in an clean beaker. The beaker was placed in a muffle at 550°C for two hours. When the filter was cool down it was weighted and placed in a petri dish for its use.

3.3.2 Volatile suspended solids

Volatile suspended solids (VSS) refers to the weight loss on ignition. VSS was measured according to the procedure 2540 E. in the Standard Methods for the examination of water and wastewater described in the Appendix 3.

3.3.3 Total COD

To analyze total COD (TCOD) content in the sample, the municipal ww (taken after the sand trap at NFR wwtp) without filtering was used, 100 ml of the sample was homogenized for one minute with a T25 basic ULTRA-TURRAX®, *and subsequently* Dr. Lange Cuvette test LCK 514 was used following the procedure described in the Appendix 5 (Hach Lange,2001b). The measurement scan was done with the spectrophotometer DR 5000 at a wavelength of 605nm.

3.3.4 Soluble COD

To analyze soluble COD (sCOD) content in the sample, Dr. Lange Cuvette test LCK 614 was used. The supernatant sample was filtered through 25µm Whatman glass microfiber filter followed by the procedure described in the Appendix 6 (Hach Lange,2001b). The measurement scan was done with the spectrophotometer DR 5000 at a wavelength of 448nm.

3.3.5 Total nitrogen

To analyze total nitrogen (TN) content in the sample, Dr. Lange Cuvette test LCK 338 was used using raw wastewater without filtering and wastewater after 18µm filtration followed by the procedure described in the Appendix 7 (Hach Lange,2005a) The measurement scan was done with the spectrophotometer DR 5000 at a wavelength of 345nm.

3.3.6 Ammonium nitrogen

To analyze ammonium nitrogen (NH_4-N) content in the sample, Dr. Lange Cuvette test LCK 303 was used. A sample from the supernatant (treated effluent) was filtered through 25µm Whatman glass microfiber filter followed by the procedure described in the Appendix 8 (Hach Lange,2000). The measurement scan was done with the spectrophotometer DR 5000 at a wavelength of 694nm.

3.3.7 Nitrate nitrogen

To analyze nitrate nitrogen (NO_3-N) content in the sample, Dr. Lange Cuvette test LCK 339 and LCK 340 were used. The supernatant sample was filtered through 25µm Whatman glass microfiber filter followed by the procedure described in the Appendix 9 and 10 for respectively test (Hach Lange,2005b). The measurement scan was done with the spectrophotometer DR 5000 at a wavelength of 370nm.

3.3.8 Nitrite nitrogen

To analyze nitrite nitrogen (NO_2-N) content in the sample, Dr. Lange Cuvette test LCK 341 was used. The supernatant sample was filtered through 25µm Whatman glass microfiber filter followed by the procedure described in the Appendix 11 (Hach Lange,2001a). The measurement scan was done with the spectrophotometer DR 5000 at a wavelength of 515nm.

3.3.9 Orthophosphate

To analyze orthophosphate (PO_4-P) content in the sample, Dr. Lange Cuvette test LCK 349 and LCK 350 were used. The supernatant sample was filtered through 25µm Whatman glass microfiber filter followed by the procedure described in the Appendix 12 and 13 for respectively test (Hach Lange,2003). The measurement scan was done with the spectrophotometer DR 5000 at a wavelength of 850nm.

3.3.10 pH, Temperature and Dissolved oxygen

pH, temperature and dissolved oxygen (DO) was measured with a Multi-parameter WTW 3420.

3.4 EXPERIMENTAL DESIGN SBR

Mixed liquor suspended solids (MLSS): biomass was collected from BRA at the recycle stream channel from the secondary clarifier.

Samples of raw wastewater were collected from NFR as shown in Table 9 for 9 weeks. The samples were taken after the sand trap. After collecting the samples it had to be stored at 4°C in plastic containers to avoid degradation and before use it had to be brought to room temperature. Before filling each reactor dissolved oxygen was purged by passing nitrogen gas through the wastewater.

Table 9. Experiment program

Week		The program was followed during 9 weeks				
Day		Monday	Tuesday	Wednesday	Thursday	Friday
Sampling (L)		20		20		30
Particle analysis		X	x		X	
Influent analysis	TCOD	X	x		X	
	sCOD	X	x		X	
	TN	X	x		X	
	NO_3-N	X	x		X	
	NO_2-N	X	x		X	
	NH_4-N	X	x		X	
	PO_4-P	X	x		X	
	TP					
	TSS, VSS	X	x		X	
Filtrate analysis (18um)	tCOD	X	x		X	
	TSS,VSS	X	x		X	
Effluent analysis (3 reactors)	sCOD	X	x	X	X	x

Week	The program was followed during 9 weeks					
Day		Monday	Tuesday	Wednesday	Thursday	Friday

Effluent analysis (3 reactors)	NO_3-N	X	x	X	X	x
	NO_2-N	X	x	X	X	x
	NH_4-N	X	x	X	X	x
	PO_4-P	X	x	X	X	x
	TSS, VSS	X	x	X	X	x
Nitrification and Denitrification test			x		X	

Note: On Saturdays and Sundays analysis were not performed, only the protocol shown in Table 9.

The first reactor contains MLSS mixed with raw wastewater without filtering. The second reactor contains MLSS mixed with wastewater filtered with 1.2 µm Salsnes filter mesh sieve, and the third reactor contains MLSS mixed with wastewater filtered with 18 µm Salsnes filter mesh sieve.

The SBR was operated at a controlled temperature of approximately 21°C, with a SRT of 15 days. Stirrers were used to provide adequate mixing during the react period. DO, pH and temperature was recorded by a multi-parameter in each cycle. Each cycle lasted 24 hours.

The protocol for the SBR operation is shown in Table 10 for unfiltered wastewater, filtered wastewater after 1.2µm filtration and filtered wastewater after18µm filtration.

Table 10. Activity for SBR operation for nitrification and denitrification

Activity	Reactor 1 - Unfiltered wastewater	Reactor 2 - filtered wastewater after 1.2 um filtration	Reactor 3 - filtered wastewater after 18 um filtration
	Time		
Fill (1.5 L) and start automatic function on Multi-parameter	9:00	9:20	9:40
Anoxic mixing	9:00 16:30 21:00 22:00 23:00 0:00 1:00 2:00 3:00 4:00 5:00 6:00	9:20 16:50 21:20 22:20 23:20 0:20 1:20 2:20 3:20 4:20 5:20 6:20	9:40 17:10 21:40 22:40 23:40 0:40 1:40 2:40 3:40 4:40 5:40 6:40
Aeration	11:30 19:00 21:30 22:30 23:30 0:30 1:30 2:30 3:30 4:30 5:30 6:30	11:50 19:20 21:50 22:50 23:50 0:50 1:50 2:50 3:50 4:50 5:50 6:50	12:10 19:40 22:10 23:10 0:10 1:10 2:10 3:10 4:10 5:10 6:10 7:10

Activity	Reactor 1 - Unfiltered wastewater	Reactor 2 - filtered wastewater after 1.2 um filtration	Reactor 3 - filtered wastewater after 18 um filtration
	Time		
Start settling	7:30	7:50	8:10
Record Sludge volume	8:00	8:20	8:40
Decant Settle sample down to 1.5L mark Prepare sample for analysis Determine TSS and VSS (decant) Transfer DO data to USB drive Erase stored date on the Multi-parameter Prepare new feed	8:30	8:50	9:10

TSS, VSS, Nitrate, Nitrite, Ortho-phosphate and Ammonium analyses were done for the influent and effluent in each cycle.

IV. RESULTS AND DISCUSSIONS

This chapter shows the results of the SBR performance for the three reactors. For convenience, Reactor one will be referred as R1 (municipal ww without filtration used as a feed), Reactor two will be referred as R2 (ww filtered through 1.2µm used as a feed) and Reactor three will be referred as R3 (ww filtered through 18µm used as a feed). The results will be divided in four sub-sections; the first three will show specific results for each reactor and a final subsection which shows comparative results of the three reactors such as percentage COD removal, percentage SS removal and denitrification rates.

Table 11. Average values SBR influent and effluent wastewater characterization.

Parameter (mg/L)	R1		R2		R3	
	Influent	**Effluent**	**Influent**	**Effluent**	**Influent**	**Effluent**
TSS	329.5	16.50	329.5	23.77	118.9	22.72
VSS	285.4	14.85	NA	20.51	100.9	19.65
TCOD	618.4	NA	186.5	NA	348.4	NA
sCOD	186.5	43.12	186.5	36.61	186.5	40.36
pCOD	431.51	NA	NA	NA	161.99	NA
TN	53.6	NA	NA	NA	46.2	NA
NH_4-N	38.7	0.45	38.7	2.45	38.7	0.67
NO_3-N	0.26	13.77	0.26	28.09	0.26	25.92
NO_2-N	0.03	0.14	0.03	0.08	0.03	0.04
PO_4-P	3.36	2.48	3.36	2.96	3.36	2.75

NA: Not available

Characterization of the influent ww and the effluent for each reactor is shown in Table 11, it can be observed that soluble COD fractions, which contains the readily biodegradable substrate are about 30.15% of the total substrate for R1 and 53.53% for R3; R2 contains ww made up of 100% soluble fraction. The values for the Influent R1, are values closer to typical compositions for municipal ww with minor industrial contributions in the low range, which corresponds to diluted ww according to Henze *et al.* (2008). Influent TSS concentration for unfiltered ww is in the same range as the one found by Rusten,Lundar (2006) in a bench scale testing with SF using ww from NFR. It can be seen a substantial reduction in NH_4-N concentrations from the influent to the effluent of each reactor, which means oxidation of NH_4-N was accomplished, this can be seen in more detailed in specific figures for each reactor

4.1 REACTOR 1 – PRIMARY INFLUENT MUNICIPAL WASTEWATER

Figure 12 shows the variation of the NO_3-N during the SBR operation for 37 days for Reactor 1. The average concentration of NO_3-N in the influent was 0.26 mg N/L and in the effluent was 13.64 mg N/L. Approximately 510 mg N/day was removed.

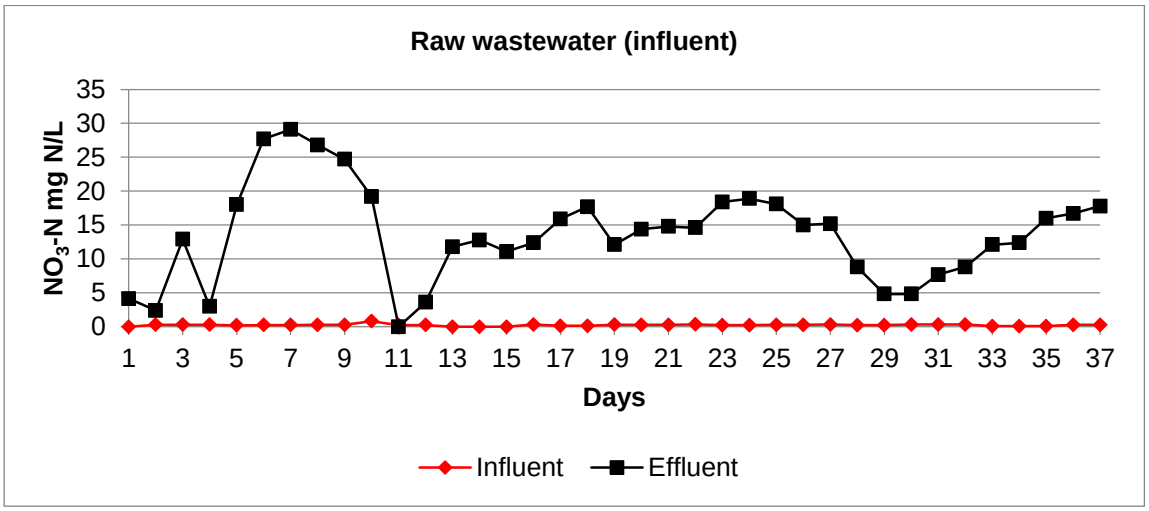


Figure 12. Variation of nitrate nitrogen concentration for Reactor 1 during 37 days of the SBR operation.

Figure 13 shows the variation of the NO_2-N during the SBR operation for 37 days for Reactor 1. The average concentration of NO_2-N in the influent was 0.03 mg N/L and in the effluent was 0.14 mg N/L. From day 12 the operation changed from 50% anoxic, 50% aerobic to 70% anoxic and 30% aerobic , this might be the reason why a peak can be observed in day 13 with a value of 1.37 mg/L.

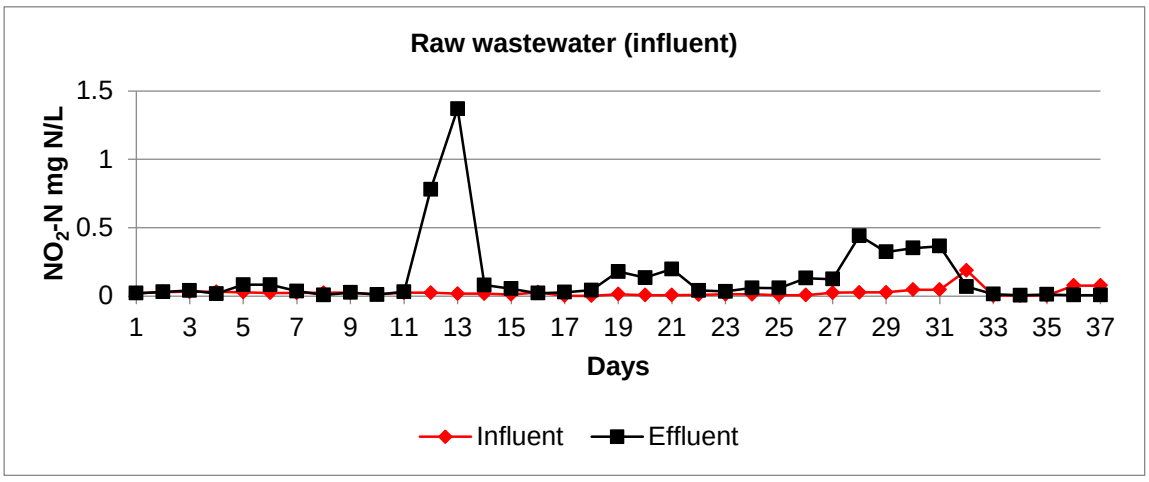


Figure 13. Variation of nitrite nitrogen concentration for Reactor 1 during 37 days of the SBR operation.

Figure 14 shows the variation of the NH_4-N during the SBR operation for 37 days for Reactor 1. The average concentration of NH_4-N in the influent was 38.68 mg N/L and in the effluent was 0.49 mg N/L. The average of NH_4-N removed was 98.78%.

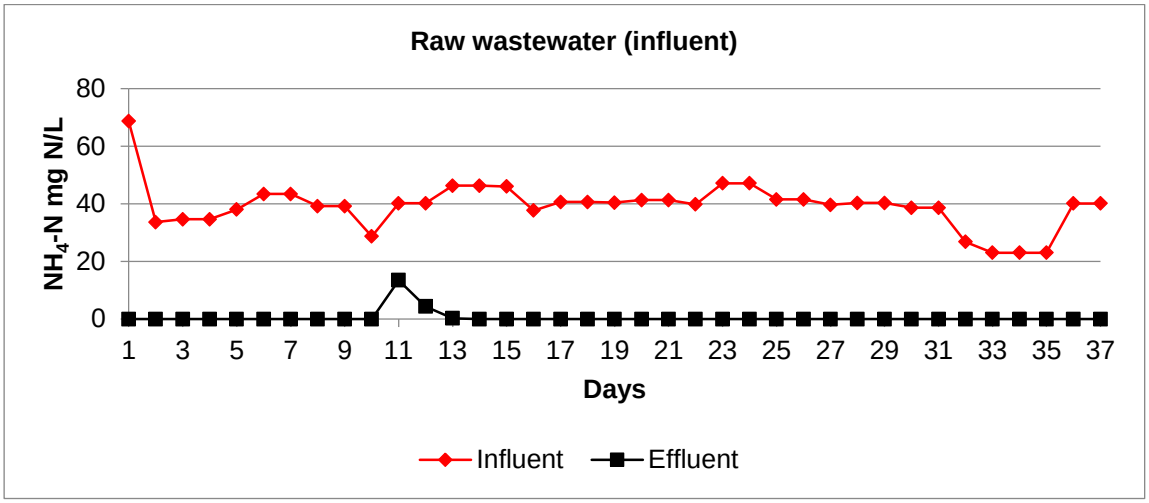


Figure 14. Variation of ammonium nitrogen concentration for Reactor 1 during 37 days of the SBR operation.

Figure 15 shows the variation of the PO_4-P during the SBR operation for 37 days for Reactor 1. The average concentration of PO_4-P in the influent was 3.34 mg P/L and in the effluent was 2.48 mg P/L. In average 19.40% of PO_4-P was removed.

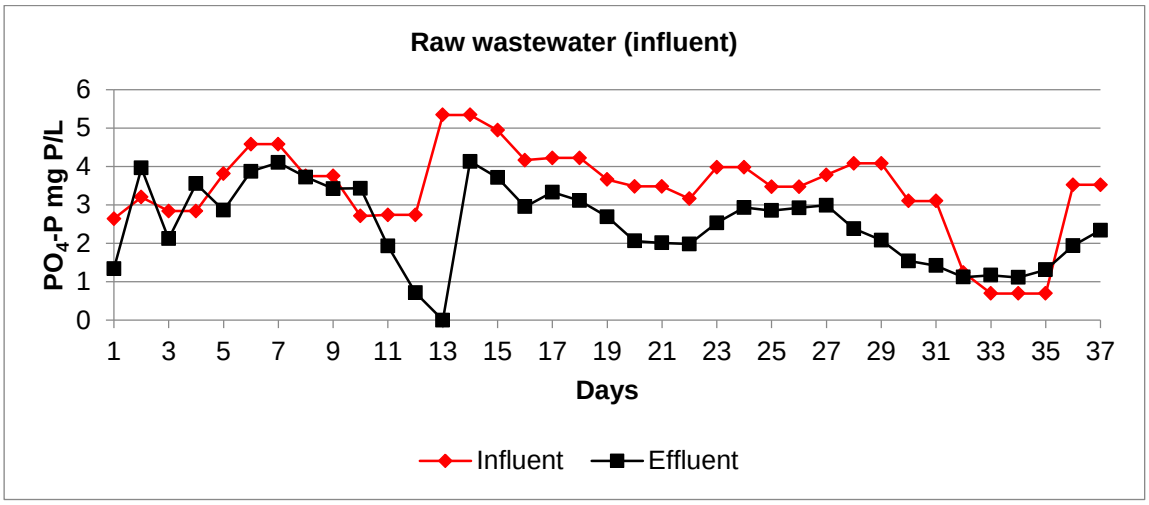


Figure 15. Variation of orthophosphate concentration for Reactor 1 during 37 days of the SBR operation.

Figure 16 shows the variation of the sCOD during the SBR operation for 37 days for Reactor 1. The average concentration of sCOD in the influent was 187.1 mg/L and in the effluent was 43.18 mg/L, with a 76.31%COD removal.

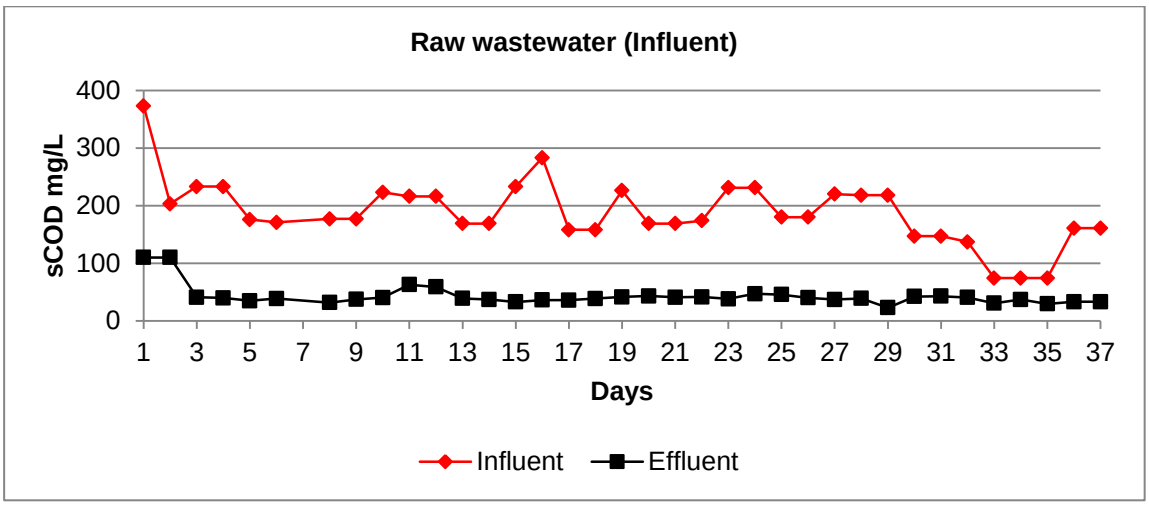


Figure 16. Variation of soluble COD for Reactor 1 during 37 days of the SBR operation.

Figure 17 shows the variation of the TSS during the SBR operation for 37 days for Reactor 1. The average concentration of TSS in the influent was 329.5 mg/L and in the effluent was 16.50 mg/L, with a 94.84% TSS removal.

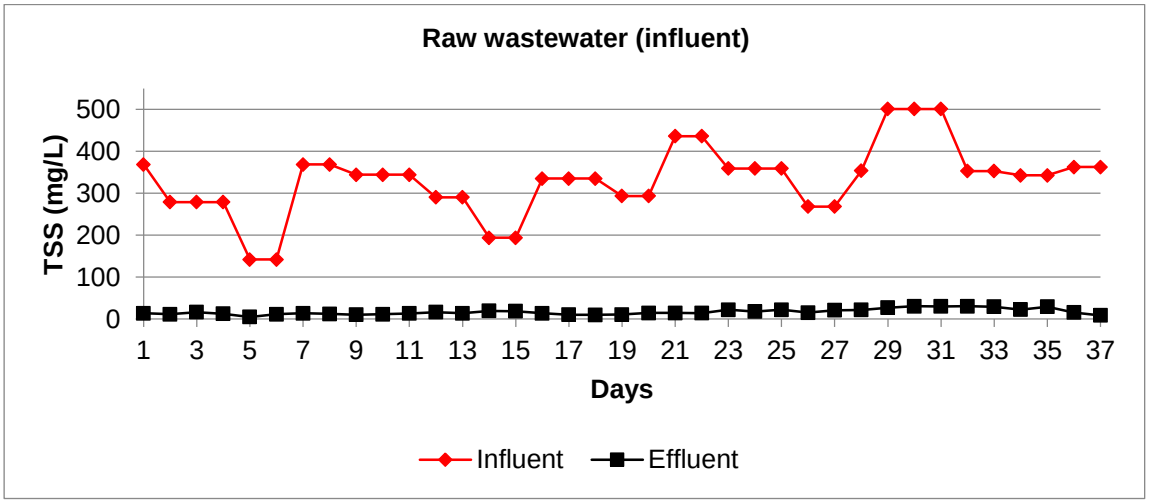


Figure 17. Variation of total suspended solids for Reactor 1 during 37 days of the SBR operation.

4.2 REACTOR 2– WW FILTERED THROUGH 1.2µm

Figure 18 shows the variation of the NO_3-N during the SBR operation for 37 days for Reactor 2. The average concentration of NO_3-N in the influent was 0.26 mg N/L and in

the effluent was 28.96 mg N/L. Approximately 20 mg N/day was removed, this value is lower than the one obtained in R1 (510 mg N/day)

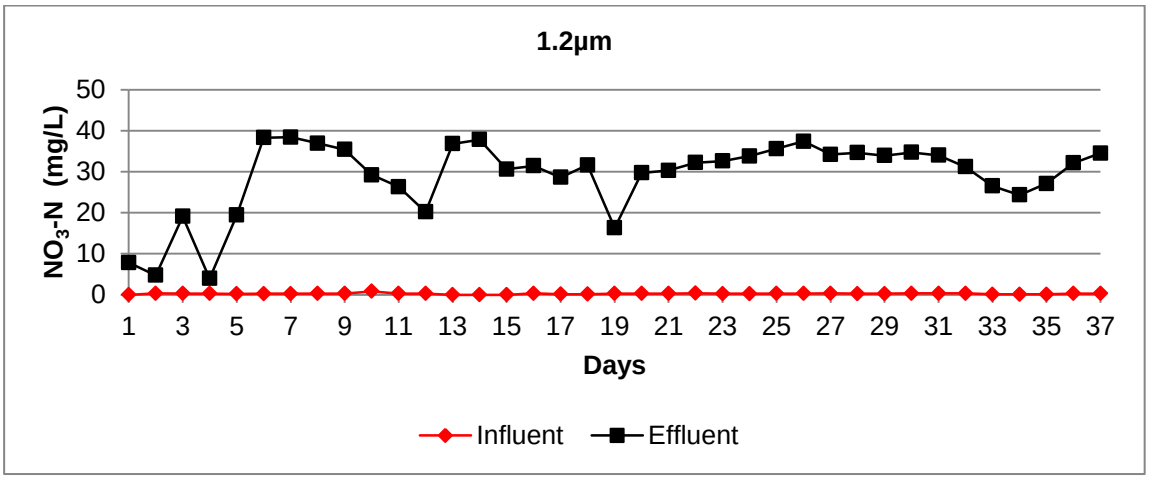


Figure 18. Variation nitrate nitrogen concentration for Reactor 2 during 37 days of the SBR operation.

Figure 19 shows the variation of the NO_2-N during the SBR operation for 37 days for Reactor 2. The average concentration of NO_2-N in the influent was 0.03 mg N/L and in the effluent was 0.07 mg N/L. In comparison with the NO_2-N concentration from R1 in the effluent, it can be seen a similar trend in the graph, with most of the values within the range of 0 – 0.5 mg/L NO_2-N approximately in the effluent, however the average concentration in the effluent for R2 was half of that from R1.

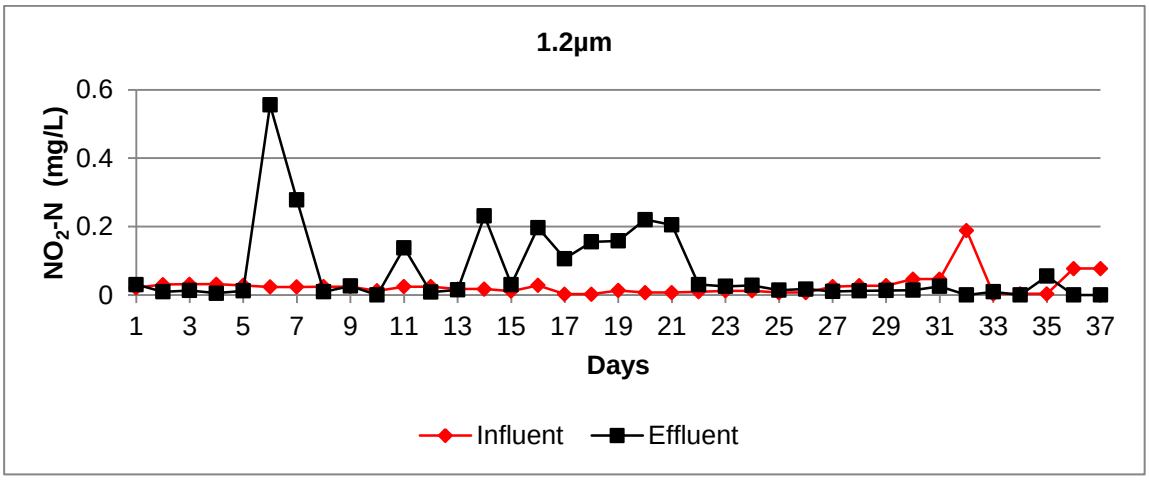


Figure 19. Variation nitrite nitrogen concentration for Reactor 2 during 37 days of the SBR operation.

Figure 20 shows the variation of the NH_4-N during the SBR operation for 37 days for Reactor 2. The average concentration of NH_4-N in the influent was 38.68 mg N/L and in the effluent was 1.59 mg N/L. The average % of NH_4-N removed was 96.09%.

It can be observed the same trend as in Figure 14 corresponding to R1, the concentrations and % of NH_4-N removed were very similar, with a difference of only 2.69% of NH_4-N removed.

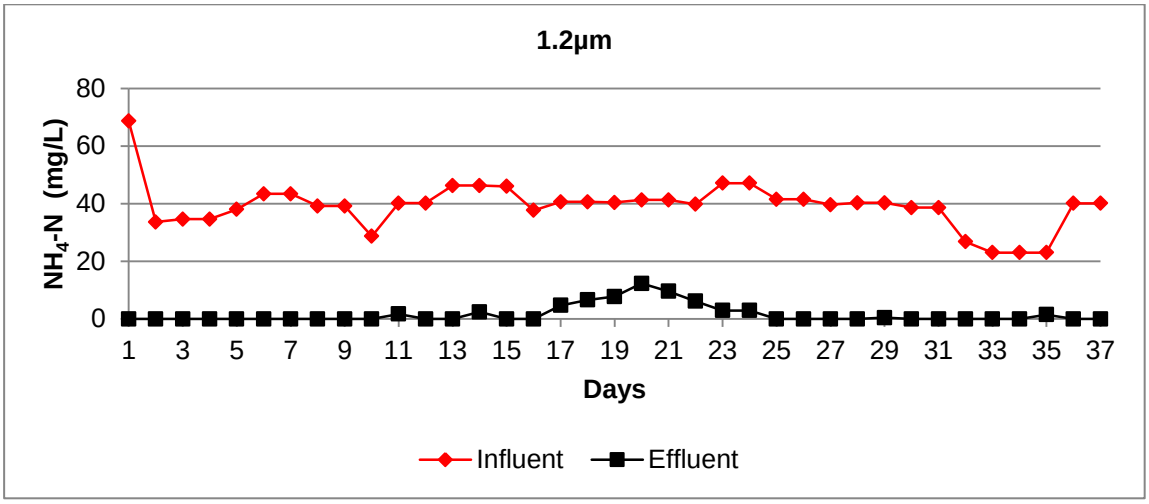


Figure 20. Variation ammonium nitrogen concentration for Reactor 2 during 37 days of the SBR operation.

Figure 21 shows the variation of the PO_4-P during the SBR operation for 37 days for Reactor 2. The average concentration of PO_4-P in the influent was 3.34 mg P/L and in the effluent was 2.92 mg P/L. In average 3.46% of PO_4-P was removed. In comparison with Figure 15 from R1,

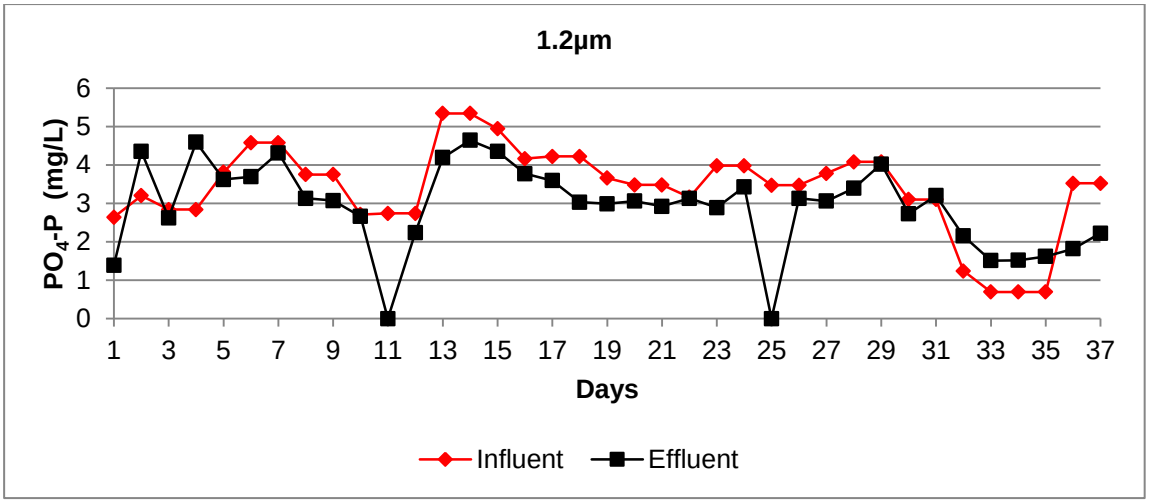


Figure 21. Variation orthophosphate concentration for Reactor 2 during 37 days of the SBR operation.

Figure 22 shows the variation of the sCOD during the SBR operation for 37 days for Reactor 2. The average concentration of sCOD in the influent was 186.5 mg/L and in the effluent was 36.61 mg/L, with a 79.82%COD removal.

In comparison with Figure 16 from R1 there is no visible difference, the graphs have the same trend and the %COD removal is very similar, with a difference of 4.17% between each reactor.

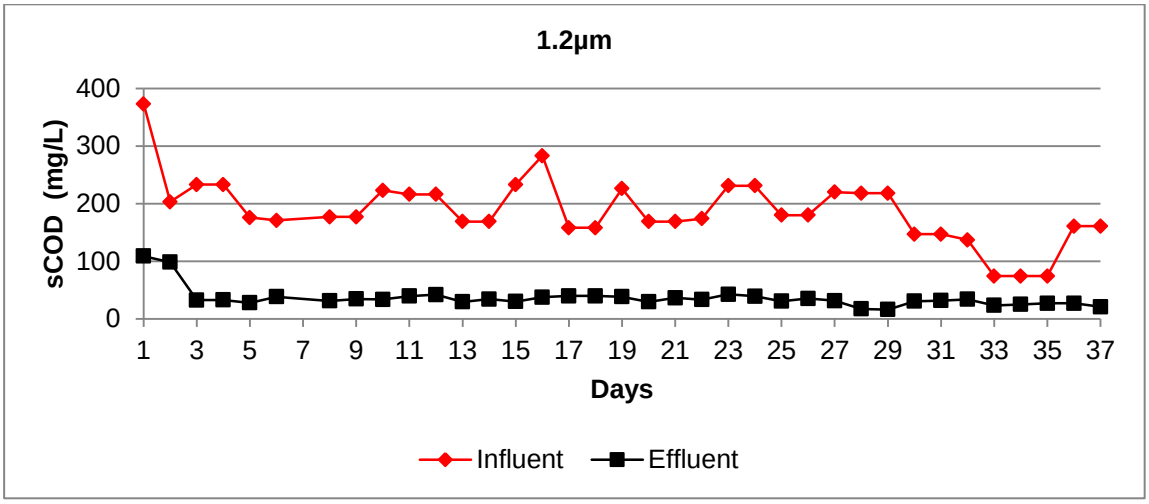


Figure 22. Variation of soluble COD for Reactor 2 during 37 days of the SBR operation.

Figure 23 shows the variation of the TSS during the SBR operation for 37 days for Reactor 2. The average concentration of TSS in the influent was 329.5 mg/L and in the effluent was 23.77 mg/L, with a 92.73% TSS removal.
In comparison with Figure 17 from R1 there is a difference in %TSS removal of 2.11%, both graphs shows the same trend.

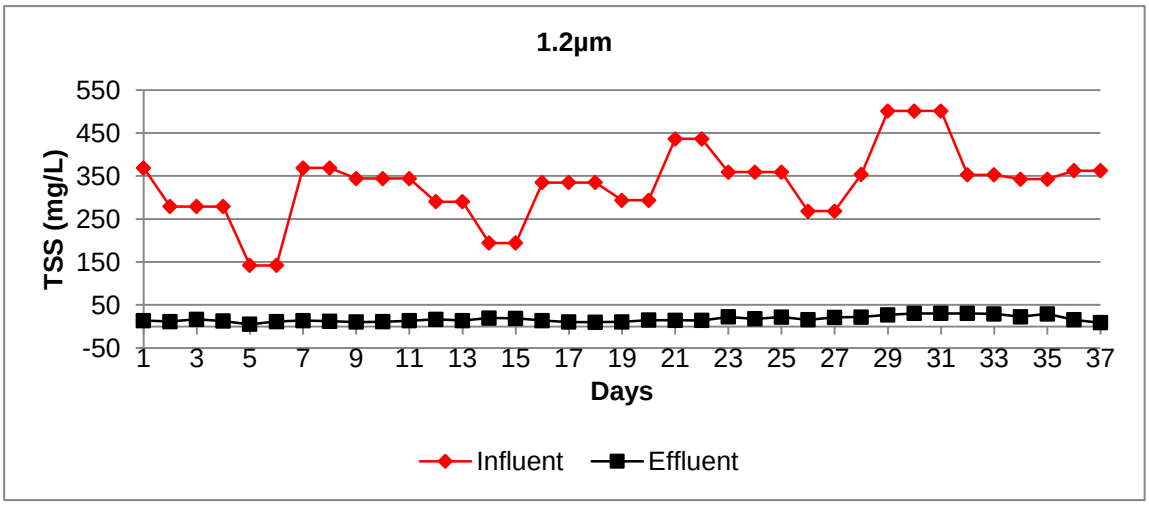


Figure 23. Variation of total suspended solids for Reactor 2 during 37 days of the SBR operation.

4.3 REACTOR 3- BENCH SCALE SALSNES FILTER (18 microns)

Figure 24 shows the variation of the NO_3-N during the SBR operation for 37 days for Reactor 3. The average concentration of NO_3-N in the influent was 0.26 mg N/L and in

the effluent was 26.24 mg N/L. Approximately 80 mg N/day was removed, this value is lower than the one obtained in R1 (510 mg N/day) and higher than the one obtained in R2 (20 mg N/day).

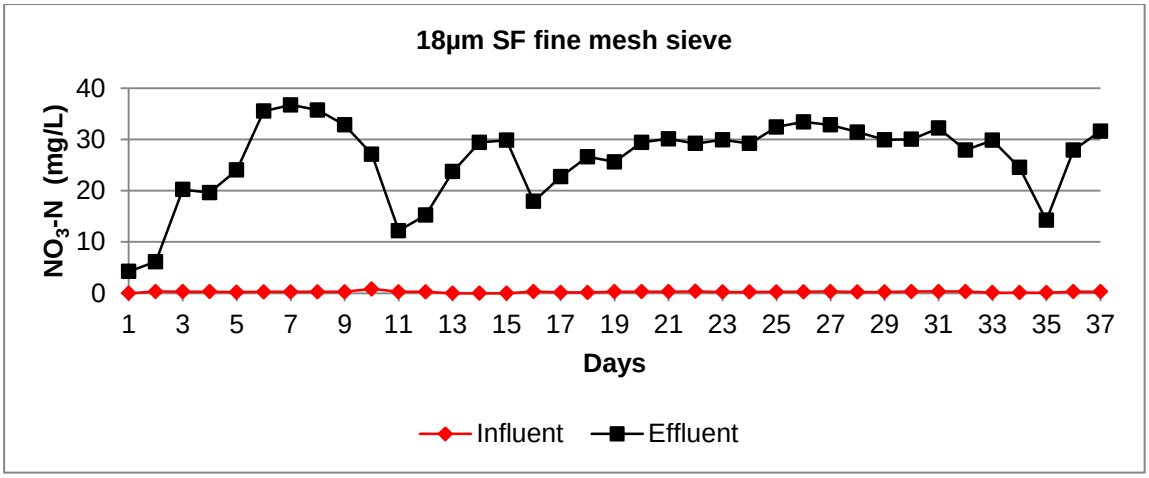


Figure 24. Variation of nitrate nitrogen concentration for Reactor 3 during 37 days of the SBR operation.

Figure 25 shows the variation of the NO_2-N during the SBR operation for 37 days for Reactor 3. The average concentration of NO_2-N in the influent was 0.03 mg N/L and in the effluent was 0.04 mg N/L.

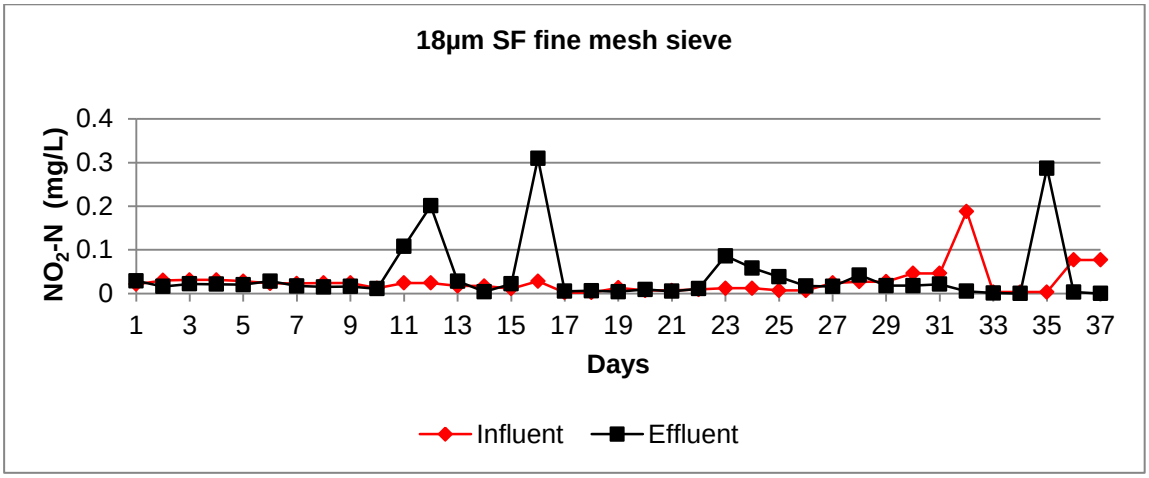


Figure 25. Variation of nitrite nitrogen concentration for Reactor 3 during 37 days of the SBR operation.

Figure 26 shows the variation of the NH_4-N during the SBR operation for 37 days for Reactor 3. The average concentration of NH_4-N in the influent was 38.68 mg N/L and in the effluent was 0.57 mg N/L. The average % of NH_4-N removed was 98.22%. R3 has the same trend as R1 and R2 with very similar concentrations and %NH_4-N removed.

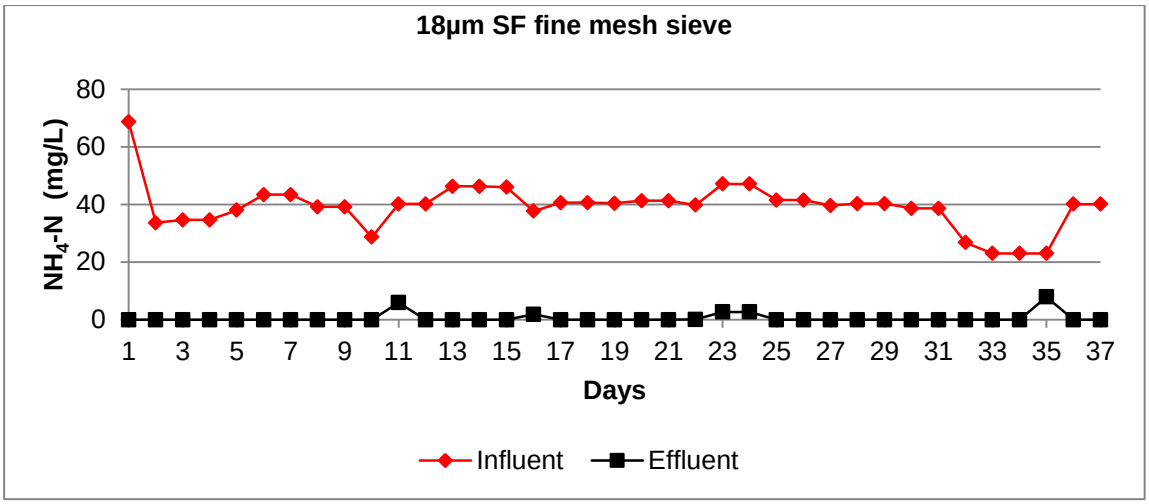


Figure 26. Variation of ammonium nitrogen concentration for Reactor 3 during 37 days of the SBR operation.

Figure 27 shows the variation of the PO_4-P during the SBR operation for 37 days for Reactor 3. The average concentration of PO_4-P in the influent was 3.34 mg P/L and in the effluent was 2.73 mg P/L. In average 10.26% of PO_4-P was removed.

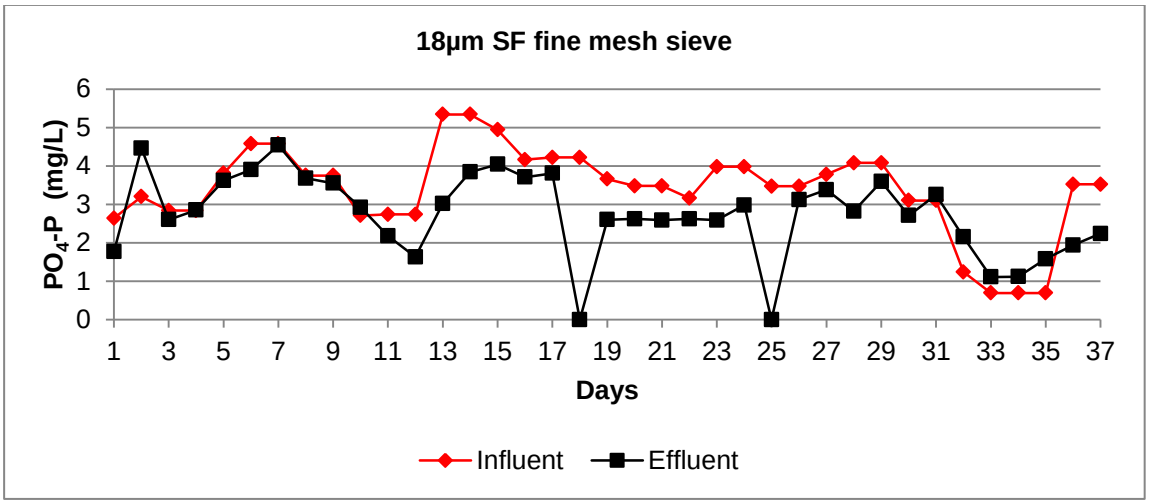


Figure 27. Variation of orthophosphate concentration for Reactor 3 during 37 days of the SBR operation.

Figure 28 shows the variation of the sCOD during the SBR operation for 37 days for Reactor 3. The average concentration of sCOD in the influent was 187.1 mg/L and in the effluent was 40.42 mg/L, with a 77.87%COD removal. The trend for R3 is the same than that from R1 and R2, there is no significant difference of %COD removed in the three reactors.

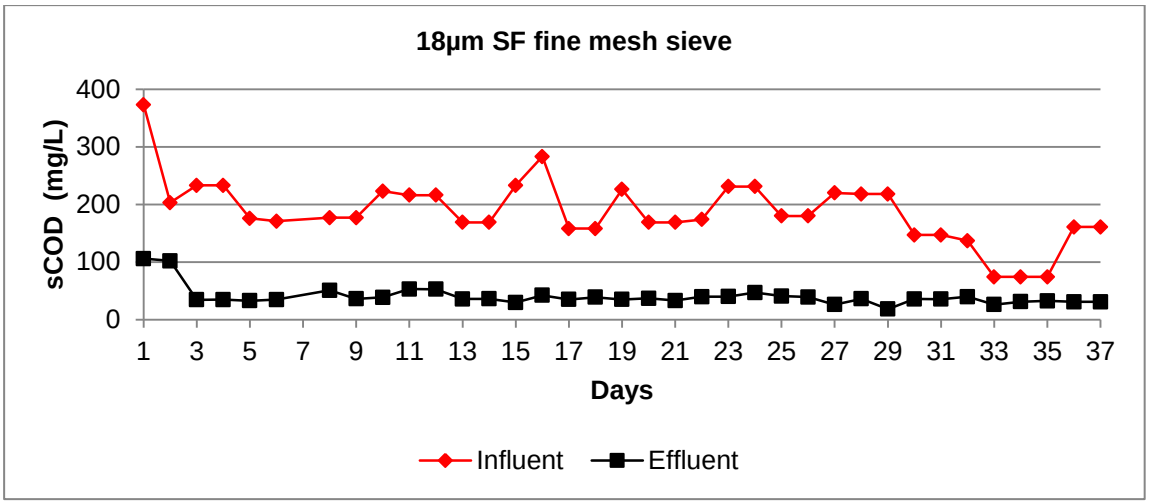


Figure 28. Variation of soluble COD for Reactor 3 during 37 days of the SBR operation.

Figure 29 shows the variation of the TSS during the SBR operation for 37 days for Reactor 3. The average concentration of TSS in the influent was 118.90 mg/L and in the effluent was 22.72 mg/L, with an 81.95% TSS removal. In comparison with R1 and R2, R3 removed less TSS, R1 and R2 removed up to 94.84% and 92.73% respectively.

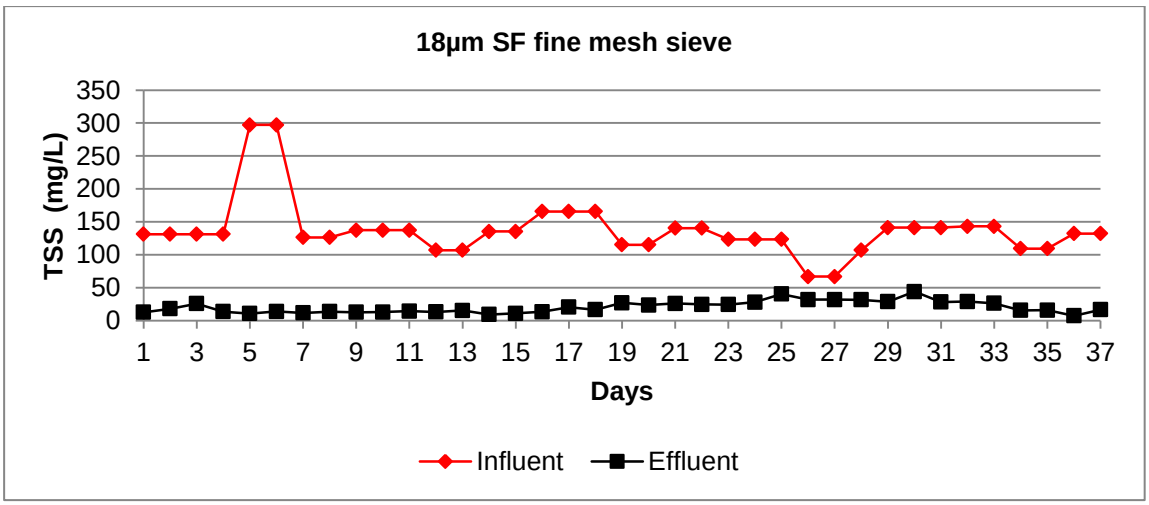


Figure 29. Variation of total suspended solids for Reactor 3 during 37 days of the SBR operation.

4.4 COD REMOVAL

Figure 30 shows the percentage COD removal per day for the three reactors for 37 days of the SBR operation. Reactor 1 had an average %COD removal of 76.31%, reactor 2 and 3 had an average of %COD removal of 80.37% and 77.87% respectively.

The removal efficiency for Reactor 1, 2 and 3 were 23.69%, 19.63% and 22.13% respectively. The %COD removal and the removal efficiencies from the Reactors that used ww filtered through SF (Reactor 2 =1.2µm, Reactor 3=18µm) has slightly higher values than Reactor 1 which used ww without filtration as a feed.

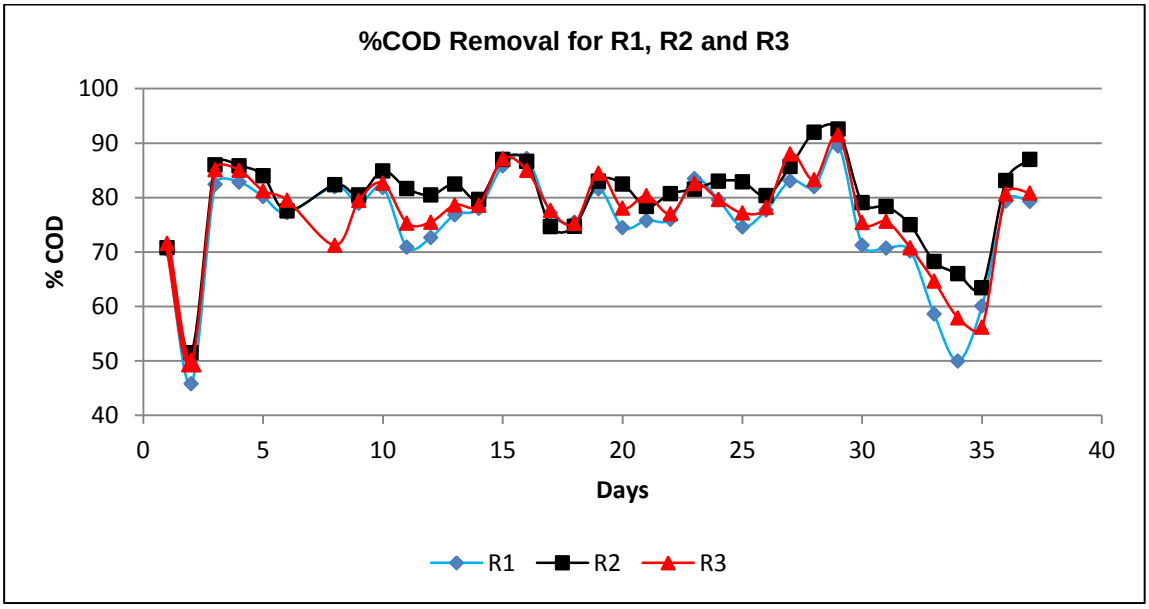


Figure 30. COD removal during 37 days of the SBR operation.

4.5 TSS REMOVAL

Figure 31 shows the %TSS removal for each one of the three Reactors for 37 days of the SBR operation. Reactor 1 had an average %TSS removal of 94.84%, Reactors 2 and 3 had an average of %TSS removal of 92.73% and 81.95% respectively. Percentage removals are close to those reported by US EPA (1992) which ranged from 84.7 to 97.2%; the values are also higher than the one found by Newcombe *et al.* (2011) at a full scale plant using a RBS from SF after grit removal with a 350 micro mesh sieve, the removal rate found was 45% TSS. Reactor 1 removed higher SS than Reactor 2 and 3, opposite to the COD removal shown before.

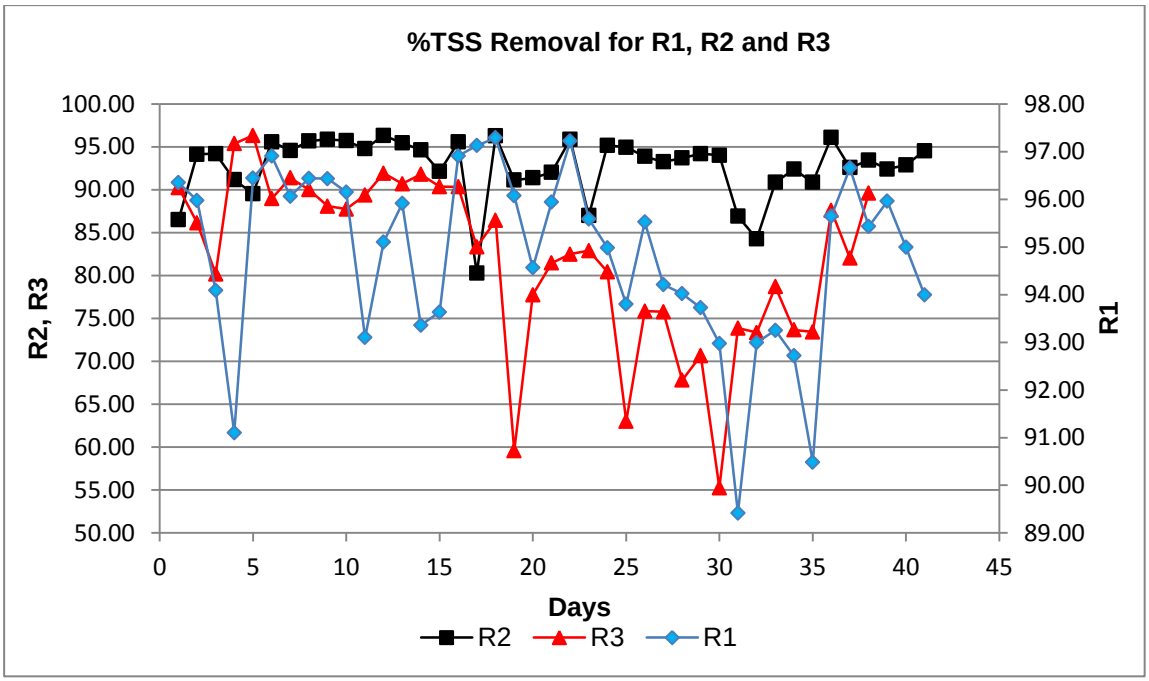


Figure 31. SS removal during 37 days of the SBR operation.

4.6 DENITRIFICATION RATES

Figure 32 shows the performance of the Reactor 1 during the nitrification and denitrification test on day 18th (28.Feb.2013) for the first 13 hours after the fill cycle. The concentration of NH_4-N (21.9 mg N/L) in the influent slightly increased during the first anoxic stage (first 5 hours) until it reached a concentration of 23.6 mg N/L; during the first aerobic stage it decreased progressively until it reached a concentration of 3.24 mg N/L, from this point it continued decreasing until it reached a concentration of approximately 0.7 mg N/L, the whole cycle had a 96.8% NH_4-N reduced. The concentration of NO_3-N and NO_2-N started increasing at 5 hours operation due to biological oxidation of NH_4-N. Concentrations of NH_4-N and NO_3-N are found at some extent in the effluent, indicating that the process of nitrification-denitrification was incomplete, suggesting that more aeration time was required to achieve complete oxidation of NH_4-N. About 96.8% of NH_4-N was transformed to NO_2-N and NO_3-N.

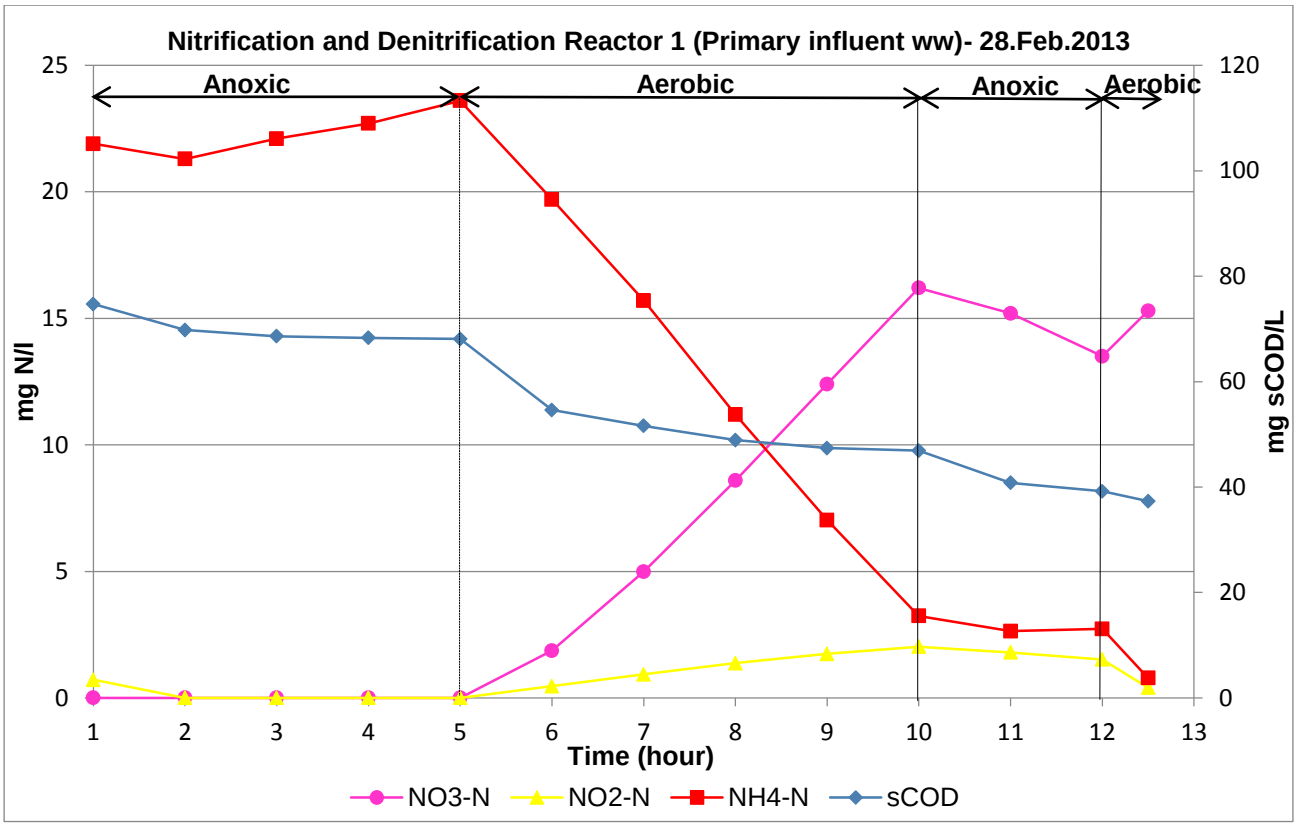


Figure 32. Performance of Reactor 1. Nitrification and denitrification on 28.Feb.2013 for the first 13 hours after fill cycle.

Figure 33 shows the performance of the Reactor 1 during the nitrification and denitrification test on day 26th (12.Mar.2013) for the first 13 hours after the fill cycle. Unlike the concentration of NH_4-N showed in Figure 34, the concentration in Figure 35 (20.4 mg N/L) in the influent was stable during the first anoxic stage (first 5 hours) until it reached a concentration of 20.2 mg N/L; after this point it showed the same trend as Figure 34 decreasing progressively during the first aerobic stage until it reached a concentration of 1.86 mg N/L, from this point it continued decreasing until it reached a concentration of 0 mg N/L, the whole cycle had a 100% NH_4-N reduced. The concentration of NO_3-N and NO_2-N started increasing at 5 hours operation due to biological oxidation of NH_4-N. About 100% of NH_4-N was transformed to NO_2-N and NO_3-N.

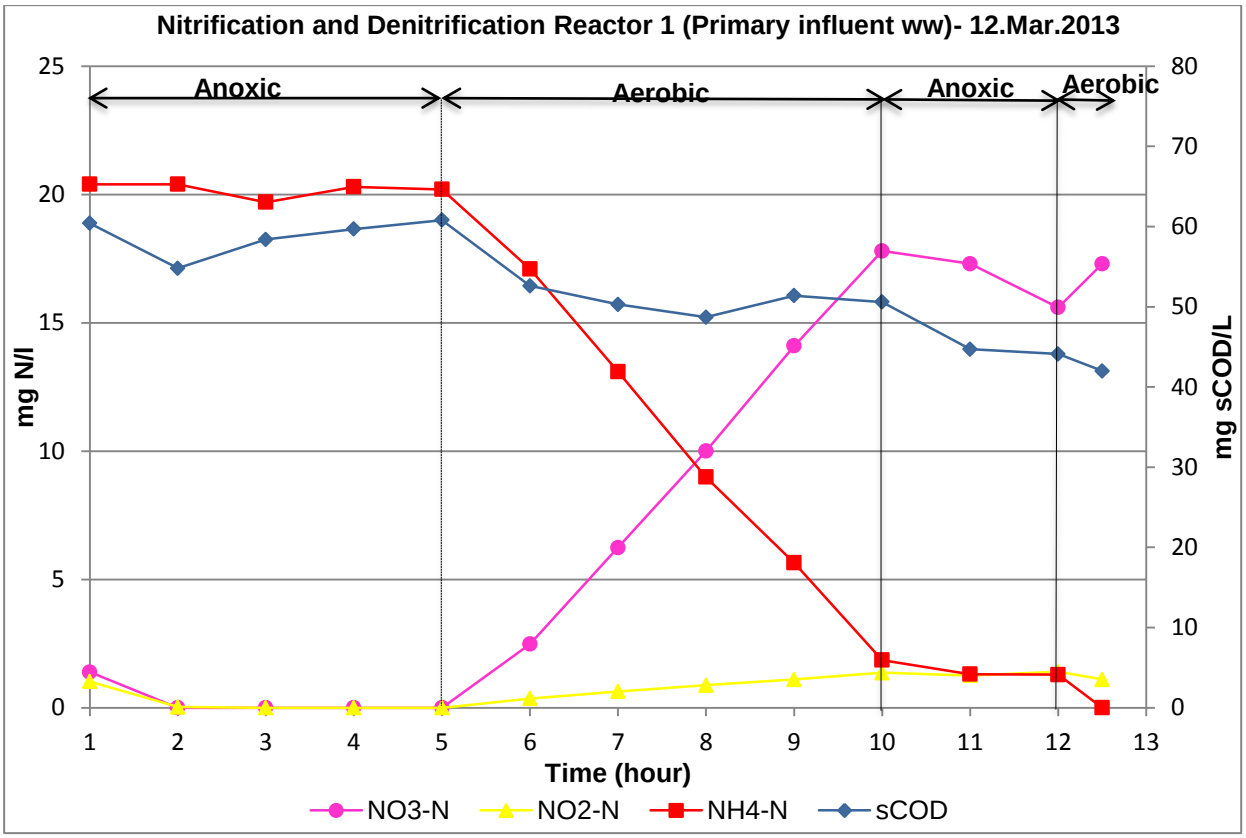


Figure 33. Performance of Reactor 1. Nitrification and denitrification on 12.Mar.2013 for the first 13 hours after fill cycle.

Figure 34 shows the performance of the Reactor 2 during the nitrification and denitrification test on day 18th (28.Feb.2013) for the first 13 hours after the fill cycle. In comparison with the same test performed the same day for R1, the concentration of NH_4-N (24.3 mg N/L) in the influent kept stable during the first anoxic stage instead of increasing (first 5 hours); after this point it showed the same trend as the one for R1 decreasing progressively during the first aerobic stage until it reached a concentration of 10.6 mg N/L, this value is higher than the one for R1 (3.24 mg N/L) from this point it continued decreasing until it reached a concentration of 7.73 mg N/L, the whole cycle had a 68.18% NH_4-N reduced which is lower than that obtained in R1 of 96.8% NH_4-N reduced.

The concentration of NO_3-N and NO_2-N started increasing at 5 hours operation due to biological oxidation of NH_4-N, but unlike R1 the concentration of NO_3-N started at 17.6 mg N/L and not at 0 mg N/L. About 68.18% of NH_4-N was transformed to NO_2-N and NO_3-N.

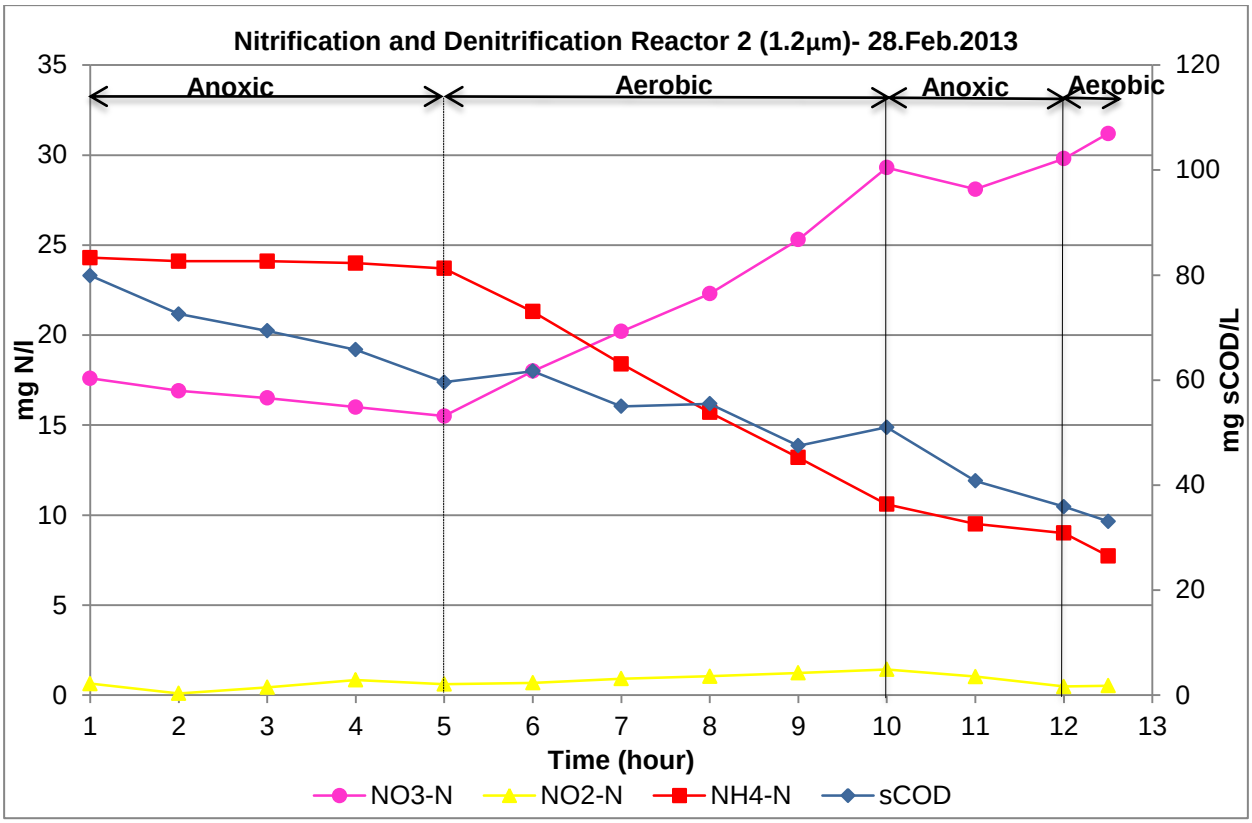


Figure 34. Performance of Reactor 2. Nitrification and denitrification on 28.Feb.2013 for the first 13 hours after fill cycle

Figure 35 shows the performance of the Reactor 2 during the nitrification and denitrification test on day 26th (12.Mar.2013) for the first 13 hours after the fill cycle. In comparison with the same test performed the same day for R1, the concentration of NH_4-N (29.3 mg N/L) in the influent was stable during the first anoxic stage as well (first 5 hours); after this point it decreased during the first aerobic stage until it reached a concentration of 23.7 mg N/L, this value is higher than the one for R1 (1.86 mg N/L) from this point it continued decreasing until it reached a concentration of 22.2 mg N/L, the whole cycle had a 19.11% NH_4-N reduced which is much lower than that obtained in R1 of 100% NH_4-N reduced.

Unlike R1, the concentration of NO_2-N was stable during the whole test with values close to 0 mg N/L; the NO_3-N concentration started increasing at 5 hours operation due to biological oxidation of NH_4-N, but unlike R1 the concentration of NO_3-N started at 12.7 mg N/L and not at 1.02 mg N/L. About 19.11% of NH_4-N was transformed to NO_2-N and NO_3-N.

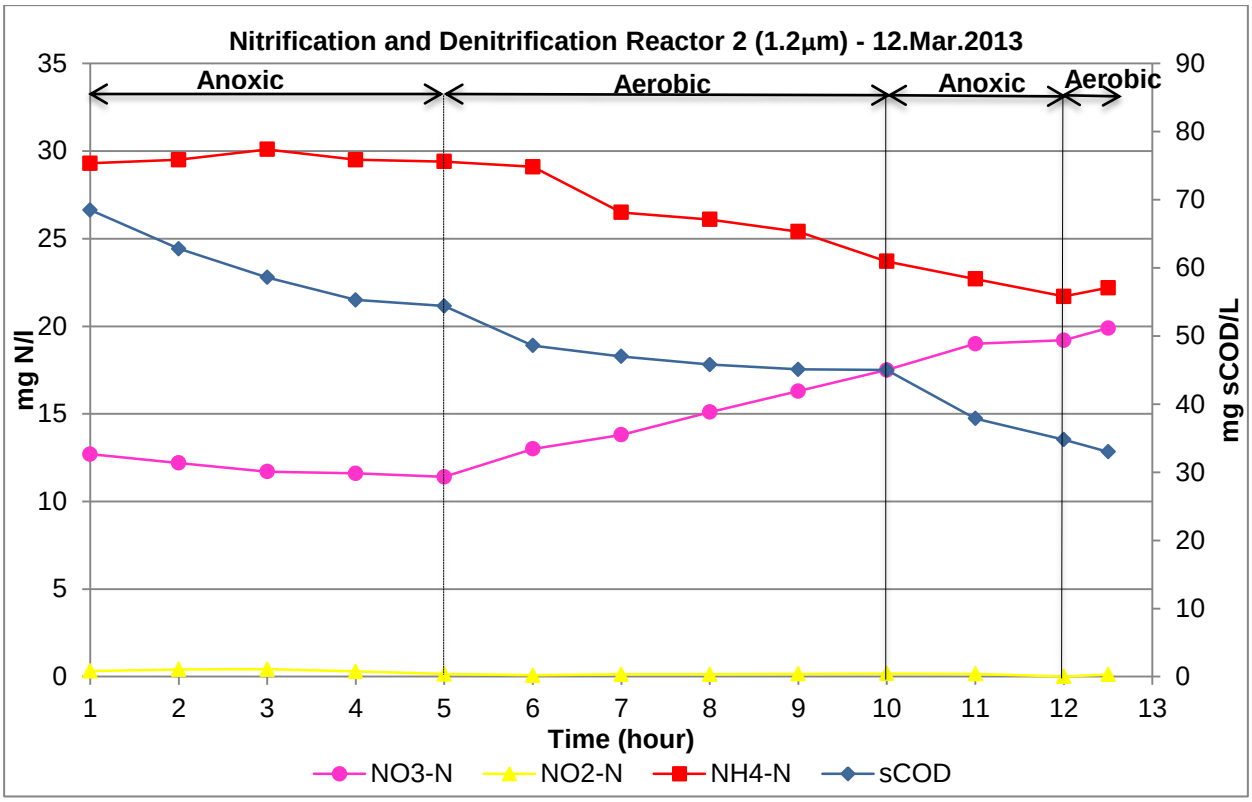


Figure 35. Performance of Reactor 2. Nitrification and denitrification on 12.Mar.2013 for the first 13 hours after fill cycle

Figure 36 shows the performance of the Reactor 3 during the nitrification and denitrification test on day 18th (28.Feb.2013) for the first 13 hours after the fill cycle. In comparison with the same test performed the same day for R1 and R2, the concentration of NH_4-N (22 mg N/L) in the influent kept stable during the first anoxic stage as in R2 instead of increasing as in R1 (first 5 hours); after this point it showed the same trend as the one for R1 and R2 decreasing progressively during the first aerobic stage until it reached a concentration of 3.47 mg N/L, this value is similar as the one for R1 and lower than the one for R2 (23.7 mg N/L) from this point it continued decreasing until it reached a concentration of 0.96 mg N/L, the whole cycle had a 95.6% NH_4-N reduced which is similar as the one obtained in R1 (96.8%) and higher than that obtained in R2 (68.18%).

As in R2 the concentration of NO_3-N started at a higher concentration than in R1 (11.9 mg N/L), both NO_2-N and NO_3-N concentrations started increasing at 5 hours operation due to biological oxidation of NH_4-N. About 95.6% of NH_4-N was transformed to NO_2-N and NO_3-N, this value is similar as the one obtained in R1 (96.8%) and higher than the one obtained in R2 (68.18%).

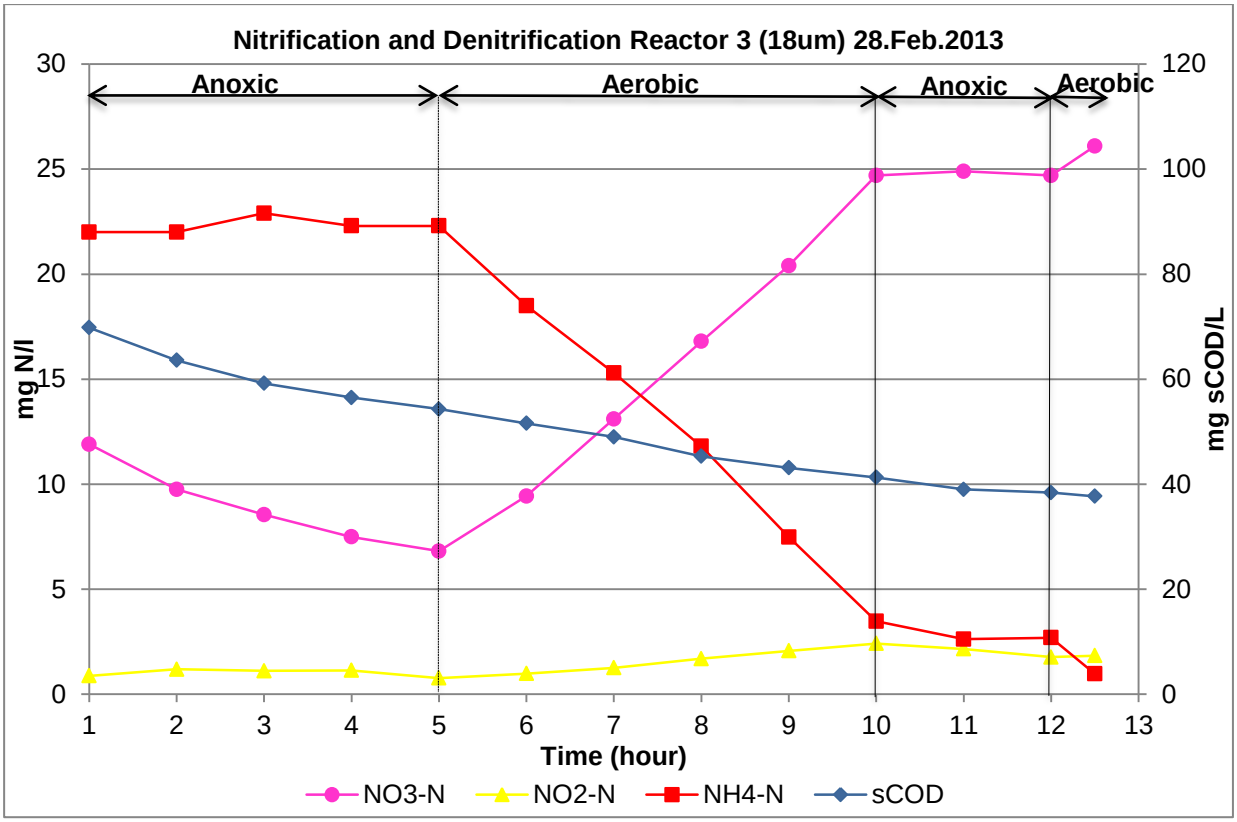


Figure 36. Performance of Reactor 3. Nitrification and denitrification on 28.Feb.2013 for the first 13 hours after fill cycle

Figure 37 shows the performance of the Reactor 3 during the nitrification and denitrification test on day 26th (12.Mar.2013) for the first 13 hours after the fill cycle. As in R1 and R2, the concentration of NH_4-N (21.7 mg N/L) in the influent kept stable during the first anoxic stage (first 5 hours); after this point it showed the same trend as the one for R1 and R2 decreasing progressively during the first aerobic stage until it reached a concentration of 8.74 mg N/L, from this point it continued decreasing until it reached a concentration of 6.44 mg N/L, the whole cycle had a 70.32% NH_4-N reduced which is lower than the one obtained in R1 (100%) and higher than that obtained in R2 (19.11%).

As in R2 the concentration of NO_3-N started at a higher concentration than in R1 (10 mg N/L) and it started increasing at 5 hours operation due to biological oxidation of NH_4-N. The concentration of NO_2-N was stable during the whole test with values close to 0 mg N/L approximately. About 70.32% of NH_4-N was transformed to NO_2-N and NO_3-N.

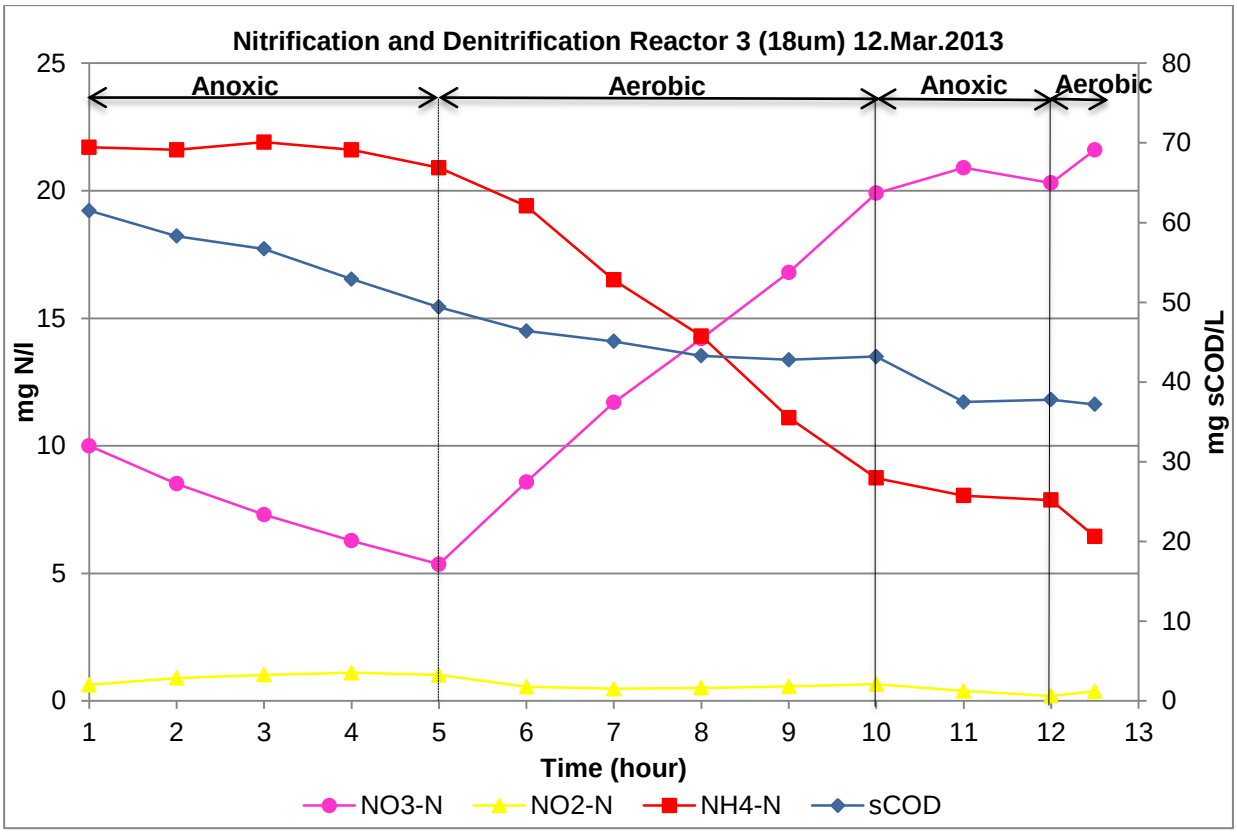


Figure 37. Performance of Reactor 3. Nitrification and denitrification on 12.Mar.2013 for the first 13 hours after fill cycle

Since NO_2-N accumulation during the denitrification test was observed, concentrations of NO_2-N and NO_3-N were taken into consideration to calculate the denitrification rate shown in Table 12. Figure 38 shows that the denitrification rate for R1 was slightly higher than the one for R2 and R3. The denitrification rate for R3 was higher than the one for R2, however with a small difference.

Table 12. Denitrification rates

Day	Date	Denitrification rate (gN/gVSS.d)		
		Unfiltered	18µm	1.2µm
12	19.02.13	0.06	0.05	0.02
14	21.02.13	0.05	0.04	0.02
21	28.02.13	0.07	0.04	0.04
32	12.03.13	0.07	0.05	0.04
39	19.03.13	0.05	0.05	0.03
41	21.03.13	0.06	0.03	0.02
54	03.04.13	0.05	0.03	0.01

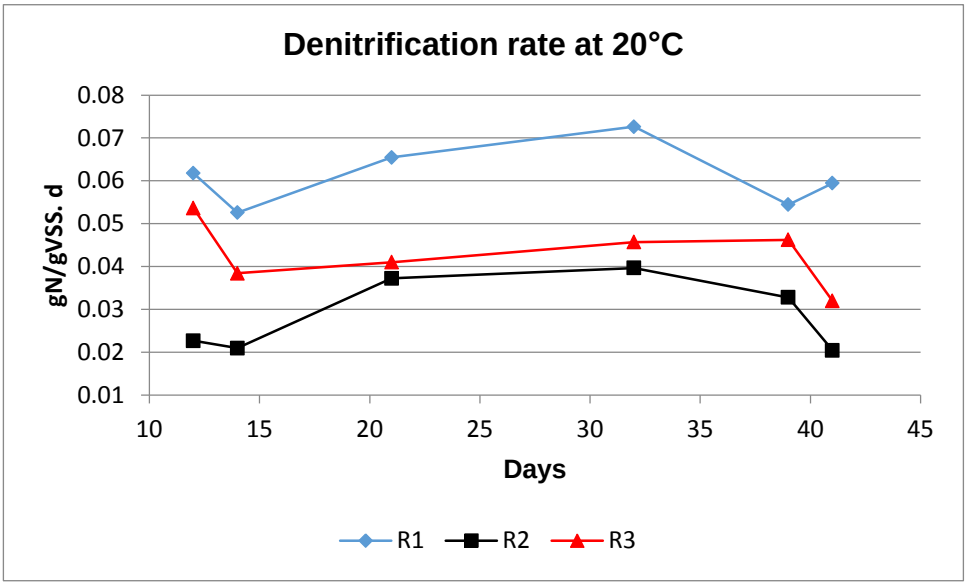


Figure 38. Denitrification rate for Reactor 1, 2 and 3.

4.7 DO AND pH

Figure 39 shows the variation of DO and pH during the denitrification test the day 18th (28.feb.2013). The average DO concentration during the aeration phase was approximately 4.45mg/L, theoretically, nitrification would be carried out without difficulty since efficiency for nitrification is good for values above 2.0 mg/L (Rodríguez *et al.*,2011a). pH was maintained at an average approximately 7.54 during the whole test by adding HCl(1M) and NaOH(1M). The optimum pH range has been found to be 7.0 to 8.0 for both nitrification and denitrification(Sedlak,1991). Figures for the other days when the test was performed followed the same trend since DO and pH was controlled intentionally, DO was controlled by diffusers connected to time controllers and pH was maintained with NaOH and HCl as explained before.

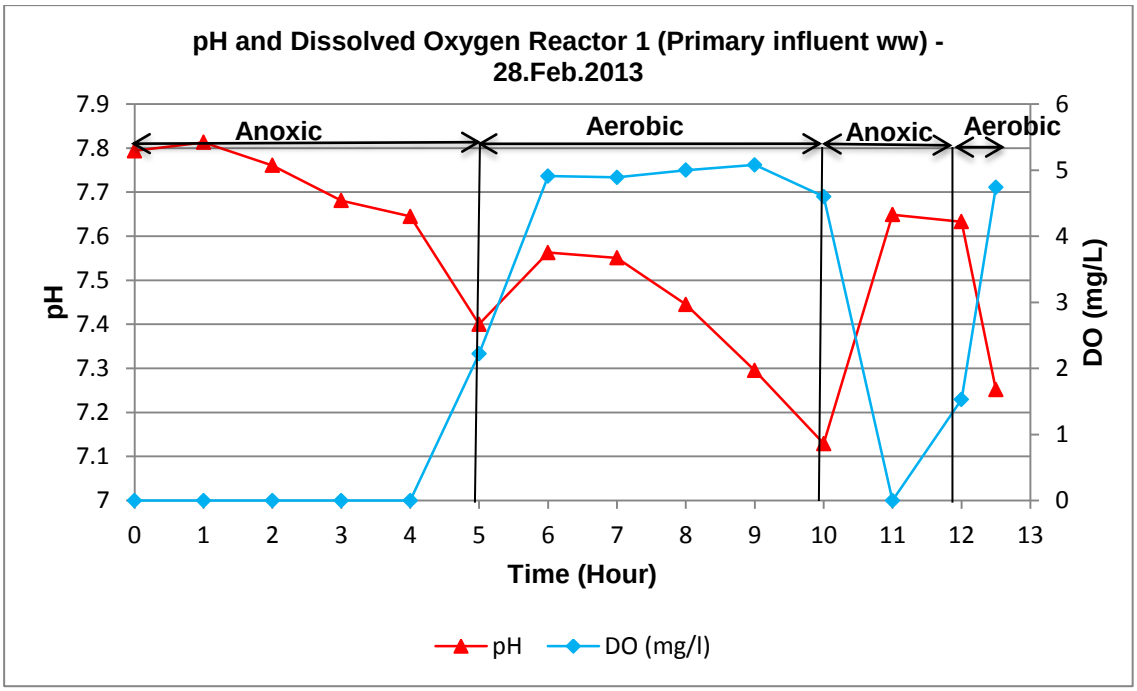


Figure 39. Variation of dissolved oxygen and pH in Reactor 1 during nitrification and denitrification test the 28.Feb.2013.

V. CONCLUSIONS

This study investigated nitrogen removal of municipal wastewater, using sequencing batch reactors (SBR). Municipal wastewater prior to primary treatment with and without filtration through SF was used as a feed. The overall objective was to determine how denitrification is affected by solids removal using two different mesh sizes (1.2 µm and 18µm SF fine mesh sieve) using bench scale SF. The specific objectives of this study were to: set up an experimental method with three different conditions (unfiltered ww, filter after 18 µm and ww filter after 1.2 µm) and evaluate the performance of SBRs for long term denitrification process; investigate the effect of removal of organic material prior to biological nutrient removal process; compare nitrification rates for different size of SF mesh sieves and characterize particle size distribution after separation with SF.

The results of this study showed that the SF mesh sieves removed a significant amount of material as a primary treatment device; the influent ww had a pCOD of 431.51 mg/L for Reactor 1 and 161.99 mg/L for Reactor 3, the values for TSS in the influent were 329.5 mg/L for Reactor 1 and 2 and 118.9 mg/L for Reactor 3. The removal percentage was 92.73% and 81.95% TSS for Reactors 2 and 3 using 1.2µm and 18µm SF fine mesh sieve respectively. These results are similar to the percentage of TSS removed by Reactor 1(94.84%), showing there is no significant difference between ww without filtering and ww filtered through SF.

The percentage of NH_4-N removed in the 3 reactors was similar, showing that most of the NH_4-N was transformed into NO_2-N and NO_3-N. Results for TCOD removal showed higher percentage removed by SF fine mesh sieve (18 microns) and 1.2 microns in comparison with Reactor 1 which used wastewater without filtration with SF, however this difference was no significant, Reactor 1 removed 76.31%, Reactor 2 and 3 removed 79.82% and 77.87% respectively.

Results obtained from the denitrification and nitrification tests showed that the denitrification rate was higher for Reactor 1. Reactor 3 had a higher denitrification rate than Reactor 2 which may lead to conclude that wastewater filtered through 18µm has a better performance than wastewater filtered through 1.2µm; however the difference between the denitrification rates in the three reactors is not significant enough to assure 18µm has a better performance, to conclude that the use of SF in wastewater prior to

biological nutrient removal process does not affect the denitrification rate, is necessary to perform more detailed studies.

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VII. APPENDIX

A.1 . LT 200 SPECIFICATIONS. ADAPTED FROM (Lange,2012)

Parameters	Specifications
Heating programs	Pre-programmed for 40°C, 100°C, 148°C and freely selectable 37-150 °C, 1-148 min
Temperature stability	$\pm$ 1°C in conformity with the international organization for standardization (ISO) and the United States environmental protection agency (EPA) methods
Dimensions	250 x 145 x 310 mm (QxHxD)
Weight	2.8 kg
Power input	115V/600 VA 230V/900VA
Number of cuvettes	30x13 mm diameter

A.2 TECHNICAL DATA MULTI-PARAMETER WTW 3420. Adapted from (WTW Wissendschaftlich-Technische Werkstätten,2009)

General Specifications	
Memory	Automatic, 10000 data sets
Data logger	Manual/time controlled
Interface	USB host and mini-USB
Power supply	Battery charge or 4 x 1.2 V NiMH rechargeable batteries
Continuous	100 h
Protection class	IP 67
Calibration memory	Up to 10 calibrations
D-O. measurement	
Concentration	0.0- 20.00 mg/l
Saturation	0.0 – 200.0%
Partial pressure	0 – 400.0 hPa
Temperature	0.0 – 50.0°C
Auto read	Automatic/manual
pH measurement	
pH	-2.0 – 20.0 pH -2.00 – 20.00 pH -2.000 – 20.000 pH
mV	+- 2000; +- 1250.0
Temperature	-5.0- 105.0°C
Auto read	Automatic/manual
Calibration	1-,2-,3-,4-,5- point; WTW Technical, DIN/NIST, additionally 20 buffer sets

A.3 STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER – TOTAL SUSPENDED SOLIDS

7. Bibliography

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2540 D. Total Suspended Solids Dried at 103–105°C

1. General Discussion

a. Principle: A well-mixed sample is filtered through a weighed standard glass-fiber filter and the residue retained on the filter is dried to a constant weight at 103 to 105°C. The increase in weight of the filter represents the total suspended solids. If the suspended material clogs the filter and prolongs filtration, it may be necessary to increase the diameter of the filter or decrease the sample volume. To obtain an estimate of total suspended solids, calculate the difference between total dissolved solids and total solids.

b. Interferences: See Section 2540A.2 and Section 2540B.1. Exclude large floating particles or submerged agglomerates of nonhomogeneous materials from the sample if it is determined that their inclusion is not representative. Because excessive residue on the filter may form a

water-entrapping crust, limit the sample size to that yielding no more than 200 mg residue. For samples high in dissolved solids thoroughly wash the filter to ensure removal of dissolved material. Prolonged filtration times resulting from filter clogging may produce high results owing to increased colloidal materials captured on the clogged filter.

2. Apparatus

Apparatus listed in Section 2540B.2 and Section 2540C.2 is required, except for evaporating dishes, steam bath, and 180°C drying oven. In addition:

Aluminum weighing dishes.

3. Procedure

a. Preparation of glass-fiber filter disk: If pre-prepared glass fiber filter disks are used, eliminate this step. Insert disk with wrinkled side up in filtration apparatus. Apply vacuum and wash disk with three successive 20-mL portions of reagent-grade water. Continue suction to remove all traces of water, turn vacuum off, and discard washings. Remove filter from filtration apparatus and transfer to an inert aluminum weighing dish. If a Gooch crucible is used, remove crucible and filter combination. Dry in an oven at 103 to 105°C for 1 h. If volatile solids are to be measured, ignite at 550°C for 15 min in a muffle furnace. Cool in desiccator to balance temperature and weigh. Repeat cycle of drying or igniting, cooling, desiccating, and weighing until a constant weight is obtained or until weight change is less than 4% of the previous weighing or 0.5 mg, whichever is less. Store in desiccator until needed.

b. Selection of filter and sample sizes: Choose sample volume to yield between 2.5 and 200 mg dried residue. If volume filtered fails to meet minimum yield, increase sample volume up to 1 L. If complete filtration takes more than 10 min, increase filter diameter or decrease sample volume.

c. Sample analysis: Assemble filtering apparatus and filter and begin suction. Wet filter with a small volume of reagent-grade water to seat it. Stir sample with a magnetic stirrer at a speed to shear larger particles, if practical, to obtain a more uniform (preferably homogeneous) particle size. Centrifugal force may separate particles by size and density, resulting in poor precision when point of sample withdrawal is varied. While stirring, pipet a measured volume onto the seated glass-fiber filter. For homogeneous samples, pipet from the approximate midpoint of container but not in vortex. Choose a point both middepth and midway between wall and vortex. Wash filter with three successive 10-mL volumes of reagent-grade water, allowing complete drainage between washings, and continue suction for about 3 min after filtration is complete. Samples with high dissolved solids may require additional washings. Carefully remove filter from filtration apparatus and transfer to an aluminum weighing dish as a support. Alternatively, remove the crucible and filter combination from the crucible adapter if a Gooch crucible is used. Dry for at least 1 h at 103 to 105°C in an oven, cool in a desiccator to balance temperature, and weigh. Repeat the cycle of drying, cooling, desiccating, and weighing until a constant weight is obtained or until the weight change is less than 4% of the previous weight or 0.5 mg, whichever is less. Analyze at least 10% of all samples in duplicate. Duplicate determinations should agree

within 5% of their average weight. If volatile solids are to be determined, treat the residue according to 2540E.

4. Calculation

$$\text{mg total suspended solids/L} = \frac{(A - B) \times 1000}{\text{sample volume, mL}}$$

where:

A = weight of filter + dried residue, mg, and
B = weight of filter, mg.

5. Precision

The standard deviation was 5.2 mg/L (coefficient of variation 33%) at 15 mg/L, 24 mg/L (10%) at 242 mg/L, and 13 mg/L (0.76%) at 1707 mg/L in studies by two analysts of four sets of 10 determinations each.

Single-laboratory duplicate analyses of 50 samples of water and wastewater were made with a standard deviation of differences of 2.8 mg/L.

6. Bibliography

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determination. *J. Water Pollut. Control Fed.* 50:2370.

2540 E. Fixed and Volatile Solids Ignited at 550°C

1. General Discussion

a. Principle: The residue from Method B, C, or D is ignited to constant weight at 550°C. The remaining solids represent the fixed total, dissolved, or suspended solids while the weight lost on ignition is the volatile solids. The determination is useful in control of wastewater treatment plant operation because it offers a rough approximation of the amount of organic matter present in the solid fraction of wastewater, activated sludge, and industrial wastes.

b. Interferences: Negative errors in the volatile solids may be produced by loss of volatile matter during drying. Determination of low concentrations of volatile solids in the presence of high fixed solids concentrations may be subject to considerable error. In such cases, measure for suspect volatile components by another test, for example, total organic carbon (Section 5310). Highly alkaline residues may react with silica in sample or silica-containing crucibles.

2. Apparatus

See Section 2540B.2, Section 2540C.2, and Section 2540D.2.

3. Procedure

Ignite residue produced by Method 2540B, C, or D to constant weight in a muffle furnace at a temperature of 550°C. Ignite a blank glass fiber filter along with samples. Have furnace up to temperature before inserting sample. Usually, 15 to 20 min ignition are required for 200 mg residue. However, more than one sample and/or heavier residues may overtax the furnace and necessitate longer ignition times. Let dish or filter disk cool partially in air until most of the heat has been dissipated. Transfer to a desiccator for final cooling in a dry atmosphere. Do not overload desiccator. Weigh dish or disk as soon as it has cooled to balance temperature. Repeat cycle of igniting, cooling, desiccating, and weighing until a constant weight is obtained or until weight change is less than 4% or 0.5 mg, whichever is less. Analyze at least 10% of all samples in duplicate. Duplicate determinations should agree within 5% of their average weight. Weight loss of the blank filter is an indication of unsuitability of a particular brand or type of filter for this analysis.

4. Calculation

A.4 STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER – SETTLEABLE SOLIDS

$$\text{mg volatile solids/L} = \frac{(A - B) \times 1000}{\text{sample volume, mL}}$$

$$\text{mg fixed solids/L} = \frac{(B - C) \times 1000}{\text{sample volume, mL}}$$

where:

A = weight of residue + dish before ignition, mg,
B = weight of residue + dish or filter after ignition, mg, and
C = weight of dish or filter, mg.

5. Precision

The standard deviation was 11 mg/L at 170 mg/L volatile total solids in studies by three laboratories on four samples and 10 replicates. Bias data on actual samples cannot be obtained.

2540 F. Settleable Solids

1. General Discussion

Settleable solids in surface and saline waters as well as domestic and industrial wastes may be determined and reported on either a volume (mL/L) or a weight (mg/L) basis.

2. Apparatus

The volumetric test requires only an Imhoff cone. The gravimetric test requires all the apparatus listed in Section 2540D.2 and a glass vessel with a minimum diameter of 9 cm.

3. Procedure

a. Volumetric: Fill an Imhoff cone to the 1-L mark with a well-mixed sample. Settle for 45 min, gently agitate sample near the sides of the cone with a rod or by spinning, settle 15 min longer, and record volume of settleable solids in the cone as milliliters per liter. If the settled matter contains pockets of liquid between large settled particles, estimate volume of these and subtract from volume of settled solids. The practical lower limit of measurement depends on sample composition and generally is in the range of 0.1 to 1.0 mL/L. Where a separation of settleable and floating materials occurs, do not estimate the floating material as settleable matter. Replicates usually are not required.

Where biological or chemical floc is present, the gravimetric method (3*b*) is preferred.

b. Gravimetric:

1) Determine total suspended solids as in Section 2540D.

2) Pour a well-mixed sample into a glass vessel of not less than 9 cm diam using not less

than 1 L and sufficient sample to give a depth of 20 cm. Alternatively use a glass vessel of greater diameter and a larger volume of sample. Let stand quiescent for 1 h and, without disturbing the settled or floating material, siphon 250 mL from center of container at a point halfway between the surface of the settled material and the liquid surface. Determine total suspended solids (milligrams per liter) of this supernatant liquor (Section 2540D). These are the nonsettleable solids.

4. Calculation

mg settleable solids/L = mg total suspended solids/L – mg nonsettleable solids/L

5. Precision and Bias

Precision and bias data are not now available.

6. Bibliography

FISCHER, A.J. & G.E. SYMONS. 1944. The determination of settleable sewage solids by weight. *Water Sewage Works* 91:37.

2540 G. Total, Fixed, and Volatile Solids in Solid and Semisolid Samples

1. General Discussion

a. Applicability: This method is applicable to the determination of total solids and its fixed and volatile fractions in such solid and semisolid samples as river and lake sediments, sludges separated from water and wastewater treatment processes, and sludge cakes from vacuum filtration, centrifugation, or other sludge dewatering processes.

b. Interferences: The determination of both total and volatile solids in these materials is subject to negative error due to loss of ammonium carbonate and volatile organic matter during drying. Although this is true also for wastewater, the effect tends to be more pronounced with sediments, and especially with sludges and sludge cakes. The mass of organic matter recovered from sludge and sediment requires a longer ignition time than that specified for wastewaters, effluents, or polluted waters. Carefully observe specified ignition time and temperature to control losses of volatile inorganic salts if these are a problem. Make all weighings quickly because wet samples tend to lose weight by evaporation. After drying or ignition, residues often are very hygroscopic and rapidly absorb moisture from the air. Highly alkaline residues may react with silica in the samples or silica-containing crucibles.

2. Apparatus

All the apparatus listed in Section 2540B.2 is required except that a magnetic stirrer and pipets are not used and a balance capable of weighing to 10 mg may be used.

3. Procedure

A.5 WORKING PROCEDURE LCK 514

LANGE FOR WATER QUALITY

LCK 514

100–2000 mg/l

In het donker bewaren
Protect against light
Işığa karşı koruma

Houdbaarheid
Storage
Saklama
+15 °C .... +25 °C

T1

Datatabel · Data table · Veri tablosu

LP2W	***06/1997***
*LCK 514 *) · F1 = 0 · F2 = 2071 · F3 = -35.81*	
CADAS 30/30S/50/50S	***07/2001***
*LCK 514 *) · λ: 605 nm · Pro.: 1 · F1 = 0 · F2 = 2045 · K = -105.7*	
ISIS 6000/9000	***07/2001***
*LCK 514 *) · λ: 610 nm · Pro.: 1 · F1 = 0 · F2 = 2118 · K = -122.2*	
CADAS 100/LPG 158	***06/1997***
*LCK 514 *) · λ: 605 nm · F1 = 2046 · F2 = -37.39*	
CADAS 100/LPG 210	***06/1997***
*LCK 514 *) · λ: 605 nm · F1 = 2046 · F2 = -37.39*	

**) CZV klassiek/HT*
COD classic/HT
COD klasik / HT

NL

LCK 514 CZV
Chemisch zuurstof verbruik

Let a.u.b. op de "Uitgave datum" (zie datatabel) en lees de "Opmerking". Veiligheidsadvies en houdbaarheidsdatum op de verpakking.

Principe
Oxideerbare stoffen reageren met een zwavelzure kaliumdichromaatoplossing in aanwezigheid van zilversulfaat als katalysator. Chloride wordt met kwiksulfaat gemaskeerd. Gemeten wordt de groene kleur van het Cr^{3+}.

Toepassingsgebied
Afvalwater, procesanalyse

Storingen
De methode kan worden toegepast in monsters met een chloridegehalte van maximaal 1500 mg/l. De meetresultaten zijn via een plausibiliteitsonderzoek te controleren (verdunning en/of standaardadditie).

Opmerking!
In vergelijking met de klassieke CZV kuvettentest (CZV klassiek) is de hogere ontsluitingstemperatuur en korte ontsluitingstijd een belangrijk kenmerk van de HT-CZV.
In de praktijk wordt een vergelijking met de klassieke methode geadviseerd om er zeker van te zijn dat de HT-CZV voor de eigen monsters vergelijkbare resultaten oplevert.

Speciale aandachtspunten
Voor een optimale stabiliteit tot de houdbaarheidsdatum, wordt opslag van de kuvettentest LCK 514 in een koelkast aanbevolen.

EN

LCK 514 COD
Chemical Oxygen Demand

Please check the "Edition Date" (see data table) and read the "Note". Safety advice and expiry date on package.

Principle
Oxidizable substances react with sulphuric acid – potassium dichromate solution in the presence of silver sulphate as a catalyst. Chloride is masked by mercury sulphate. The green coloration of Cr^{3+} is evaluated.

Range of Application
Waste water, process analysis

Interferences
The method can be used for samples (or diluted samples) with chloride concentrations of up to 1500 mg/l.
The measurement results must be subjected to plausibility checks (dilute and/or spike the sample).

Note
In contrast to the classic COD Cuvette Test (COD classic) the HT-COD is characterised by a higher digestion temperature and shorter digestion time.
Users are advised to carry out a comparison with the COD classic, in order to be sure that the results obtained from their own samples when using the HT-COD are comparable to the standard.

Special note
For optimal stability until it's expiry date, it is recommended the reagent LCK 514 is stored in a fridge.

TR

LCK 514 COD
Kimyasal Oksijen İsteği

Lütfen "Baskı Tarihi"ni kontrol edin (bkz. veri tablosu) ve "Not"u okuyun. Güvenlik önerisi ve son kullanma tarihi ambalajın üzerindedir.

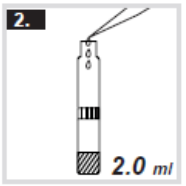
Prensip
Okside edilebilir maddeler gümüş sülfatın katalizör olarak bulunduğu ortamda sülfürik asit – potasyum dikromat solüsyonuyla reaksiyona girer. Civa sülfatın bulunduğu ortamda klorür görünmez. Cr^{3+} yeşil rengi aldığında değerlendirilir.

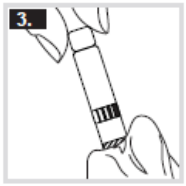
Uygulama Alanları
Atık su, proses analizi

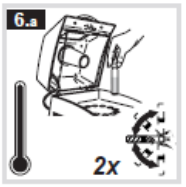
Girişim Yapan Maddeler
Bu metot 1500 mg/l'ye kadar klorür konsantrasyonlu numunelerde (veya seyreltilmiş numunelerde) kullanılır.
Ölçüm sonuçlarında olasılık kontrolü yapılmalıdır (numuneyi seyreltin ve/veya katkılayın).

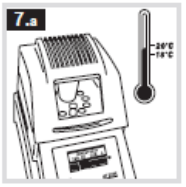
Not
HT-COD testini klasik COD Küvet Testinden (COD klasik) ayıran özellikler daha yüksek sindirim sıcaklığı ve daha düşük sindirim süresidir.
Kullanıcıların HT-COD kullanırken kendi numunelerinden aldıkları sonuçların standartlara uygun olduğundan emin olmaları için COD klasikle kıyaslamaları önerilir.

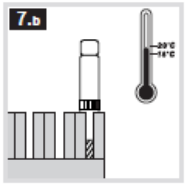
Özel not
Son kullanma tarihine kadar stabilitesini koruması için, LCK 514'ün buzdolabında saklanması tavsiye edilmektedir.

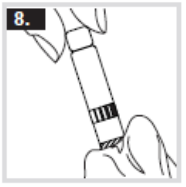












DE

1. Bodensatz durch Schwenken in Schwebe bringen.
2. *2.0 ml* Probe *vorsichtig* pipettieren.
3. Küvette verschließen, von außen gut säubern.
4. Schwenken.
5. Im Thermostaten erhitzen.
   HT 200 S: 15 min im Standardprogramm *HT*
   CSB classic: 2 Std bei *148 °C*
6. *Heiße* Küvette entnehmen.
   a. *HT 200 S:* Nach Freigabe der Verriegelung *2 x vorsichtig* schwenken.
   b. *CSB classic: 2 x vorsichtig* schwenken.
7. Auf Raumtemperatur abkühlen.
   a. *HT 200 S:* im Thermostaten
   b. *CSB classic:* im Küvettenständer
8. *HT 200 S:* Feststoffteilchen müssen vor der Auswertung vollständig abgesetzt sein! Küvette außen gut säubern und auswerten.
   CSB classic: Küvette außen gut säubern und auswerten.

FR

1. Mélanger le contenu pour avoir une solution homogène.
2. Pipetter *2.0 ml* d'échantillon *avec précaution*.
3. Fermer la cuve et nettoyer l'extérieur de celle-ci.
4. Mélanger.
5. Chauffer dans le thermostat.
   HT 200 S: 15 min avec le programme standard *HT*
   DCO classique: 2 h à *148 °C*
6. Sortir la cuve *chaude*.
   a. *HT 200 S:* Après le déverrouillage, retourner *2 x avec précaution*.
   b. *DCO classique:* Retourner *2 x avec précaution*.
7. Laisser refroidir à température ambiante.
   a. *HT 200 S:* dans le thermostat
   b. *DCO classique:* dans le support de cuve
8. *HT 200 S:* Les résidus doivent être complètement éliminés avant l'évaluation. Bien nettoyer l'extérieur de la cuve et mesurer.
   DCO classique: Bien nettoyer l'extérieur de la cuve et mesurer.

IT

1. Agitare delicatamente per sospendere il fondo.
2. Pipettare *attentamente 2.0 ml* di campione.
3. Tappare la cuvetta, pulirla bene esternamente.
4. Mescolare.
5. Riscaldare nel termostato.
   HT 200 S: 15 min nel programma standard *HT*
   COD classica: 2 h a *148 °C*
6. Estrarre la cuvetta *calda*.
   a. *HT 200 S:* Dopo il rilascio del dispositivo di bloccaggio, agitare *delicatamente 2 volte*.
   b. *COD classica:* Agitare *delicatamente 2 volte*.
7. Lasciare raffreddare a temperatura ambiente.
   a. *HT 200 S:* nel termostato
   b. *COD classica:* in un portacuvetta
8. *HT 200 S:* Prima dell'analisi il sedimento deve essersi completamente depositato. Pulire bene la cuvetta esternamente e leggere.
   COD classica: Pulire bene la cuvetta esternamente e leggere.

NL

1. Bezinking door schudden in suspensie brengen.
2. *2.0 ml* monster *voorzichtig* pipetteren.
3. Kuvet sluiten, van buiten goed reinigen.
4. Zwenken.
5. In het thermostaat verhitten.
   HT 200 S: 15 min in standaard-programma *HT*
   CZV klassiek: 2 h bij *148 °C*
6. Het *hete* kuvet eruit nemen.
   a. *HT 200 S:* Na de vrijgeving van de afsluit-beveiliging, *2 x voorzichtig* zwenken.
   b. *CZV klassiek: 2 x voorzichtig* zwenken.
7. Laten afkoelen tot kamertemperatuur.
   a. *HT 200 S:* in thermostaat
   b. *CZV klassiek:* in kuvettenstandaard
8. *HT 200 S:* De nog aanwezige vaste stof moet voor de meting volledig bezonken zijn. Kuvet van buiten goed reinigen en meten.
   CZV klassiek: Kuvet van buiten goed reinigen en meten.

EN

1. Bring the sediment into suspension by inverting a few times.
2. *Carefully* pipette *2.0 ml* sample.
3. Close cuvette, thoroughly clean the outside.
4. Invert.
5. Heat in the thermostat.
   HT 200 S: in standard program *HT* for *15 min*
   COD classic: 2 h at *148 °C*
6. Remove the *hot* cuvette.
   a. *HT 200 S:* After the lock opens, *carefully* invert *twice*.
   b. *COD classic: Carefully* invert *twice*.
7. Allow to cool to room temperature.
   a. *HT 200 S:* in the thermostat
   b. *COD classic:* in a cooling rack
8. *HT 200 S:* Sediment must be completely settled before evaluation is carried out. Clean the outside of the cuvette and evaluate.
   COD classic: Clean the outside of the cuvette and evaluate.

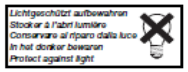
TR

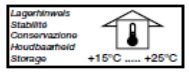
1. Çökeltiyi birkaç kez ters çevirerek karışmasını sağlayın.
2. *Dikkatlice 2.0 ml* numune ekleyin.
3. Küveti kapatın ve dışını iyice temizleyin.
4. Ters çevirin.
5. Termostatı ısıtın.
   HT 200 S: standart program *HT*'de *15 dk*.
   COD klasik: 148 °C'de *2 saat*.
6. Sıcak küveti *çıkarın*.
   a. *HT 200 S:* Kilit açıldıktan sonra, *dikkatlice iki kez ters* çevirin.
   b. *COD klasik: İki kez dikkatlice* ters çevirin.
7. Oda sıcaklığına gelmesini bekleyin.
   a. *HT 200 S:* termostatta
   b. *COD klasik:* soğutma rafında
8. *HT 200 S:* Değerlendirme yapmadan önce çökelti tamamen çökmelidir. Küvetin dışını temizleyin ve değerlendirmeye alın.
   COD klasik: Küvetin dışını temizleyin ve değerlendirmeye alın.

A.6 WORKING PROCEDURE LCK 614

HACH LANGE
UNITED FOR WATER QUALITY

LCK 614 50 – 300 mg/l





Datatabel / Data table

LP2W	***04/1998***
LCK 614 * • *F1 = 0 • F2 = -262.3 • K = 395.8*	
CADAS 30/30S/50/50S	***09/2001***
LCK 614 * • *λ: 448 nm • Pro.: 1 • F1 = 0 • F2 = -256.4 • K = 403.2*	
ISIS 6000/9000	***09/2001***
LCK 614 * • *λ: 455 nm • Pro.: 1 • F1 = 0 • F2 = -266 • K = 401.9*	
CADAS 100 / LPG 158	***08/1999***
LCK 614 * • *λ: 448 nm • F1 = -254 • F2 = 392.5*	
CADAS 100 / LPG 210	***08/1999***
LCK 614 * • *λ: 448 nm • F1 = -254 • K = 392.5*	

***) CZV klassiek / HT**
COD classic / HT

NL

LCK 614 CZV
Chemisch zuurstof verbruik

Let a.u.b. op de "Uitgave datum" (zie datatabel) en lees de "Opmerking!". Veiligheidsadvies en houdbaarheids-datum op de verpakking.

Principe
Oxideerbare stoffen reageren met een zwavelzure kaliumdichromaatoplossing in aanwezigheid van zilversulfaat als katalysator. Chloride wordt met kwiksulfaat gemaskeerd. Gemeten wordt de gele kleur van het Cr^{6+}.

Toepassingsgebied
Afvalwater, procesanalyse

Storingen
De methode kan worden toegepast in monsters met een chloridegehalte van maximaal 1500 mg/l.
Een veel te grote hoeveelheid CZV kan ertoe leiden dat een resultaat wordt aangegeven dat binnen het meetbereik ligt. Het verdient in dit geval aanbeveling, te verdunnen een betrouwbaarheidscontrole uit te voeren.
De meetresultaten zijn via een plausibiliteitsonder-zoek te controleren (verdunning en/of standaard-additie).

Opmerking!
In vergelijking met de klassieke CZV kuvettentest (CZV klassiek) is de hogere ontsluitingstemperatuur en korte ontsluitingstijd een belangrijk kenmerk van de HT-CZV.
In de praktijk wordt een vergelijking met de klassieke methode geadviseerd om er zeker van te zijn dat de HT-CZV voor de eigen monsters vergelijkbare resultaten oplevert.

GB

LCK 614 COD
Chemical Oxygen Demand

Please check the "Edition Date" (see data table) and read the "Note". Safety advice and expiry date on package.

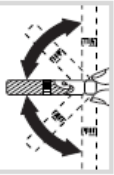
Principle
Oxidizable substances react with sulphuric acid – potassium dichromate solution in the presence of silver sulphate as a catalyst. Chloride is masked by mercury sulphate. The reduction in the yellow coloration of Cr^{6+} is evaluated.

Range of Application
Waste water, process analysis

Interferences
The method can be used for samples (or diluted samples) with chloride concentrations of up to 1500 mg/l.
A large excess of COD can cause result displays within the measuring range. It is advisable to carry out a plausibility check by making dilutions.
The measurement results must be subjected to plausibility checks (dilute and/or spike the sample).

Note
In contrast to the classic COD Cuvette Test (COD classic) the HT-COD is characterised by a higher digestion temperature and shorter digestion time.
Users are advised to carry out a comparison with the COD classic, in order to be sure that the results obtained from their own samples when using the HT-COD are comparable to the standard.

❶



Bodensatz durch Schwenken in Schwebe bringen.

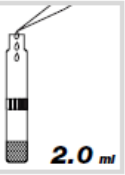
Mélanger le contenu pour avoir une solution homogène.

Agitare delicatamente per sospendere il fondo.

Bezinking door schudden in suspensie brengen.

Bring the sediment into suspension by inverting a few times.

❷



2.0 ml Probe ***vorsichtig*** pipettieren.

Pipetter ***2.0 ml*** d'échantillon ***avec précaution***.

Pipettare ***attentamente 2.0 ml*** di campione.

2.0 ml monster ***voorzichtig*** pipetteren.

Carefully pipette ***2.0 ml*** sample.

❸

Küvette verschließen, von außen gut säubern.

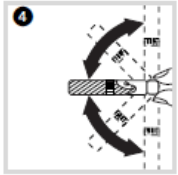
Fermer la cuve et nettoyer l'extérieur de celle-ci.

Tappare la cuvetta, pulirla bene esternamente.

Kuvet sluiten, van buiten goed reinigen.

Close cuvette, thoroughly clean the outside.

❹



Schwenken.

Mélanger.

Mescolare.

Zwenken.

Invert.

❺a

Im Thermostaten erhitzen.
a) CSB classic: ***2 Std*** bei ***148°C***
b) HT 200 S: ***15 min*** im Standardprogramm ***HT***

Chauffer dans le thermostat.
a) DCO classique: ***2 h*** à ***148°C***
b) HT 200 S: ***15 min*** avec le programme standard ***HT***

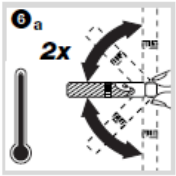
Riscaldare nel termostato.
a) COD classica: ***2 h*** a ***148°C***
b) HT 200 S: ***15 min*** nel programma standard ***HT***

❺b

In het thermostaat verhitten.
a) CZV klassiek: ***2 h*** bij ***148°C***
b) HT 200 S: ***15 min*** in standaard-programma ***HT***

Heat in the thermostat.
a) COD classic: ***2 h*** at ***148°C***
b) HT 200 S: in standard program ***HT*** for ***15 min***

❻a

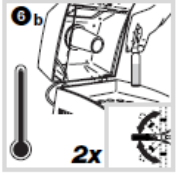


Heiße Küvette entnehmen.
a) CSB classic: ***2 x vorsichtig*** schwenken.
b) HT 200 S: Nach Freigabe der Verriegelung ***2 x vorsichtig*** schwenken.

Sortir la cuve ***chaude***.
a) DCO classique: Retourner ***2 x avec précaution***.
b) HT 200 S: Après le déverrouillage, retourner ***2 x avec précaution***.

Estrarre la cuvetta ***calda***.
a) COD classica: Agitare ***delicatamente 2 volte***.
b) HT 200 S: Dopo il rilascio del dispositivo di bloccaggio, agitare ***delicatamente 2 volte***.

❻b



Het ***hete*** kuvet eruit nemen.
a) CZV klassiek: ***2x voorzichtig*** zwenken.
b) HT 200 S: Na de vrijgeving van de afsluitbeveiliging, ***2x voorzichtig*** zwenken.

Remove the ***hot*** cuvette.
a) COD classic: ***Carefully*** invert ***twice***.
b) HT 200 S: After the lock opens, ***carefully*** invert ***twice***.

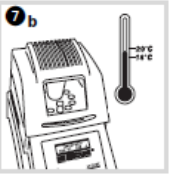
❼a

Auf Raumtemperatur abkühlen.
a) CSB classic: im Küvettenständer
b) HT 200 S: im Thermostaten

Laisser refroidir à température ambiante.
a) DCO classique: dans le support de cuve
b) HT 200 S: dans le thermostat

Lasciare raffreddare a temperatura ambiente.
a) COD classica: in un portacuvetta
b) HT 200 S: nel termostato

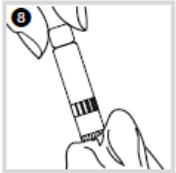
❼b



Laten afkoelen tot kamertemperatuur.
a) CZV klassiek: in kuvettenstandaard
b) HT 200 S: in thermostaat

Allow to cool to room temperature.
a) COD classic: in a cooling rack
b) HT 200 S: in the thermostat

❽



CSB classic: Küvette außen gut säubern und auswerten.
HT 200 S: Feststoffteilchen müssen vor der Auswertung vollständig abgesetzt sein! Küvette außen gut säubern und auswerten.

DCO classique: Bien nettoyer l'extérieur de la cuve et mesurer.
HT 200 S: Les résidus doivent être complètement éliminés avant l'évaluation. Bien nettoyer l'extérieur de la cuve et mesurer.

COD classica: Pulire bene la cuvetta esternamente e leggere.
HT 200 S: Prima dell'analisi il sedimento deve essersi completamente depositato. Pulire bene la cuvetta esternamente e leggere.

CZV klassiek: Kuvet van buiten goed reinigen en meten.
HT 200 S: De nog aanwezige vaste stof moet voor de meting volledig bezonken zijn. Kuvet van buiten goed reinigen en meten.

COD classic: Clean the outside of the cuvette and evaluate.
HT 200 S: Sediment must be completely settled before evaluation is carried out. Clean the outside of the cuvette and evaluate.

A.7 WORKING PROCEDURE LCK 338

HACH LANGE
UNITED FOR WATER QUALITY

LCK 338 20 – 100 mg/l LATONN

Lagerhinweis / Stabilità / Conservazione / Houdbaarheid / Storage: +15°C ..... +25°C

T1

2500 mg/l: CZV / COD

5000 mg/l: Cl^-

Datatabel / Data table

LP2W	***07/2004***
LCK 338 *) • *F1 = 0 • F2 = 134.2 • K = -10.27*	
CADAS 30/30S/50/50S	***07/2004***
LCK 338 *) • *λ: 345 nm • Pro.: 1 • F1 = 0 • F2 = 120.3 • K = -15.73*	
ISIS 6000/9000	***07/2004***
LCK 338 *) • *λ: 360 nm • Pro.: 1 • F1 = 0 • F2 = 141.0 • K = -15.67*	
CADAS 100 / LPG 158	***07/2004***
LCK 338 *) • *λ: 370 nm • F1 = 180.4 • F2 = -8.22*	
CADAS 100 / LPG 210	***07/2004***
LCK 338 *) • *λ: 370 nm • F1 = 180.4 • K = -8.22*	
CADAS 200	***07/2004***
LCK 338 *) • *E1W1 = E1•F1-F2 • W1 = 345 nm • F1 = 119.7 • F2 = 16.14*	

*) TN_b

NL

LCK 338 Totaal-stikstof, TN_b

Let a.u.b. op de "Uitgave datum" (zie datatabel). Veiligheidsadvies en houdbaarheidsdatum op de verpakking.

Principe
Anorganisch en organisch gebonden stikstof wordt door een ontsluiting met peroxodisulfaat tot nitraat geoxydeerd. Nitraat reageert in een zwavel- en fosforzure oplossing met 2.6-dimethylphenol tot een nitrophenol.

Toepassingsgebied
Water en afvalwater

Storingen
De, in ***T1*** genoemde ionen, zijn tot aan de aangegeven concentratie afzonderlijk onderzocht en storen niet. De invloed van het cummulatief effect en invloed van andere ionen is niet door ons onderzocht.

Aanwezigheid van reductiemiddelen kunnen leiden tot lagere meetresultaten.
De meetresultaten zijn via een plausibiliteitsonderzoek te controleren (verdunning en/of standaardadditie).

Speciale aandachtspunten
1. Natronloog A / Oxidatiemiddel tablet B / MicroCap C
   Na toevoeging van de reagentia A, B en C moeten deze weer ***direkt*** gesloten worden.
2. Reactieglazen
   De reactieglazen dienen niet meer dan ***13 keer*** te worden gebruikt. Na ieder gebruik zijn ze met behulp van spoelborstels en leidingwater grondig te reinigen, en aansluitend met stikstofvrij gedestilleerd water na te spoelen en te drogen.
3. Troebeling
   Geringe troebelingen, storen niet. Sterke troebelingen, na toevoeging van het MicroCap C laten bezinken of met LCW 904 membraanfiltratie-set filtreren.

pH-waarde monster .....3 – 12
Temperaturen monster/reagentia.....15 – 25°C

GB

LCK 338 Total Nitrogen, TN_b

Please check the "Edition Date" (see data table). Safety advice and expiry date on package.

Principle
Inorganically and organically bonded nitrogen is oxidized to nitrate by digestion with peroxodisulphate. The nitrate ions react with 2.6-dimethylphenol in a solution of sulphuric and phosphoric acid to form a nitrophenol.

Range of Application
Water, waste water

Interferences
The ions listed in ***T1*** have been individually checked up to the given concentrations and do not cause interference. We have not determined cumulative effects and the influence of other ions.

Low-bias results are to be expected if the samples contain large amounts of reducing agents.
The measurement results must be subjected to plausibility checks (dilute and/or spike the sample).

Special note
1. Sodium hydroxide solution A / Oxidant tablet B / MicroCap C
   After addition of reagents A, B and C the bottles must be reclosed ***immediately***.
2. Reaction Tubes
   The reaction tubes should not be used more than ***13 times***. After use, clean thoroughly with a brush and water from the tap, then rinse well with nitrogen-free distilled water and dry.
3. Turbidity
   Slight turbidities present do not interfere; stronger turbidities after addition of the MicroCap C should be allowed to settle or filtered off using Membrane Filtration Set LCW 904.

pH sample .....3 – 12
Temperature sample/reagents .....15 – 25°C

HACH LANGE
UNITED FOR WATER QUALITY

LCK 338 20 – 100 mg/l LATON

Lagerhinweis / Stabilité / Conservazione / Houdbaarheid / Storage: +15°C ..... +25°C

T1

2500 mg/l: CSB / DCO / COD

5000 mg/l: Cl^-

Datentabelle / Table des données / Tabella dati

LP2W	***07/2004***
LCK 338 *) • *F1 = 0 • F2 = 134.2 • K = -10.27*	
CADAS 30/30S/50/50S	***07/2004***
LCK 338 *) • *λ: 345 nm • Pro.: 1 • F1 = 0 • F2 = 120.3 • K = -15.73*	
ISIS 6000/9000	***07/2004***
LCK 338 *) • *λ: 360 nm • Pro.: 1 • F1 = 0 • F2 = 141.0 • K = -15.67*	
CADAS 100 / LPG 158	***07/2004***
LCK 338 *) • *λ: 370 nm • F1 = 180.4 • F2 = -8.22*	
CADAS 100 / LPG 210	***07/2004***
LCK 338 *) • *λ: 370 nm • F1 = 180.4 • K = -8.22*	
CADAS 200	***07/2004***
LCK 338 *) • *E1W1 = E1•F1-F2 • W1 = 345 nm • F1 = 119.7 • F2 = 16.14*	

*) TN_b
NT

D

LCK 338 Gesamt-Stickstoff, TN_b

Bitte "Ausgabedatum" (s. Datentabelle) beachten.
Sicherheitshinweise und Verfallsdatum auf der Packung.

Prinzip
Anorganisch und organisch gebundener Stickstoff wird durch einen Aufschluss mit Peroxodisulfat zu Nitrat oxidiert. Die Nitrationen reagieren in schwefel- und phosphorsaurer Lösung mit 2.6-Dimethyl-phenol zu einem Nitrophenol.

Anwendungsbereich
Wasser und Abwasser

Störungen
Die in ***T1*** aufgeführten Ionen wurden bis zu den angegebenen Konzentrationen einzeln überprüft und stören nicht. Die summarische Wirkung sowie der Einfluss weiterer Ionen wurden von uns nicht ermittelt.

Minderbefunde sind zu erwarten, sofern die Proben große Mengen an Reduktionsmitteln enthalten. Messergebnisse sind durch eine Plausibilitäts-kontrolle zu überprüfen (Verdünnung und/oder Aufstockung).

Besonders beachten
1. Natronlauge A / Oxidationsmittel-Tablette B / MicroCap® C
   Nach Zugabe der Reagenzien A, B und C müssen die Flaschen ***sofort*** wieder verschlossen werden.
2. Reaktionsgläser
   Die Reaktionsgläser sollten nicht mehr als ***13 mal*** benutzt werden. Nach jedem Gebrauch sind sie unter Einsatz von Spülbürste und Leitungswasser gründlich zu reinigen, und anschließend mit stickstofffreiem dest. Wasser gut nachzuspülen und zu trocknen.
3. Trübung
   Vorhandene geringe Trübungen stören nicht, starke Trübungen nach Zugabe des MicroCap® C absetzen lassen oder mit LCW 904 Membran-Filtrations-Set abfiltrieren.

pH-Wert Probe .....3 – 12
Temperatur Probe/Reagenzien .....15 – 25°C

F

LCK 338 Azote Total, NT

Vérifier la date d'édition (voir table des données).
Conseils de securité et date de péremption sur l'emballage.

Principe
L'azote de composition organique et inorganique s'oxyde en présence de péroxydisulfate et se transforme donc en nitrate. Les ions nitrates réagissent dans une solution d'acides sulfurique et phosphorique avec du diméthylphénol-2.6 en formant du nitrophénol.

Domaine d'application
L'eau et eaux de rejet

Perturbations
Les ions mentionnés dans ***T1*** ont été vérifiés séparément, ils n'interferent pas jusqu'aux concentrations indiquées. Nous n'avons cependant pas étudié l'effet cumulatif et l'influence d'ions supplémentaires.

On peut s'attendre à des résultats par défaut si les échantillons contiennent des grandes quantités de réducteurs.
Les résultat de mesures sont à vérifier par un contrôle de plausibilité (dilution et/ou addition).

Remarque importante
1. Solution d'hydroxyde de sodium A / Tablette d'oxydant B / MicroCap C
   Après l'ajout des réactifs A, B et C, refermer les flacons ***immédiatement***.
2. Eprouvettes de réaction
   Ne pas utiliser les éprouvettes plus de ***13 fois***. Avant chaque usage, elles doivent être nettoyées à la brosse de rinçage et à l'eau de distribution, puis rincées soigneusement à l'eau distillée non azotée et séchées.
3. Turbidité
   De légers troubles n'ont pas d'effet perturbateur, en cas de turbidité prononcée après l'ajout du MicroCap C, laisser décanter ou filtrer à l'aide du set de filtration à membrane LCW 904.

pH échantillon .....3 – 12
Température échantillon/réactifs .....15 – 25°C

I

LCK 338 Azoto totale, TN_b

Si prega di verificare la "Data di Edizione" (vedi tabella dati).
Avvertenze e data di scadenza sulla confezione.

Principio
L'azoto in associazione organica ed inorganica viene ossidato in nitrato dissociandolo col perossidisolfato. Gli ioni nitrato reagiscono in soluzione solforica e fosforica col 2.6-dimetilfenolo dando il nitrofenolo.

Applicazione
Acqua e acque di scarico

Interferenze
Gli ioni elencati in ***T1*** sono stati verificati singolarmente fino alle concentrazioni specificate e non causano interferenze. Non sono stati verificati eventuali effetti cumulativi e l'influenza di altri ioni.

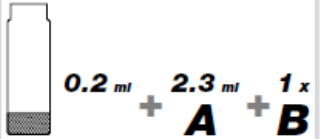
Se il campione contiene riducenti in concentrazioni elevate, il risultato sarà minore.
I risultati sono da verificare con un controllo (diluizione e/o soluzione additiva).

Pro memoria
1. Idrato di sodio A /
   Agente ossidante in pastiglia B / MicroCap C
   Richiudere i flaconi ***immediatamente*** dopo aver prelevato i reagenti A, B e C.
2. Provettoni
   Si sconsiglia di utilizzare i provettoni più di ***13 volte***. Dopo l'uso, pulire bene con una spazzola e acqua del rubinetto, poi risciacquare accuratamente con acqua distillata priva di azoto e lasciare asciugare.
3. Torbidità
   Debole torbidità non disturba. In caso di forte torbidità dopo l'aggiunta del MicroCap C, fare depositare o procedere alla filtrazione a membrana (LCW 904).

pH campione .....3 – 12
Temperatura campione/reagenti .....15 – 25°C

AD 338 N / Druckfarbe burgund / 1

❶



Nacheinander zügig in ein trockenes Reaktionsglas dosieren:
0.2 ml Probe, ***2.3 ml*** Lösung ***A*** (LCK 338 A), ***1 Tablette B*** (LCK138/238/338 B)
Sofort verschließen. ***Nicht schwenken.***

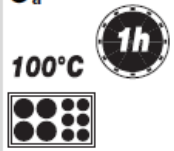
Doser ***à la suite***, ***consécutivement*** dans une éprouvette de réaction sèche:
0.2 ml d'échantillon, ***2.3 ml*** de solution ***A*** (LCK 338 A), ***1 tablette B*** (LCK 138/238/338 B)
Fermer ***immédiatement***. ***Ne pas mélanger.***

Aggiungere in un provettone di reazione asciutto in ***rapida successione***:
0.2 ml di campione, ***2.3 ml*** di soluzione ***A*** (LCK 338 A), ***1 pastiglia B*** (LCK 138/238/338 B)
Chiudere ***subito***. ***Non miscelare***.

Direct na elkaar in een droog reactieglas doseren:
0.2 ml monster, ***2.3 ml*** oplossing ***A*** (LCK 338 A), ***1 tablet B*** (LCK 138/238/338 B)
Onmiddellijk sluiten. ***Niet zwenken.***

Add in ***quick succession*** to a dry reaction tube:
0.2 ml sample, ***2.3 ml*** solution ***A*** (LCK 338 A), ***1 tablet B*** (LCK 138/238/338 B)
Close ***immediately*** reaction tube. ***Do not invert.***

❷a



❷b

Direkt erhitzen.
a) Thermostat: ***60 min*** bei ***100°C***
b) HT 200 S: ***15 min*** im Standardprogramm ***HT***

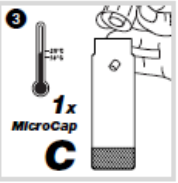
Chauffer ***directement***.
a) Thermostat: ***60 min*** à ***100°C***
b) HT 200 S: ***15 min*** avec le programme standard ***HT***

Riscaldare ***subito***.
a) Termostato: ***60 min*** a ***100°C***
b) HT 200 S: ***15 min*** nel programma standard ***HT***

Direct verhitten.
a) Thermostaat: ***60 min*** bij ***100°C***
b) HT 200 S: ***15 min*** in standaard-programma ***HT***

Heat ***immediately***.
a) Thermostat: ***60 min*** at ***100°C***
b) HT 200 S: in standard program ***HT*** for ***15 min***

❸



Abkühlen und
1 MicroCap® C
(LCK138/238/338 C) zugeben.

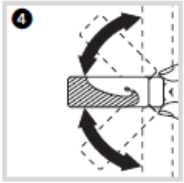
Refroidir et ajouter
1 MicroCap C
(LCK 138/238/338 C).

Raffreddare e aggiungere un
1 MicroCap C
(LCK 138/238/338 C).

Afkoelen en
1 MicroCap C
(LCK 138/238/338 C) toevoegen.

Cool down and add
1 MicroCap C
(LCK 138/238/338 C).

❹



Reaktionsglas verschließen und schwenken, bis das Lyophilisat ***vollständig*** und ***schlierenfrei*** aus dem MicroCap® C herausgelöst ist.

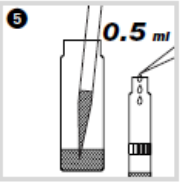
Fermer l'éprouvette de réaction et mélanger jusqu'à ce que le lyophilisat se soit ***complètement*** dissous du MicroCap C et qu'il ***n'y ait aucune particule restante***.

Chiudere il provettone e mescolare con cura finchè il liofilizzato contenuto nel MicroCap C si sia ***sciolto*** e miscelato ***perfettamente***, ***senza lasciare striature***.

Reactieglas sluiten en zwenken totdat het lyophilisaat ***volledig*** uit de MicroCap C opgelost is en ***homogeen*** verdeeld is.

Close reaction tube and invert a few times until the freezedried contents are ***fully removed*** from the MicroCap C and ***all streaks are vanished***.

❺



In Küvetten-Test ***langsam*** pipettieren:
0.5 ml aufgeschlossene Probe.

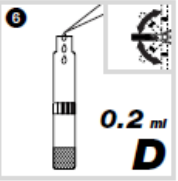
Pipetter ***lentement*** dans le Test en Cuve:
0.5 ml d'échantillon désagrégé.

Pipettare ***con attenzione*** nella cuvetta-test:
0.5 ml di campione preparato.

Langzaam in kuvettentest pipetteren:
0.5 ml ontsloten monster.

Slowly pipette into the Cuvette Test:
0.5 ml digested sample.

❻



0.2 ml Lösung ***D*** (LCK 138/238/338 D) ***langsam*** pipettieren.
Küvette ***sofort*** verschließen und schwenken, bis ***keine*** Schlieren mehr zu beobachten sind.

Pipetter ***lentement 0.2 ml*** de solution ***D*** (LCK 138/238/338 D). Fermer ***immédiatement*** la cuve et mélanger le contenu en la retournant plusieurs fois de suite jusqu'à qu'***aucun*** dépot ou agrégat ne soit observable.

Pipettare ***con attenzione 0.2 ml*** di soluzione ***D*** (LCK 138/238/338 D).
Tappare ***subito*** la cuvetta e mescolare fino a scioglimento completo ***(assenza di striature)***.

Langzaam 0.2 ml oplossing ***D*** (LCK 138/238/338 D) pipetteren.
Kuvet ***onmiddellijk*** sluiten en zwenken totdat er ***geen*** slierten meer zichtbaar zijn.

Slowly pipette ***0.2 ml*** solution ***D*** (LCK 138/238/338 D).
Immediately close cuvette and invert a few times until ***no more*** streaks can be seen.

❼ 15 min

Nach ***15 min*** Küvette außen gut säubern und auswerten.

Attendre ***15 min***, bien nettoyer l'extérieur de la cuve et mesurer.

Dopo ***15 min*** pulire bene la cuvetta esternamente e leggere.

Na ***15 min*** het kuvet van buiten goed reinigen en meten.

After ***15 min*** thoroughly clean the outside of the cuvette and evaluate.

A.8 WORKING PROCEDURE LCK 303

HACH LANGE
UNITED FOR WATER QUALITY

LCK 303 2 – 47 mg/l NH_4-N / 2.5 – 60.0 mg/l NH_4

Lagerhinweis / Stabilità / Conservazione / Houdbaarheid / Storage +2°C ..... +8°C

T1

1000 mg/l:	Cl^-, SO_4^{2-}
500 mg/l:	K^+, Na^+, Ca^{2+}
50 mg/l:	CO_3^{2-}, NO_3^-, Fe^{3+}, Cr^{3+}, Cr^{6+}, Zn^{2+}, Cu^{2+}, Co^{2+}, Ni^{2+}, Hg^{2+}
25 mg/l:	Fe^{2+}
10 mg/l:	Sn^{2+}
5 mg/l:	Pb^{2+}
2 mg/l:	Ag^+

Datatabel / Data table

LP2W	***08/2010***
NH_4-N • *F1 = 0 • F2 = 23.01 • K = -0.84*	
NH_4 • *F1 = 0 • F2 = 29.58 • K = -1.083*	
CADAS 30/30S/50/50S	***08/2010***
NH_4-N • *λ: 690 nm • Pro.: 1 • F1 = 0 • F2 = 22.45 • K = -1.445*	
NH_4 • *λ: 690 nm • Pro.: 1 • F1 = 0 • F2 = 28.88 • K = -1.856*	
ISIS 6000/9000	***08/2010***
NH_4-N • *λ: 695 nm • Pro.: 1 • F1 = 0 • F2 = 22.98 • K = -1.865*	
NH_4 • *λ: 695 nm • Pro.: 1 • F1 = 0 • F2 = 29.54 • K = -2.397*	
CADAS 100 / LPG 158	***08/2010***
NH_4-N • *λ: 694 nm • F1 = 22.48 • F2 = -0.721*	
NH_4 • *λ: 694 nm • F1 = 28.84 • F2 = -0.931*	
CADAS 100 / LPG 210	***08/2010***
NH_4-N • *λ: 694 nm • F1 = 22.48 • F2 = -0.721*	
NH_4 • *λ: 694 nm • F1 = 28.84 • F2 = -0.931*	
CADAS 200	***08/2010***
NH_4-N • *E1W1 • C1 = E1*F1-F2 •*	
W1 = 694 nm • F1 = 22.48 • F2 = 1.465	
NH_4 • *E1W1 • C1 = E1*F1-F2 •*	
W1 = 694 nm • F1 = 28.91 • F2 = 1.884	
DR2800/DR3800	***08/2010***
NH_4-N • *F1 = 22.502 • F2 = 1.446 • λ: 690 nm*	
DR5000	***08/2010***
NH_4-N • *F1 = 23.044 • F2 = 1.6884 • λ: 694 nm*	

NL **LCK 303 Ammonium-Stikstof**

Let a.u.b. op de "Uitgave datum" (zie datatabel) en lees de "Opmerking". Veiligheidsadvies en houdbaarheids-datum op de verpakking.

Principe
Ammonium-ionen reageren bij een pH-waarde van 12.6 met hypo-chloriet-ionen en salicylaat-ionen in verbinding met natriumnitro-prusside als katalysator en vormen zo de stof indofenol-blauw.

Toepassingsgebied
Oppervlaktewateren, afvalwater, bodem, substraat

Storingen
De, in ***T1*** genoemde ionen, zijn tot aan de aangegeven concentratie afzonderlijk onderzocht en storen niet. De invloed van het cummulatief effect en invloed van andere ionen is niet door ons onderzocht.

Primaire aminen worden mee geregistreerd en geven een te hoog resultaat. Een hoeveelheid van 10000 maal de toegestane hoeveelheid ureum stoort niet. Alle reductiemiddelen storen en geven te lage resultaten.
Een veel te grote hoeveelheid ammonium kan ertoe leiden dat een resultaat wordt aangegeven dat binnen het meetbereik ligt. Het verdient in dit geval aanbeveling, te verdunnen en een betrouwbaarheids-controle uit te voeren.
De meetresultaten zijn via een plausibiliteitsonderzoek te controleren (verdunning en/of standaard-additie).

pH-waarde monster .....4 – 9
Temperaturen monster/analyse-kuvet .....20°C
Afwijkende temperatuuren beïnvloeden de nauwkeurigheid van het resultaat.
Het monster dient zo snel mogelijk na de monstername te worden onderzocht.

Afhankelijkheid van de tijd
De eindextinctie is na een reactietijd van ***15 min*** gerealiseerd en blijft dan ***15 min lang constant***.

Opmerking!
Verandering van de factoren in alle fotometers.

GB **LCK 303 Ammonium-Nitrogen**

Please check the "Edition Date" (see data table) and read the "Note". Safety advice and expiry date on package.

Principle
Ammonium ions react at pH 12.6 with hypochlorite ions and salicylate ions in the presence of sodium nitroprusside as a catalyst to form indophenol blue.

Range of Application
Surface water, waste water, soils, substrates

Interferences
The ions listed in ***T1*** have been individually checked up to the given concentrations and do not cause interference. We have not determined cumulative effects and the influence of other ions.

Primary amines are also determined and cause high-bias results. A 10000-fold excess of urea does not interfere. All reducing agents interfere and cause low-bias results.
A large excess of ammonium can cause result displays within the measuring range. It is advisable to carry out a plausibility check by making dilutions.
The measurement results must be subjected to plausibility checks (dilute and/or spike the sample).

pH sample .....4 – 9
Temperature sample/sample cuvette.....20°C
In case of not working at the right recommanded temperature an incorrect result may be obtained.
The sample should be analysed as soon as possible after it has been taken.

Time dependency
The final absorbance is reached after a reaction time of ***15 min*** and then remains ***constant for a further 15 min***.

Note
Change of factor for all types of photometers.

HACH LANGE
UNITED FOR WATER QUALITY

LCK 303

2 – 47 mg/l NH_4-N / 2.5 – 60.0 mg/l NH_4

Lagerhinweis / Stabilité / Conservazione / Houdbaarheid / Storage +2°C ..... +8°C

T1

1000 mg/l:	Cl^-, SO_4^{2-}
500 mg/l:	K^+, Na^+, Ca^{2+}
50 mg/l:	CO_3^{2-}, NO_3^-, Fe^{3+}, Cr^{3+}, Cr^{6+}, Zn^{2+}, Cu^{2+}, Co^{2+}, Ni^{2+}, Hg^{2+}
25 mg/l:	Fe^{2+}
10 mg/l:	Sn^{2+}
5 mg/l:	Pb^{2+}
2 mg/l:	Ag^+

Datentabelle / Table des données / Tabella dati

LP2W	***08/2010***
NH_4-N • *F1 = 0 • F2 = 23.01 • K = -0.84*	
NH_4 • *F1 = 0 • F2 = 29.58 • K = -1.083*	
CADAS 30/30S/50/50S	***08/2010***
NH_4-N • *λ: 690 nm • Pro.: 1 • F1 = 0 • F2 = 22.45 • K = -1.445*	
NH_4 • *λ: 690 nm • Pro.: 1 • F1 = 0 • F2 = 28.88 • K = -1.856*	
ISIS 6000/9000	***08/2010***
NH_4-N • *λ: 695 nm • Pro.: 1 • F1 = 0 • F2 = 22.98 • K = -1.865*	
NH_4 • *λ: 695 nm • Pro.: 1 • F1 = 0 • F2 = 29.54 • K = -2.397*	
CADAS 100 / LPG 158	***08/2010***
NH_4-N • *λ: 694 nm • F1 = 22.48 • F2 = -0.721*	
NH_4 • *λ: 694 nm • F1 = 28.84 • F2 = -0.931*	
CADAS 100 / LPG 210	***08/2010***
NH_4-N • *λ: 694 nm • F1 = 22.48 • F2 = -0.721*	
NH_4 • *λ: 694 nm • F1 = 28.84 • F2 = -0.931*	
CADAS 200	***08/2010***
NH_4-N • *E1W1 • C1 = E1*F1-F2 • W1 = 694 nm • F1 = 22.48 • F2 = 1.465*	
NH_4 • *E1W1 • C1 = E1*F1-F2 • W1 = 694 nm • F1 = 28.91 • F2 = 1.884*	
DR2800/DR3800	***08/2010***
NH_4-N • *F1 = 22.502 • F2 = 1.446 • λ: 690 nm*	
DR5000	***08/2010***
NH_4-N • *F1 = 23.044 • F2 = 1.6884 • λ: 694 nm*	

D

LCK 303 Ammonium-Stickstoff

Bitte "Ausgabedatum" (s. Datentabelle) und "Hinweis" beachten. Sicherheitshinweise und Verfallsdatum auf der Packung.

Prinzip
Ammoniumionen reagieren bei pH 12.6 mit Hypochloritionen und Salicylationen in Gegenwart von Nitroprussid-Natrium als Katalysator zu Indophenolblau.

Anwendungsbereich
Oberflächenwasser, Abwasser, Boden, Substrat

Störungen
Die in ***T1*** aufgeführten Ionen wurden bis zu den angegebenen Konzentrationen einzeln überprüft und stören nicht. Die summarische Wirkung sowie der Einfluss weiterer Ionen wurden von uns nicht ermittelt.

Primäre Amine werden miterfasst und ergeben Mehrbefunde. Ein 10000facher Überschuss an Harnstoff stört nicht. Alle Reduktionsmittel stören und führen zu Minderbefunden.
Ein hoher Überschuss an Ammonium kann zu Ergebnisanzeigen innerhalb des Messbereichs führen. Hier ist eine Plausibilitätskontrolle durch Verdünnen empfehlenswert.
Messergebnisse sind durch eine Plausibilitätskontrolle zu überprüfen (Verdünnung und/oder Aufstockung).

pH-Wert Probe .....4 – 9
Temperatur Probe/Analysenküvette .....20°C
Abweichende Temperaturen beeinflussen die Ergebnisrichtigkeit.
Die Wasserprobe sollte sobald wie möglich nach der Probenahme untersucht werden.

Zeitabhängigkeit
Die Endextinktion liegt nach einer Reaktionszeit von ***15 min*** vor und bleibt dann ***15 min konstant***.

Hinweis
Faktoränderung bei allen Photometertypen.

F

LCK 303 Azote ammoniacal

Vérifier la date d'édition (voir table des données) et lire la "Remarque". Conseils de securité et date de péremption sur l'emballage.

Principe
En présence de sodium nitroprussique agissant comme catalyseur et à une valeur du pH d'environ 12.6, les ions ammonium réagissent avec les ions hypochloreux et salicyliques et donnent une coloration bleue indophénol.

Domaine d'application
Eaux de surface, eaux de rejet, sols, substrats

Perturbations
Les ions mentionnés dans ***T1*** ont été vérifiés séparément, ils n'interferent pas jusqu'aux concentrations indiquées. Nous n'avons cependant pas étudié l'effet cumulatif et l'influence d'ions supplémentaires.

Les amines primaires sont aussi déterminées et sont donc à l'origine des résultats trop élevés. Un excédent 10000 fois plus élevé en urée ne gêne pas l'évaluation. Tous les réducteurs gênent et donnent des résultats trop faibles.
Malgré un excédent important d'ammonium, l'appareil peut tout de même afficher un résultat d'analyse compris dans la gamme de mesure. Pour éliminer une telle erreur, il est recommandé ici de vérifier le résultat obtenu en effectuant une nouvelle analyse après avoir dilué l'échantillon (contrôle de plausibilité).
Les résultat de mesures sont à vérifier par un contrôle de plausibilité (dilution et/ou addition).

pH échantillon .....4 – 9
Température échantillon/cuve d'analyse .....20°C
Des températures différentes influencent l'exactitude des résultats.
L'analyse doit être réalisée immédiatement après la prise d'échantillon.

Importance du temps
L'extinction finale apparaît après un temps de réaction de ***15 min*** et reste ***constante*** pendant ***15 min***.

Remarque
Modification de facteur pour tous les types de photomètres.

I

LCK 303 Ammonio/Azoto ammoniacale

Si prega di verificare la "Data di Edizione" (vedi tabella dati) e di leggere le "Note". Avvertenze e data di scadenza sulla confezione.

Principio
Ioni ammonio reagiscono a un pH 12.6 con ioni di ipoclorito e di salicilato, in presenza di nitroprussiato sodico quale catalizzatore, dando il blu indofenolo.

Applicazione
Acque di superficie, acque di scarico, terreni, substrati

Interferenze
Gli ioni elencati in ***T1*** sono stati verificati singolarmente fino alle concentrazioni specificate e non causano interferenze. Non sono stati verificati eventuali effetti cumulativi e l'influenza di altri ioni.

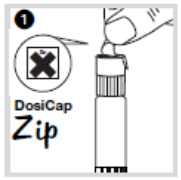
Le ammine primarie possono reagire dando valori più elevati. Un contenuto di urea 10000 volte più elevato non interferisce. Tutte le sostanze riducenti interferiscono e danno valori minori.
Concentrazioni molto elevate di ammonio rischiano di dare risultati che rientrano nel campo di misura. Verificare diluendo il campione.
I risultati sono da verificare con un controllo (diluizione e/o soluzione additiva).

pH campione .....4 – 9
Temperatura campione/cuvetta d'analisi .....20°C
Variazioni della temperatura influenzano la correttezza del valore misurato.
Fare l'analisi subito dopo aver prelevato in campione!

Tempo
Il valore definitivo dell'estinzione si ottiene dopo ***15 min*** di reazione; il valore rimane ***costante per 15 min***.

Note
Variazione del fattore su tutti i fotometri.

AD 303 N / Druckfarbe blau / 1



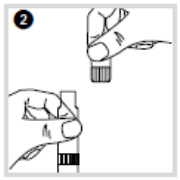
Siegelfolie von dem aufgeschraubten **DosiCap® Zip *vorsichtig*** abziehen.

Enlevez ***délicatement*** la feuille de protection du **DosiCap Zip** détachable.

Rimuovere ***con attenzione*** il foglio di alluminio.

Afdekfolie ***voorzichtig*** verwijderen.

Carefully remove the foil from the screwed-on **DosiCap Zip**.



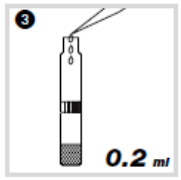
DosiCap® Zip abschrauben.

Dévissez le **DosiCap Zip**.

Svitare il **DosiCap Zip**.

DosiCap Zip afschroeven.

Unscrew the **DosiCap Zip**.



0.2 ml Probe pipettieren.

Pipetter ***0.2 ml*** d'échantillon.

Pipettare ***0.2 ml*** di campione.

0.2 ml monster pipetteren.

Pipette ***0.2 ml*** sample.

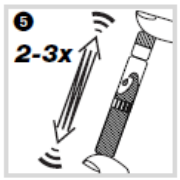
Sofort **DosiCap® Zip** aufschrauben; Riffelung oben.

Vissez ***immédiatement*** le **DosiCap Zip**; dirigeant le cannelage vers le haut.

Avvitare ***subito*** il **DosiCap Zip**; scanalatura esterna verso l'alto.

Onmiddellijk **DosiCap Zip** opschroeven; geribbelde zijde naar boven.

Immediately screw the **DosiCap Zip** back; fluting at the top.



Kräftig schütteln.

Secouer énergiquement.

Agitare energicamente.

Krachtig schudden.

Shake firmly.

Nach ***15 min*** Küvette außen gut säubern und auswerten.

Attendre ***15 min***, bien nettoyer l'extérieur de la cuve et mesurer.

Dopo ***15 min*** pulire bene la cuvetta esternamente e leggere.

Na ***15 min*** het kuvet van buiten goed reinigen en meten.

After ***15 min*** thoroughly clean the outside of the cuvette and evaluate.

A.9 WORKING PROCEDURE LCK 339

HACH LANGE
UNITED FOR WATER QUALITY

LCK 339

0.23 – 13.50 mg/l NO_3-N / 1 – 60 mg/l NO_3

Lagerhinweis / Stabilité / Conservazione / Houdbaarheid / Storage: +15°C ..... +25°C

T1

500 mg/l: K^+, Na^+, Cl^-

100 mg/l: Ag^+

50 mg/l: Pb^{2+}, Zn^{2+}, Ni^{2+}, Fe^{3+}, Cd^{2+}, Sn^{2+}, Ca^{2+}, Cu^{2+}

10 mg/l: Co^{2+}, Fe^{2+}

5 mg/l: Cr^{6+}

Datatabel / Data table

LP2W	***12/2000***
NO_3-N • *F1 = 0 • F2 = 9.71 • K = -0.113*	
NO_3 • *F1 = 0 • F2 = 43 • K = -0.51*	
CADAS 30/30S/50/50S	***04/1998***
NO_3-N • *λ: 345 nm • Pro.: 1 • F1 = 0 • F2 = 8.734 • K = -0.582*	
NO_3 • *λ: 345 nm • Pro.: 1 • F1 = 0 • F2 = 38.68 • K = -2.557*	
ISIS 6000/9000	***04/1998***
NO_3-N • *λ: 360 nm • Pro.: 1 • F1 = 0 • F2 = 10.28 • K = -0.703*	
NO_3 • *λ: 360 nm • Pro.: 1 • F1 = 0 • F2 = 45.52 • K = -3.091*	
CADAS 100 / LPG 158	***12/2000***
NO_3-N • *λ: 370 nm • F1 = 12.62 • F2 = 0.003*	
NO_3 • *λ: 370 nm • F1 = 56 • F2 = 0.003*	
CADAS 100 / LPG 210	***12/2000***
NO_3-N • *λ: 370 nm • F1 = 12.62 • K = 0.003*	
NO_3 • *λ: 370 nm • F1 = 56 • K = 0.003*	

NL

LCK 339 Nitraat

Let a.u.b. op de "Uitgave datum" (zie datatabel).
Veiligheidsadvies en houdbaarheids-datum op de verpakking.

Principe
In zwavel- en fosforzuuroplossing reageren nitraat-ionen met 2.6-dimethylfenol tot 4-nitro-2.6-dimethyl-fenol.

Toepassingsgebied
Afvalwater (let op storingen!), drinkwater, ongezuiverd water, oppervlaktewateren, grond, substraat, voedingsstof

Storingen
De, in ***T1*** genoemde ionen, zijn tot aan de aan-gegeven concentratie afzonderlijk onderzocht en storen niet. De invloed van het cummulatief effect en invloed van andere ionen is niet door ons onderzocht.
Een hoge belasting van oxideerbare, organische substanties (CZV) leidt tot een verkleuring van de reagentia en daardoor ook tot een hoger resultaat. De test is daarom alleen bij onderzoek van afval-water te gebruiken, wanneer de CZV-waarde beneden de 200 mg/l ligt.
De meetresultaten zijn via een plausibiliteitsonder-zoek te controleren (verdunning en/of standaard-additie).

Opheffen van storingen
Nitriet-concentraties boven 2.0 mg/l storen (hogere resultaten!) en kunnen door toevoeging van een spatelpunt amidosulfonzuur worden geëlimineerd.
De chloriden kunnen met zilversulfaat als zilver-chloride worden neergeslagen.
Bij hogere calcium-concentraties ontstaat een troebeling, die de bepaling stoort. Door toevoeging van een spatelpunt EDTA aan het monster kan dit echter worden verhinderd.

pH-waarde monster .....3 – 10
Temperaturen monster/reagentia.....20 – 24°C
Afwijkende temperaturen beïnvloeden de nauwkeurigheid van het resultaat.
Het tijdstip waarop het monster wordt onderzocht, mag niet langer dan 3 uur na de monstername liggen. ***Koel bewaren!***

GB

LCK 339 Nitrate

Please check the "Edition Date" (see data table).
Safety advice and expiry date on package.

Principle
Nitrate ions in solutions containing sulphuric and phosphoric acids react with 2.6-dimethylphenol to form 4-nitro-2.6-dimethylphenol.

Range of Application
Waste water (beware of interferences!), drinking water, raw water, surface water, soils, substrates, nutrient solutions

Interferences
The ions listed in ***T1*** have been individually checked up to the given concentrations and do not cause interference. We have not determined cumulative effects and the influence of other ions.
High loads of oxidizable organic substances (COD) cause the reagent to change colour and to give high-bias results. The test can thus only be used for waste water analyses if the COD is less than 200 mg/l.
The measurement results must be subjected to plausibility checks (dilute and/or spike the sample).

Removal of Interferences
Nitrite concentrations of more than 2.0 mg/l interfere (high-bias results) and can be removed by the addition of a spatula-tipfull of amidosulphonic acid.
The chloride can be precipitated out as silver chloride by adding silver sulphate.
High calcium concentrations cause turbidity.
This interferes with the determination but can be prevented by adding a spatula-tipfull of EDTA to the sample.

pH sample .....3 – 10
Temperature sample/reagents .....20 – 24°C
In case of not working at the right recommanded temperature an incorrect result may be obtained.
Not more than 3 hours should elapse between sampling and analysis. ***Store in a cool place!***

HACH LANGE
UNITED FOR WATER QUALITY

LCK 339

0.23 – 13.50 mg/l NO_3-N / 1 – 60 mg/l NO_3

Lagerhinweis / Stabilité / Conservazione / Houdbaarheid / Storage: +15°C ..... +25°C

T1

500 mg/l: K^+, Na^+, Cl^-

100 mg/l: Ag^+

50 mg/l: Pb^{2+}, Zn^{2+}, Ni^{2+}, Fe^{3+}, Cd^{2+}, Sn^{2+}, Ca^{2+}, Cu^{2+}

10 mg/l: Co^{2+}, Fe^{2+}

5 mg/l: Cr^{6+}

Datentabelle / Table des données / Tabella dati

LP2W	***12/2000***
NO_3-N • *F1 = 0 • F2 = 9.71 • K = -0.113*	
NO_3 • *F1 = 0 • F2 = 43 • K = -0.51*	
CADAS 30/30S/50/50S	***04/1998***
NO_3-N • *λ: 345 nm • Pro.: 1 • F1 = 0 • F2 = 8.734 • K = -0.582*	
NO_3 • *λ: 345 nm • Pro.: 1 • F1 = 0 • F2 = 38.68 • K = -2.557*	
ISIS 6000/9000	***04/1998***
NO_3-N • *λ: 360 nm • Pro.: 1 • F1 = 0 • F2 = 10.28 • K = -0.703*	
NO_3 • *λ: 360 nm • Pro.: 1 • F1 = 0 • F2 = 45.52 • K = -3.091*	
CADAS 100 / LPG 158	***12/2000***
NO_3-N • *λ: 370 nm • F1 = 12.62 • F2 = 0.003*	
NO_3 • *λ: 370 nm • F1 = 56 • F2 = 0.003*	
CADAS 100 / LPG 210	***12/2000***
NO_3-N • *λ: 370 nm • F1 = 12.62 • K = 0.003*	
NO_3 • *λ: 370 nm • F1 = 56 • K = 0.003*	

D

LCK 339 Nitrat

Bitte "Ausgabedatum" (s. Datentabelle) beachten.
Sicherheitshinweise und Verfallsdatum auf der Packung.

Prinzip
In schwefel- und phosphorsaurer Lösung reagieren Nitrationen mit 2.6-Dimethylphenol zu 4-Nitro-2.6-dimethylphenol.

Anwendungsbereich
Abwasser (Störungen beachten!), Trinkwasser, Rohwasser, Oberflächenwasser, Boden, Substrat, Nährlösung

Störungen
Die in ***T1*** aufgeführten Ionen wurden bis zu den angegebenen Konzentrationen einzeln überprüft und stören nicht. Die summarische Wirkung sowie der Einfluss weiterer Ionen wurden von uns nicht ermittelt.
Hohe Belastung von oxidierbaren, organischen Substanzen (CSB) führen zu einer Verfärbung des Reagenzes und damit zu Mehrbefunden. Der Test ist nur bei Abwasseruntersuchungen verwendbar, bei denen der CSB-Gehalt unter 200 mg/l liegt. Messergebnisse sind durch eine Plausibilitätskontrolle zu überprüfen (Verdünnung und/oder Aufstockung).

Beseitigung von Störungen
Nitrit-Konzentrationen über 2.0 mg/l stören (Mehrbefunde) und können durch Zusatz von Amidosulfonsäure beseitigt werden.
Die Chloride können mit Silbersulfat als Silberchlorid gefällt werden.
Bei höheren Calcium-Konzentrationen tritt eine Trübung auf. Diese stört die Bestimmung, kann jedoch durch Zusatz von EDTA zur Probe verhindert werden.

pH-Wert Probe .....3 – 10
Temperatur Probe/Reagenzien .....20 – 24°C
Abweichende Temperaturen beeinflussen die Ergebnisrichtigkeit.
Zwischen Probenahme und Untersuchung der Probe sollten 3 Stunden nicht überschritten werden.
Probe kühl lagern!

F

LCK 339 Nitrate

Vérifier la date d'edition (voir table des données).
Conseils de securité et date de péremption sur l'emballage.

Principe
Dans une solution d'acide sulfurique et phosphorique, les ions nitrate réagissent avec le 2.6-diméthylphénol pour donner du 4-nitro-2.6-diméthylphénol.

Domaine d'application
Eaux de rejet (voir perturbations!), eaux potables, eaux brutes, eaux de surface, sols, substrat, solutions nutritives

Perturbations
Les ions mentionnés dans ***T1*** ont été vérifiés séparément, ils n'interferent pas jusqu'aux concentrations indiquées. Nous n'avons cependant pas étudié l'effet cumulatif et l'influence d'ions supplémentaires.
Une présence importante de substances organiques oxydables (DCO) est à l'origine d'une coloration du réactif induisant des résultats trop élevés. Le test est donc applicable aux eaux de rejet, à condition que leur teneur en DCO soit en-dessous de 200 mg/l.
Les résultat de mesures sont à vérifier par un contrôle de plausibilité (dilution et/ou addition).

Solutions aux perturbations
Les concentrations en nitrite au-dessus de 2.0 mg/l gênent l'évaluation (résultats trop élevés) et peuvent être éliminées en ajoutant un bout de spatule d'acide sulfamique.
Les chlorures peuvent être précipités par le sulfate d'argent sous forme de chlorure d'argent.
Les concentrations de calcium élevées génèrent une turbidité qui gêne la détermination, mais qui toutefois peut être évitée en ajoutant un bout de spatule de EDTA à l'échantillon.

pH échantillon .....3 – 10
Température échantillon/réactifs .....20 – 24°C
Des températures différentes influencent l'exactitude des résultats.
Il ne doit pas s'écouler plus de 3 heures entre le prélèvement de l'échantillon et l'analyse.
Conserver au frais!

I

LCK 339 Nitrati

Si prega di verificare la "Data di Edizione" (vedi tabella dati).
Avvertenze e data di scadenza sulla confezione.

Principio
Ioni nitrato reagiscono in soluzione di acido solforico-fosforico con 2.6-dimetilfenolo dando 4-nitro-2.6-dimetilfenolo.

Applicazione
Acque di scarico (v. "interferenze"), acqua potabile, acqua grezza, acque di superficie, terreni, substrati, soluzioni nutritive

Interferenze
Gli ioni elencati in ***T1*** sono stati verificati singolarmente fino alle concentrazioni specificate e non causano interferenze. Non sono stati verificati eventuali effetti cumulativi e l'influenza di altri ioni.
Con la presenza di sostanze organiche ossidabili (COD) in forti concentrazioni, il reattivo cambia colore e provoca risultati in eccesso. Per questo motivo, il test si può usare solamente per acque con concentrazioni di COD inferiori a 200 mg/l.
I risultati sono da verificare con un controllo (diluizione e/o soluzione additiva).

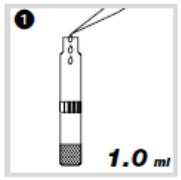
Eliminazione interferenze
Concentrazioni di nitriti superiori a 2.0 mg/l disturbano (valori in eccesso) e possono essere eliminati con l'aggiunta di acido amidosulfonico.
I cloruri vanno precipitati sottoforma di cloruri d'argento con solfato d'argento.
In caso di forti concentrazioni di calcio la soluzione si presenta torbida. Può essere lotta legando il calcio con EDTA.

pH campione .....3 – 10
Temperatura campione/reagenti .....20 – 24°C
Variazioni della temperatura influenzano la correttezza del valore misurato.
Fra il prelievo del campione e l'analisi non devono passare più di 3 ore. ***Mettere in fresco!***

AD 339 L / Druckfarbe blau / 1

LCK 339
NO_3-N / NO_3

11/2005



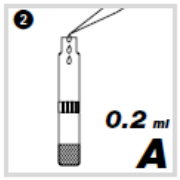
1.0 ml Probe ***langsam*** pipettieren.

Pipetter ***lentement 1.0 ml*** d'échantillon.

Pipettare ***con attenzione 1.0 ml*** di campione.

Langzaam 1.0 ml monster pipetteren.

Slowly pipette ***1.0 ml*** sample.



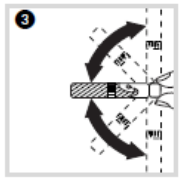
0.2 ml Lösung LCK 339 ***A langsam*** pipettieren.

Pipetter ***lentement 0.2 ml*** de la solution LCK 339 ***A***.

Pipettare ***con attenzione 0.2 ml*** di soluzione LCK 339 ***A***.

Langzaam 0.2 ml oplossing LCK 339 ***A*** pipetteren.

Slowly pipette ***0.2 ml*** solution LCK 339 ***A***.



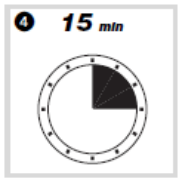
Küvette verschließen und schwenken, bis keine Schlieren mehr zu beobachten sind.

Fermer la cuve et mélanger le contenu en la retournant plusieurs fois de suite jusqu'à ce que le mélange soit complet.

Tappare la cuvetta e mescolare accuratamente fino a miscelazione completa (assenza di striature).

Kuvet sluiten en zwenken tot er geen stroopdraden meer aanwezig zijn.

Close cuvette and invert a few times until no more streaks can be seen.



Nach ***15 min*** Küvette außen gut säubern und auswerten.

Attendre ***15 min***, bien nettoyer l'extérieur de la cuve et mesurer.

Dopo ***15 min*** pulire bene la cuvetta esternamente e leggere.

Na ***15 min*** het kuvet van buiten goed reinigen en meten.

After ***15 min*** thoroughly clean the outside of the cuvette and evaluate.

A.10 WORKING PROCEDURE LCK 340

HACH LANGE
UNITED FOR WATER QUALITY

LCK 340

5 – 35 mg/l NO_3-N / 22 – 155 mg/l NO_3

Lagerhinweis / Stabilité / Conservazione / Houdbaarheid / Storage: +15°C ..... +25°C

T1

2000 mg/l:	K^+
1500 mg/l:	Na^+
1000 mg/l:	Cl^-
500 mg/l:	CZV / COD *)
250 mg/l:	Ca^{2+}
100 mg/l:	Ag^+
50 mg/l:	Pb^{2+}, Zn^{2+}, Ni^{2+}, Fe^{3+}, Cd^{2+}, Cu^{2+}
20 mg/l:	Fe^{2+}
10 mg/l:	Co^{2+}
5 mg/l:	Cr^{6+}
2 mg/l:	NO_2^-

*) (Kaliumwaterstofftalaat)
(Potassium hydrogen phtalate)

Datatabel / Data table

LP2W	***06/2001***
NO_3-N • *F1 = 0 • F2 = 45.59 • K = -0.405*	
NO_3 • *F1 = 0 • F2 = 201.8 • K = -1.776*	
CADAS 30/30S/50/50S	***06/2001***
NO_3-N • *λ: 345 nm • Pro.: 1 • F1 = 0 • F2 = 42.2 • K = -3.007*	
NO_3 • *λ: 345 nm • Pro.: 1 • F1 = 0 • F2 = 186.8 • K = -13.34*	
ISIS 6000/9000	***06/2001***
NO_3-N • *λ: 360 nm • Pro.: 1 • F1 = 0 • F2 = 47.33 • K = -3.001*	
NO_3 • *λ: 360 nm • Pro.: 1 • F1 = 0 • F2 = 209.5 • K = -13.26*	
CADAS 100 / LPG 158	***06/2001***
NO_3-N • *λ: 370 nm • F1 = 60.65 • F2 = -0.607*	
NO_3 • *λ: 370 nm • F1 = 268.6 • F2 = -2.679*	
CADAS 100 / LPG 210	***06/2001***
NO_3-N • *λ: 370 nm • F1 = 60.65 • K = -0.607*	
NO_3 • *λ: 370 nm • F1 = 268.6 • K = -2.679*	
CADAS 200	***06/2001***
NO_3-N • *E1W1 • C1 = E1•F1-F2 •*	
W1 = 370 nm • F1 = 59.46 • F2 = 3.217	
NO_3 • *E1W1 • C1 = E1•F1-F2 •*	
W1 = 370 nm • F1 = 263.2 • F2 = 14.26	

NL

LCK 340 Nitraat

Let a.u.b. op de "Uitgave datum" (zie datatabel) en lees de "Opmerking!". Veiligheidsadvies en houdbaarheids-datum op de verpakking.

Principe
In zwavel- en fosforzuuroplossing reageren nitraat-ionen met 2.6-dimethylfenol tot 4-nitro-2.6-dimethyl-fenol.

Toepassingsgebied
Afvalwater (let op storingen!), drinkwater, ongezuiverd water, oppervlaktewateren, grond, substraat, voedingsstof

Storingen
De, in ***T1*** genoemde ionen, zijn tot aan de aan-gegeven concentratie afzonderlijk onderzocht en storen niet. De invloed van het cummulatief effect en invloed van andere ionen is niet door ons onderzocht.
Een hoge belasting van oxideerbare, organische substanties (CZV) leidt tot een verkleuring van de reagentia en daardoor ook tot een hoger resultaat. De test is daarom alleen bij onderzoek van afval-water te gebruiken, wanneer de CZV-waarde beneden de 500 mg/l ligt.
De meetresultaten zijn via een plausibiliteitsonder-zoek te controleren (verdunning en/of standaard-additie).

Opheffen van storingen
Nitriet-concentraties boven 2.0 mg/l storen (hogere resultaten!) en kunnen door toevoeging van een spatelpunt amidosulfonzuur worden geëlimineerd.
De chloriden kunnen met zilversulfaat als zilver-chloride worden neergeslagen.
Bij hogere calcium-concentraties ontstaat een troebeling, die de bepaling stoort. Door toevoeging van een spatelpunt EDTA aan het monster kan dit echter worden verhinderd.

pH-waarde monster .....3 – 10
Temperaturen monster/reagentia.....20 – 24°C
Afwijkende temperaturen beïnvloeden de nauwkeurigheid van het resultaat.
Het tijdstip waarop het monster wordt onderzocht, mag niet langer dan 3 uur na de monstername liggen. ***Koel bewaren!***

Opmerking!
Verandering van de factoren in alle fotometers (met uitzondering van LASA aqua).

GB

LCK 340 Nitrate

Please check the "Edition Date" (see data table) and read the "Note". Safety advice and expiry date on package.

Principle
Nitrate ions in solutions containing sulphuric and phosphoric acids react with 2.6-dimethylphenol to form 4-nitro-2.6-dimethylphenol.

Range of Application
Waste water (beware of interferences!), drinking water, raw water, surface water, soils, substrates, nutrient solutions

Interferences
The ions listed in ***T1*** have been individually checked up to the given concentrations and do not cause interference. We have not determined cumulative effects and the influence of other ions.
High loads of oxidizable organic substances (COD) cause the reagent to change colour and give high-bias results. The test can thus only be used for waste water analyses if the COD is less than 500 mg/l.
The measurement results must be subjected to plausibility checks (dilute and/or spike the sample).

Removal of Interferences
Nitrite concentrations of more than 2.0 mg/l interfere (high-bias results) and can be removed by the addition of a spatula-tipfull of amidosulphonic acid.
The chloride can be precipitated out as silver chloride by adding silver sulphate.
High calcium concentrations cause turbidity. This interferes with the determination but can be prevented by adding a spatula-tipfull of EDTA to the sample.

pH sample .....3 – 10
Temperature sample/reagents .....20 – 24°C
In case of not working at the right recommanded temperature an incorrect result may be obtained.
Not more than 3 hours should elapse between sampling and analysis. ***Store in a cool place!***

Note
Change of factor for all types of photometers (except LASA aqua).

HACH LANGE
UNITED FOR WATER QUALITY

LCK 340

5 – 35 mg/l NO_3-N / 22 – 155 mg/l NO_3

Lagerhinweis / Stabilité / Conservazione / Houdbaarheid / Storage: +15°C ..... +25°C

T1

2000 mg/l:	K^+
1500 mg/l:	Na^+
1000 mg/l:	Cl^-
500 mg/l:	CSB / DCO / COD *)
250 mg/l:	Ca^{2+}
100 mg/l:	Ag^+
50 mg/l:	Pb^{2+}, Zn^{2+}, Ni^{2+}, Fe^{3+}, Cd^{2+}, Cu^{2+}
20 mg/l:	Fe^{2+}
10 mg/l:	Co^{2+}
5 mg/l:	Cr^{6+}
2 mg/l:	NO_2^-

*) (Kaliumhydrogenphtalat)
(Hydrogènphthalate de potassium)
(Potassio idrogenoftalato)

Datentabelle / Table des données / Tabella dati

LP2W	***06/2001***
NO_3-N • *F1 = 0 • F2 = 45.59 • K = -0.405*	
NO_3 • *F1 = 0 • F2 = 201.8 • K = -1.776*	
CADAS 30/30S/50/50S	***06/2001***
NO_3-N • *λ: 345 nm • Pro.: 1 • F1 = 0 • F2 = 42.2 • K = -3.007*	
NO_3 • *λ: 345 nm • Pro.: 1 • F1 = 0 • F2 = 186.8 • K = -13.34*	
ISIS 6000/9000	***06/2001***
NO_3-N • *λ: 360 nm • Pro.: 1 • F1 = 0 • F2 = 47.33 • K = -3.001*	
NO_3 • *λ: 360 nm • Pro.: 1 • F1 = 0 • F2 = 209.5 • K = -13.26*	
CADAS 100 / LPG 158	***06/2001***
NO_3-N • *λ: 370 nm • F1 = 60.65 • F2 = -0.607*	
NO_3 • *λ: 370 nm • F1 = 268.6 • F2 = -2.679*	
CADAS 100 / LPG 210	***06/2001***
NO_3-N • *λ: 370 nm • F1 = 60.65 • K = -0.607*	
NO_3 • *λ: 370 nm • F1 = 268.6 • K = -2.679*	
CADAS 200	***06/2001***
NO_3-N • *E1W1 • C1 = E1•F1-F2 •*	
W1 = 370 nm • F1 = 59.46 • F2 = 3.217	
NO_3 • *E1W1 • C1 = E1•F1-F2 •*	
W1 = 370 nm • F1 = 263.2 • F2 = 14.26	

D — **LCK 340 Nitrat**

Bitte "Ausgabedatum" (s. Datentabelle) und "Hinweis" beachten. Sicherheitshinweise und Verfallsdatum auf der Packung.

Prinzip
In schwefel- und phosphorsaurer Lösung reagieren Nitrationen mit 2.6-Dimethylphenol zu 4-Nitro-2.6-dimethylphenol.

Anwendungsbereich
Abwasser (Störungen beachten!), Trinkwasser, Rohwasser, Oberflächenwasser, Boden, Substrat, Nährlösung

Störungen
Die in ***T1*** aufgeführten Ionen wurden bis zu den angegebenen Konzentrationen einzeln überprüft und stören nicht. Die summarische Wirkung sowie der Einfluss weiterer Ionen wurden von uns nicht ermittelt.
Hohe Belastung von oxidierbaren, organischen Substanzen (CSB) führen zu einer Verfärbung des Reagenzes und damit zu Mehrbefunden. Der Test ist nur bei Abwasseruntersuchungen verwendbar, bei denen der CSB-Gehalt unter 500 mg/l liegt. Messergebnisse sind durch eine Plausibilitätskontrolle zu überprüfen (Verdünnung und/oder Aufstockung).

Beseitigung von Störungen
Nitrit-Konzentrationen über 2.0 mg/l stören (Mehrbefunde) und können durch Zusatz von Amidosulfonsäure beseitigt werden.
Chloride können mit Silbersulfat als Silberchlorid gefällt werden.
Bei höheren Calcium-Konzentrationen tritt eine Trübung auf. Diese stört die Bestimmung, kann jedoch durch Zusatz von EDTA zur Probe verhindert werden.

pH-Wert Probe .....3 – 10
Temperatur Probe/Reagenzien .....20 – 24°C
Abweichende Temperaturen beeinflussen die Ergebnisrichtigkeit.
Zwischen Probenahme und Untersuchung der Probe sollten 3 Stunden nicht überschritten werden.
Probe kühl lagern!

Hinweis
Faktoränderung bei allen Photometertypen (außer LASA aqua).

F — **LCK 340 Nitrate**

Vérifier la date d'édition (voir table des données) et lire la "Remarque". Conseils de securité et date de péremption sur l'emballage.

Principe
Dans une solution d'acide sulfurique et phosphorique, les ions nitrate réagissent avec le 2.6-diméthylphénol pour donner du 4-nitro-2.6-diméthylphénol.

Domaine d'application
Eaux de rejet (voir perturbations!), eaux potables, eaux brutes, eaux de surface, sols, substrat, solutions nutritives

Perturbations
Les ions mentionnés dans ***T1*** ont été vérifiés séparément, ils n'interferent pas jusqu'aux concentrations indiquées. Nous n'avons cependant pas étudié l'effet cumulatif et l'influence d'ions supplémentaires.
Une présence importante de substances organiques oxydables (DCO) est à l'origine d'une coloration du réactif induisant des résultats trop élevés. Le test est donc applicable aux eaux de rejet, à condition que leur teneur en DCO soit en-dessous de 500 mg/l.
Les résultat de mesures sont à vérifier par un contrôle de plausibilité (dilution et/ou addition).

Solutions aux perturbations
Les concentrations en nitrite au-dessus de 2.0 mg/l gênent l'évaluation (résultats trop élevés) et peuvent être éliminées en ajoutant un bout de spatule d'acide sulfamique.
Les chlorures peuvent être précipités par le sulfate d'argent sous forme de chlorure d'argent.
Les concentrations de calcium élevées génèrent une turbidité qui gêne la détermination, mais qui toutefois peut être évitée en ajoutant un bout de spatule d'EDTA à l'échantillon.

pH échantillon.....3 – 10
Température échantillon/réactifs .....20 – 24°C
Des températures différentes influencent l'exactitude des résultats.
Il ne doit pas s'écouler plus de 3 heures entre le prélèvement de l'échantillon et l'analyse.
Conserver au frais!

Remarque
Modification de facteur pour tous les types de photomètres (à l'exception LASA aqua).

I — **LCK 340 Nitrati**

Si prega di verificare la "Data di Edizione" (vedi tabella dati) e di leggere le "Note". Avvertenze e data di scadenza sulla confezione.

Principio
Ioni nitrato reagiscono in soluzione di acido solforico-fosforico con 2.6-dimetilfenolo dando 4-nitro-2.6-dimetilfenolo.

Applicazione
Acque di scarico (v. "interferenze"), acqua potabile, acqua grezza, acque di superficie, terreni, substrati, soluzioni nutritive

Interferenze
Gli ioni elencati in ***T1*** sono stati verificati singolarmente fino alle concentrazioni specificate e non causano interferenze. Non sono stati verificati eventuali effetti cumulativi e l'influenza di altri ioni.
Con la presenza di sostanze organiche ossidabili (COD) in forti concentrazioni, il reattivo cambia colore e provoca risultati in eccesso. Per questo motivo, il test si può usare solamente per acque con concentrazioni COD inferiori a 500 mg/l.
I risultati sono da verificare con un controllo (diluizione e/o soluzione additiva).

Eliminazione interferenze
Concentrazioni di nitriti superiori a 2.0 mg/l disturbano (valori in eccesso) e possono essere eliminati con l'aggiunta di acido amidosulfonico.
I cloruri vanno precipitati sottoforma di cloruri d'argento con solfato d'argento.
In caso di forti concentrazioni di calcio la soluzione si presenta torbida. Può essere letta legando il calcio con EDTA.

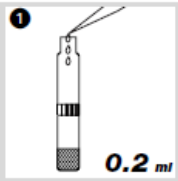
pH campione .....3 – 10
Temperatura campione/reagenti .....20 – 24°C
Variazioni della temperatura influenzano la correttezza del valore misurato.
Fra il prelievo del campione e l'analisi non devono passare più di 3 ore. ***Mettere in fresco!***

Note
Variazione del fattore su tutti i fotometri (eccetto LASA aqua).

AD 340 L / Drucktarbe schwarz / 1

LCK 340
NO_3-N / NO_3

11/2005



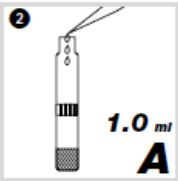
0.2 ml Probe ***langsam*** pipettieren.

Pipetter ***lentement 0.2 ml*** d'échantillon.

Pipettare ***con attenzione 0.2 ml*** di campione.

Langzaam 0.2 ml monster pipetteren.

Slowly pipette ***0.2 ml*** sample.



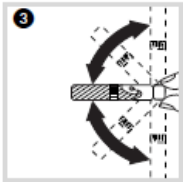
1.0 ml Lösung ***A*** (LCK 340 A) ***langsam*** pipettieren.

Pipetter ***lentement 1.0 ml*** de la solution ***A*** (LCK 340 A).

Pipettare ***con attenzione 1.0 ml*** di soluzione ***A*** (LCK 340 A).

Langzaam 1.0 ml oplossing ***A*** (LCK 340 A) pipetteren.

Slowly pipette ***1.0 ml*** solution ***A*** (LCK 340 A).



Küvette verschließen und schwenken, bis keine Schlieren mehr zu beobachten sind.

Fermer la cuve et mélanger le contenu en la retournant plusieurs fois de suite jusqu'à ce que le mélange soit complet.

Tappare la cuvetta e mescolare accuratamente fino a miscelazione completa (assenza di striature).

Kuvet sluiten en zwenken tot er geen stroopdraden meer aanwezig zijn.

Close cuvette and invert a few times until no more streaks can be seen.

Nach ***15 min*** Küvette außen gut säubern und auswerten.

Attendre ***15 min***, bien nettoyer l'extérieur de la cuve et mesurer.

Dopo ***15 min*** pulire bene la cuvetta esternamente e leggere.

Na ***15 min*** het kuvet van buiten goed reinigen en meten.

After ***15 min*** thoroughly clean the outside of the cuvette and evaluate.

A.11 WORKING PROCEDURE LCK 341

HACH LANGE
UNITED FOR WATER QUALITY

LCK 341

0.015 – 0.6 mg/l NO_2-N / 0.05 – 2.0 mg/l NO_2

Lagerhinweis / Stabilità / Conservazione / Houdbaarheid / Storage +15°C ..... +25°C

T1

2000 mg/l:	Cl^-, SO_4^{2-}
1000 mg/l:	K^+, NO_3^-
500 mg/l:	NH_4^+, PO_4^{3-}, Ca^{2+}
100 mg/l:	Mg^{2+}
50 mg/l:	Cr^{3+}
25 mg/l:	Co^{2+}, Zn^{2+}, Cd^{2+}, Mn^{2+}, Hg^{2+}
12 mg/l:	Ni^{2+}
10 mg/l:	Ag^+, Fe^{2+}
5 mg/l:	Sn^{4+}, Fe^{3+}

Datatabel / Data table

LP2W	***04/2005***
NO_2-N • *F1 = 0 • F2 = 0.539 • K = -0.024*	
NO_2 • *F1 = 0 • F2 = 1.763 • K = -0.078*	
CADAS 30/30S/50/50S	***04/2005***
NO_2-N • *λ: 515 nm • Pro.: 1 • F1 = 0 • F2 = 0.483 • K = -0.035*	
NO_2 • *λ: 515 nm • Pro.: 1 • F1 = 0 • F2 = 1.585 • K = -0.11*	
ISIS 6000/9000	***04/2005***
NO_2-N • *λ: 500 nm • Pro.: 1 • F1 = 0 • F2 = 0.524 • K = -0.036*	
NO_2 • *λ: 500 nm • Pro.: 1 • F1 = 0 • F2 = 1.726 • K = -0.119*	
CADAS 100 / LPG 158	***04/2005***
NO_2-N • *λ: 515 nm • F = 0.481 • F2 = -0.019*	
NO_2 • *λ: 515 nm • F = 1.586 • F2 = -0.065*	
CADAS 100 / LPG 210	***04/2005***
NO_3-N • *λ: 515 nm • F1 = 0.481 • K = -0.019*	
NO_2 • *λ: 515 nm • F1 = 1.586 • K = -0.065*	
CADAS 200	***04/2005***
NO_2-N • *E1W1 • C1 = E1•F1-F2 •*	
W1 = 515 nm • F1 = 0.481 • F2 = 0.036	
NO_2 • *E1W1 • C1 = E1•F1-F2 •*	
W1 = 515 nm • F1 = 1.576 • F2 = 0.118	

NL

LCK 341 Nitriet

Let a.u.b. op de "Uitgave datum" (zie datatabel) en lees de "Opmerking". Veiligheidsadvies en houdbaarheids-datum op de verpakking.

Principe
In zure oplossing reageert nitriet met primaire, aromatische aminen en vormen daarbij diazoniumzouten. Deze geven met aromatische verbindingen die een amino- of hydroxylgroep bevatten, een intensief gekleurde azo-kleurstof.

Toepassingsgebied
Afvalwater, drinkwater, mineraalwater, oppervlaktewateren

Storingen
De, in ***T1*** genoemde ionen, zijn tot aan de aangegeven concentratie afzonderlijk onderzocht en storen niet. De invloed van het cummulatief effect en invloed van andere ionen is niet door ons onderzocht.

Chroom(VI)-ionen storen de bepaling.
Koper(II)-ionen storen de bepaling al bij een concentratie van minder dan 1 mg/l.
De meetresultaten zijn via een plausibiliteitsonderzoek te controleren (verdunning en/of standaardadditie).

pH-waarde monster .....3 – 10
Temperaturen monster/reagentia.....15 – 25°C
Het tijdstip waarop het monster wordt onderzocht, mag niet langer dan ***3 uur*** na de monstername liggen.

Opmerking!
Verandering van de factoren in alle fotometers.

GB

LCK 341 Nitrite

Please check the "Edition Date" (see data table) and read the "Note". Safety advice and expiry date on package.

Principle
Nitrites react with primary aromatic amines in acidic solution to form diazonium salts. These combine with aromatic compounds that contain an amino group or a hydroxyl group to form intensively coloured azo dyes.

Range of Application
Waste water, drinking water, table water, surface water, mineral water

Interferences
The ions listed in ***T1*** have been individually checked up to the given concentrations and do not cause interference. We have not determined cumulative effects and the influence of other ions.

Chromium(VI) ions interfere with the determination.
Copper(II) ions interfere with the determination even at concentrations below 1 mg/l.
The measurement results must be subjected to plausibility checks (dilute and/or spike the sample).

pH sample .....3 – 10
Temperature sample/reagents .....15 – 25°C
Not more than ***3 hours*** should elapse between sampling and analysing the sample.

Note
Change of factor for all types of photometers.

HACH LANGE
UNITED FOR WATER QUALITY

LCK 341

0.015 – 0.6 mg/l NO_2-N / 0.05 – 2.0 mg/l NO_2

Lagerhinweis / Stabilité / Conservazione / Houdbaarheid / Storage: +15°C ..... +25°C

T1

2000 mg/l:	Cl^-, SO_4^{2-}
1000 mg/l:	K^+, NO_3^-
500 mg/l:	NH_4^+, PO_4^{3-}, Ca^{2+}
100 mg/l:	Mg^{2+}
50 mg/l:	Cr^{3+}
25 mg/l:	Co^{2+}, Zn^{2+}, Cd^{2+}, Mn^{2+}, Hg^{2+}
12 mg/l:	Ni^{2+}
10 mg/l:	Ag^+, Fe^{2+}
5 mg/l:	Sn^{4+}, Fe^{3+}

Datentabelle / Table des données / Tabella dati

LP2W	***04/2005***
NO_2-N • *F1 = 0 • F2 = 0.539 • K = -0.024*	
NO_2 • *F1 = 0 • F2 = 1.763 • K = -0.078*	
CADAS 30/30S/50/50S	***04/2005***
NO_2-N • *λ: 515 nm • Pro.: 1 • F1 = 0 • F2 = 0.483 • K = -0.035*	
NO_2 • *λ: 515 nm • Pro.: 1 • F1 = 0 • F2 = 1.585 • K = -0.11*	
ISIS 6000/9000	***04/2005***
NO_2-N • *λ: 500 nm • Pro.: 1 • F1 = 0 • F2 = 0.524 • K = -0.036*	
NO_2 • *λ: 500 nm • Pro.: 1 • F1 = 0 • F2 = 1.726 • K = -0.119*	
CADAS 100 / LPG 158	***04/2005***
NO_2-N • *λ: 515 nm • F = 0.481 • F2 = -0.019*	
NO_2 • *λ: 515 nm • F = 1.586 • F2 = -0.065*	
CADAS 100 / LPG 210	***04/2005***
NO_3-N • *λ: 515 nm • F1 = 0.481 • K = -0.019*	
NO_2 • *λ: 515 nm • F1 = 1.586 • K = -0.065*	
CADAS 200	***04/2005***
NO_2-N • *E1W1 • C1 = E1•F1-F2 •*	
W1 = 515 nm • F1 = 0.481 • F2 = 0.036	
NO_2 • *E1W1 • C1 = E1•F1-F2 •*	
W1 = 515 nm • F1 = 1.576 • F2 = 0.118	

D — **LCK 341 Nitrit**

Bitte "Ausgabedatum" (s. Datentabelle) und "Hinweis" beachten. Sicherheitshinweise und Verfallsdatum auf der Packung.

Prinzip
In saurer Lösung reagieren Nitrite mit primären, aromatischen Aminen unter Bildung von Diazoniumsalzen. Diese bilden mit aromatischen Verbindungen, die eine Amino- oder Hydroxylgruppe enthalten, intensiv gefärbte Azofarbstoffe.

Anwendungsbereich
Abwasser, Trinkwasser, Tafelwasser, Oberflächenwasser, Mineralwasser

Störungen
Die in ***T1*** aufgeführten Ionen wurden bis zu den angegebenen Konzentrationen einzeln überprüft und stören nicht. Die summarische Wirkung sowie der Einfluss weiterer Ionen wurden von uns nicht ermittelt.

Chrom(VI)-Ionen stören die Bestimmung.
Kupfer(II)-Ionen stören die Bestimmung schon bei einer Konzentration unter 1 mg/l.
Messergebnisse sind durch eine Plausibilitätskontrolle zu überprüfen (Verdünnung und/oder Aufstockung).

pH-Wert Probe .....3 – 10
Temperatur Probe/Reagenzien .....15 – 25°C
Zwischen Probenahme und Untersuchung der Probe sollten ***3 Stunden*** nicht überschritten werden.

Hinweis
Faktoränderung bei allen Photometertypen.

F — **LCK 341 Nitrite**

Vérifier la date d'édition (voir table des données) et lire la "Remarque". Conseils de securité et date de péremption sur l'emballage.

Principe
Les nitrites réagissent en solution acide avec les amines primaires et aromatiques pour donner des sels diazonium. Ceux-ci forment avec des composés aromatiques, contenant un amino-groupe ou un hydroxyle, un colorant azoique de couleur intense.

Domaine d'application
Eaux de rejet, eaux potables, eaux de table, eaux de surface, eaux minérales

Perturbations
Les ions mentionnés dans ***T1*** ont été vérifiés séparément, ils n'interferent pas jusqu'aux concentrations indiquées. Nous n'avons cependant pas étudié l'effet cumulatif et l'influence d'ions supplémentaires.

Les ions chrome(VI) gênent la détermination.
Les ions cuivre(II) gênent la détermination à partir d'une concentration de: 1.0 mg/l.
Les résultat de mesures sont à vérifier par un contrôle de plausibilité (dilution et/ou addition).

pH échantillon .....3 – 10
Température échantillon/réactifs .....15 – 25°C
Il ne doit pas s'écouler plus de ***3 heures*** entre le prélèvement de l'échantillon et l'analyse.

Remarque
Modification de facteur pour tous les types de photomètres.

I — **LCK 341 Nitriti**

Si prega di verificare la "Data di Edizione" (vedi tabella dati) e di leggere le "Note". Avvertenze e data di scadenza sulla confezione.

Principio
I nitriti reagiscono in soluzione acida con ammine aromatiche primarie formando sali di diazonio. Questi formano con complessi aromatici, contenenti un gruppo ammino o idrossilico, coloranti azoici intensamente colorati.

Applicazione
Acqua potabile, acqua da tavola, acqua minerale, acque di superficie, acque di scarico

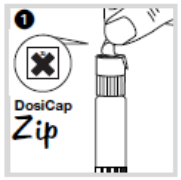
Interferenze
Gli ioni elencati in ***T1*** sono stati verificati singolarmente fino alle concentrazioni specificate e non causano interferenze. Non sono stati verificati eventuali effetti cumulativi e l'influenza di altri ioni.

Ioni cromo(VI) disturbano.
Ioni rame(II) disturbano l'analisi anche in concentrazioni inferiori a 1 mg/l.
I risultati sono da verificare con un controllo (diluizione e/o soluzione additiva).

pH campione .....3 – 10
Temperatura campione/reagenti .....15 – 25°C
Fra il prelievo del campione e l'analisi non devono passare più di ***3 ore***.

Note
Variazione del fattore su tutti i fotometri.

AD 341 P / Druckfarbe schwarz / 1



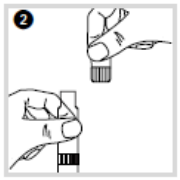
Siegelfolie von dem aufgeschraubten **DosiCap® Zip *vorsichtig*** abziehen.

Enlevez ***délicatement*** la feuille de protection du **DosiCap Zip** détachable.

Rimuovere ***con attenzione*** il foglio di alluminio.

Afdekfolie ***voorzichtig*** verwijderen.

Carefully remove the foil from the screwed-on **DosiCap Zip**.



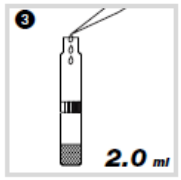
DosiCap® Zip abschrauben.

Dévissez le **DosiCap Zip**.

Svitare il **DosiCap Zip**.

DosiCap Zip afschroeven.

Unscrew the **DosiCap Zip**.



2.0 ml Probe pipettieren.

Pipetter ***2.0 ml*** d'échantillon.

Pipettare ***2.0 ml*** di campione.

2.0 ml monster pipetteren.

Pipette ***2.0 ml*** sample.

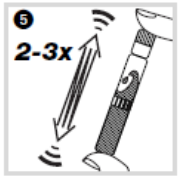
Sofort **DosiCap® Zip** aufschrauben; Riffelung oben.

Vissez immédiatement le **DosiCap Zip**; dirigeant le cannelage vers le haut.

Avvitare subito il **DosiCap Zip**; scanalatura esterna verso l'alto.

Onmiddellijk **DosiCap Zip** opschroeven; geribbelde zijde naar boven.

Immediately screw the **DosiCap Zip** back; fluting at the top.



Kräftig schütteln, bis Lyophilisat gelöst ist.

Secouer énergiquement jusqu'à dissolution du lyophilisat.

Agitare energicamente fino a scioglimento completo del liofilizzato.

Krachtig schudden tot het lyofilisaat is opgelost.

Shake firmly until the freeze-dried contents are completely dissolved.

Nach ***10 min*** Küvette noch einmal schwenken, außen gut säubern und auswerten.

Attendre ***10 min***, mélanger de nouveau, bien nettoyer l'extérieur de la cuve et mesurer.

Dopo ***10 min***, mescolare nuovamente, pulire bene la cuvetta esternamente e leggere.

Na ***10 min*** het kuvet opnieuw zwenken, van buiten goed reinigen en meten.

After ***10 min***, invert a few times more, thoroughly clean the outside of the cuvette and evaluate.

A.12 WORKING PROCEDURE LCK 349

HACH LANGE
UNITED FOR WATER QUALITY

LCK 349

0.05–1.50 mg/l PO_4-P / 0.15–4.50 mg/l PO_4
0.15–3.50 mg/l P_2O_5

Houdbaarheid / Storage: +15 °C ..... +25 °C

ACHTUNG / ATTENTION / ATTENZIONE / LET OP / NB

(DE) Wichtiger Hinweis für die Auswertung!

Ohne Hydrolyse *wird nur das (gelöste)* ***ortho-Phosphat*** *erfasst.*
Das Ergebnis Ihrer ortho-Phosphat-Bestimmung können Sie angeben als: mg/l PO_4-P (z.B. für die Prozessanalyse), mg/l PO_4 (z.B. für Trink- und Kesselwasseruntersuchungen), mg/l P_2O_5 (z.B. für Bodenuntersuchungen).

Mit Hydrolyse *wird grundsätzlich der* ***Gesamt-Phosphor*** *(Gesamt-P, P_{gesamt}) erfasst.*
Das Ergebnis Ihrer Gesamt-Phosphor-Bestimmung können Sie angeben als:
mg/l P_{ges} = Displayanzeige mg/l PO_4-P *(z.B. für die Grenzwertüberwachung im Abwasser), mg/l PO_4 (z.B. für Trink- und Kesselwasseruntersuchungen), mg/l P_2O_5 (z.B. für Bodenuntersuchungen).*

(FR) Remarque importante pour l'interprétation des résultats!

Sans hydrolyse*, seul l'****orthophosphate*** *(dissous) est détecté.*
Le résultat de votre détermination de l'orthophosphate peut s'exprimer en: mg/l PO_4-P (p. ex. pour les analyses en mode contenu), mg/l PO_4 (p. ex. pour les analyses d'eau potable et d'eau de chaudière), mg/l P_2O_5 (p. ex. pour les analyses de sols).

Avec hydrolyse*, c'est principalement le* ***phosphore total*** *(P total, P_{total}) qui est détecté.*
Le résultat de votre détermination du phosphore total peut s'exprimer en: ***mg/l P_{total} = affichage mg/l PO_4-P***
(p. ex. pour le contrôle des valeurs limites dans les eaux de rejet), mg/l PO4 (p. ex. pour les analyses d'eau potable et d'eau de chaudière), mg/l P_2O_5 (par exemple pour les analyses de sols).

(IT) Indicazioni importanti per l'analisi!

Senza idrolisi *vengono determinati solo gli* ***ortofosfati*** *(disciolti).*
Il risultato della determinazione di ortofosfato può essere espresso come: mg/l PO_4-P (per es. per analisi di processo), mg/l PO_4 (per es. per acqua potabile, acqua di caldaia), mg/l P_2O_5 (per es. per analisi di terreni).

Con idrolisi *viene determinato essentialmente il* ***fosforo totale****.*
Il risultato della determinazione di fosforo totale può essere espresso come: ***mg/l P_{tot} = display mg/l PO_4-P***
(per es. per determinazione dei valori soglia nelle acqua di scarico), mg/l PO_4 (per es. per acqua potabile, acqua di caldaia), mg/l P_2O_5 (per es. per analisi di terreni).

(NL) Belangrijke richtlijn voor de uitwaardering!

Zonder hydrolyse *wordt alleen het (opgeloste)* ***orthofosfaat*** *bepaald.*
Het resultaat van uw orthofosfaat bepaling kan u weergeven als: mg/l PO_4-P (b.v. voor procesanalyse), mg/l PO_4 (b.v. voor drinkwater- en ketelwateronderzoek), mg/l P_2O_5 (b.v. voor grondonderzoek).

Met hydrolyse *wordt in principe het* ***totaal fosfor*** *(Totaal P, P_{totaal}) bepaald.*
Het resultaat van uw totaal fosfor bepaling kan u weergeven als: ***mg/l P_{tot} = Display mg/l PO_4-P*** *(b.v. voor grensbewaking van het afvalwater), mg/l PO_4 (b.v. voor drinkwater- en ketelwateronderzoek), mg/l P_2O_5 (b.v. voor grondonderzoek).*

(EN) Important information for the evaluation!

Without hydrolysis*, only the (dissolved)* ***orthophosphate*** *is measured.*
The result of the orthophosphate measurement can be expressed as: mg/l PO_4-P (e.g. for process analysis), mg/l PO_4 (e.g. for analyses of drinking water or boiler water), mg/l P_2O_5 (e.g. for soils analyses)

With hydrolysis*, all of the* ***phosphorus*** *(Total-P, P_{total}) is measured.*
The result of the total phosphorus measurement can be expressed as: ***mg/l P_{tot} = Display mg/l PO_4-P***
(e.g. for monitoring threshold values in waste water), mg/l PO_4 (e.g. for analyses of drinking water or boiler water), mg/l P_2O_5 (e.g. for soils analyses).

NL

LCK 349
Fosfor totaal / **Fosfaat** ortho

Let a.u.b. op de "Uitgave datum" (zie datatabel) en lees de "Opmerking!". Veiligheidsadvies en houdbaarheidsdatum op de verpakking.

Principe
Fosfaat-ionen reageren in zure oplossing met molybdaat- en antimoon-ionen; dit geeft een antimonylfosformolybdaat-complex, dat door ascorbinezuur wordt gereduceerd tot fosformolybdeenblauw.

Toepassingsgebied
Afvalwater, drinkwater, ketelwater, oppervlaktewater, procesanalyse

Storingen
De, in ***T1*** genoemde ionen, zijn tot aan de aangegeven concentratie afzonderlijk onderzocht en storen niet. De invloed van het cummulatief effect en invloed van andere ionen is niet door ons onderzocht.

De meetresultaten zijn via een plausibiliteitsonderzoek te controleren (verdunning en/of standaardadditie).

Opheffen van storingen
Bij aanwezigheid van fosfonzuren moet de verwarmingstijd van de hydrolyse (zie de werkwijze voor de bepaling van fosfor totaal) worden verlengd tot ***2 uur*** bij een temperatuur van ***100°C*** in de thermostaat, teneinde te voorkomen dat te lage resultaten worden gevonden.

pH-waarde monster 2–10
Temperaturen monster/reagentia ..... 15–25 °C
Afwijkende temperaturen beïnvloeden de nauwkeurigheid van het resultaat.

Opmerking!
Het resultaat is betrouwbaarder als de kuvet na de ontsluiting wordt gezwenkt.

EN

LCK 349
Phosphorus total / **Phosphate** ortho

Please check the "Edition Date" (see data table) and read the "Note". Safety advice and expiry date on package.

Principle
Phosphate ions react with molybdate and antimony ions in an acidic solution to form an antimonyl phosphomolybdate complex, which is reduced by ascorbic acid to phosphomolybdenum blue.

Range of Application
Waste water, drinking water, boiler water, surface water, process analysis

Interferences
The ions listed in ***T1*** have been individually checked up to the given concentrations and do not cause interference. We have not determined cumulative effects and the influence of other ions.

The measurement results must be subjected to plausibility checks (dilute and/or spike the sample).

Removal of Interferences
If phosphonic acids are present the time for hydrolysis in the thermostat must be increased to ***2 h*** at ***100°C*** in order to prevent low-bias results (see procedure for the determination of total phosphorus).

pH sample 2–10
Temperature sample/reagents ..... 15–25 °C
In case of not working at the right recommended temperature an incorrect result may be obtained.

Note
Inverting the cuvette after hydrolysis improves the reliability of the result.

HACH LANGE
UNITED FOR WATER QUALITY

LCK 349

0.05–1.50 mg/l PO_4-P / 0.15–4.50 mg/l PO_4
0.15–3.50 mg/l P_2O_5

Lagerhinweis
Stabilité
Conservazione
+15 °C ..... +25 °C

T1

5000 mg/l:	SO_4^{2-}
2000 mg/l:	Cl^-
1000 mg/l:	K^+, Na^+
500 mg/l:	NO_3^-
250 mg/l:	Ca^{2+}
100 mg/l:	Mg^{2+}

50 mg/l:	Co^{2+}, Fe^{2+}, Fe^{3+}, Zn^{2+}, Cu^{2+}, Ni^{2+}, I^-, NO_2^-, Cd^{2+}, NH_4^+, Mn^{2+}, Al^{3+}, Co_3^{2-}, SiO_2
5 mg/l:	Sn^{4+}, Hg^{2+}
2.5 mg/l:	Ag^+, Pb^{2+}
1 mg/l:	Cr^{3+}
0.5 mg/l:	Cr^{6+}

Datentabelle · Table des données · Tabella dati · Datatabel · Data table

LP2W	***12/2007***
PO_4-P • F1 = 0 • F2 = 2.00 • K = -0.103	
PO_4 • F1 = 0 • F2 = 6.15 • K = -0.318	
CADAS 30/30S/50/50S	***12/2007***
PO_4-P • λ: 890 nm • Pro.: 1 • F1 = 0 • F2 = 1.412 • K = -0.179	
PO_4 • λ: 890 nm • Pro.: 1 • F1 = 0 • F2 = 4.327 • K = -0.540	
P_2O_5 • λ: 890 nm • Pro.: 1 • F1 = 0 • F2 = 3.234 • K = -0.409	
ISIS 6000/9000	***12/2007***
PO_4-P • λ: 695 nm • Pro.: 1 • F1 = 0 • F2 = 2.024 • K = -0.203	
PO_4 • λ: 695 nm • Pro.: 1 • F1 = 0 • F2 = 6.205 • K = -0.612	
P_2O_5 • λ: 695 nm • Pro.: 1 • F1 = 0 • F2 = 4.637 • K = -0.461	
CADAS 100/LPG 158	***12/2007***
PO_4-P • λ: 850 nm • F1 = 1.607 • F2 = -0.088	
PO_4 • λ: 850 nm • F1 = 4.925 • F2 = -0.270	
P_2O_5 • λ: 850 nm • F1 = 3.681 • F2 = -0.209	
CADAS 100/LPG 210	***12/2007***
PO_4-P • λ: 850 nm • F1 = 1.607 • F2 = -0.088	
PO_4 • λ: 850 nm • F1 = 4.925 • F2 = -0.270	
P_2O_5 • λ: 850 nm • F1 = 3.681 • F2 = -0.209	
CADAS 200	***12/2007***
PO_4-P • E1W1 • C1 = E1•F1-F2 • W1 = 850 nm • F1 = 1.615 • F2 = 0.177	
PO_4 • E1W1 • C1 = E1•F1-F2 • W1 = 850 nm • F1 = 4.952 • F2 = 0.548	
P_2O_5 • E1W1 • C1 = E1•F1-F2 • W1 = 850 nm • F1 = 3.709 • F2 = 0.405	
DR2800 / DR3800	***12/2007***
PO_4-P • λ: 890 nm • F1 = 1.415 • F2 = 0.1814	
DR5000	***12/2007***
PO_4-P • λ: 850 nm • F1 = 1.631 • F2 = 0.180	

DE LCK 349
Phosphor gesamt / **Phosphat** ortho

Bitte "Ausgabedatum" (s. Datentabelle) und "Hinweis" beachten. Sicherheitshinweise und Verfallsdatum auf der Packung.

Prinzip
Phosphationen reagieren in saurer Lösung mit Molybdat- und Antimonionen zu einem Antimonylphosphormolybdat-Komplex, der durch Ascorbinsäure zu Phosphormolybdänblau reduziert wird.

Anwendungsbereich
Oberflächen-, Trink-, Kessel-, Abwasser, Prozessanalytik

Störungen
Die in ***T1*** aufgeführten Ionen wurden bis zu den angegebenen Konzentrationen einzeln überprüft und stören nicht. Die summarische Wirkung sowie der Einfluss weiterer Ionen wurden von uns nicht ermittelt.

Messergebnisse sind durch eine Plausibilitätskontrolle zu überprüfen (Verdünnung und/oder Aufstockung).

Beseitigung von Störungen
Bei Anwesenheit von Phosphonsäuren muss die Temperierungszeit der Hydrolyse (siehe Arbeitsgang zur Bestimmung von Gesamt-Phosphor) auf ***2 h*** bei ***100°C*** im Thermostaten erhöht werden, um Minderbefunde zu vermeiden.

pH-Wert Probe 2–10
Temperatur Probe/Reagenzien ..... 15–25 °C
Abweichende Temperaturen beeinflussen die Ergebnisrichtigkeit.

Hinweis
Das Schwenken der Küvette nach der Hydrolyse erhöht die Ergebnissicherheit.

FR LCK 349
Phosphore total / **Phosphate** ortho

Vérifier la date d'édition (voir table des données) et lire la "Remarque". Conseils de securité et date de péremption sur l'emballage.

Principe
Les ions phosphate réagissent en solution acide avec les ions molybdate et antimoine pour donner un complexe de phosphore molybdate d'antimoine. Celui-ci est réduit par l'acide ascorbique en bleu de phosphoremolybdène.

Domaine d'application
Eaux de rejet, eaux potables, eaux de chaudière, eaux de surface, analyses en mode continu

Perturbations
Les ions mentionnés dans ***T1*** ont été vérifiés séparément, ils n'interferent pas jusqu'aux concentrations indiquées. Nous n'avons cependant pas étudié l'effet cumulatif et l'influence d'ions supplémentaires.

Les résultat de mesures sont à vérifier par un contrôle de plausibilité (dilution et/ou addition).

Solutions aux perturbations
En présence d'acides phosphoniques, le temps d'équilibrage de la température de l'hydrolyse (voir du mode opératoire pour la détermination du phosphore total) devra être augmenté à ***2 h*** à ***100°C*** dans le thermostat pour éviter des résultats trop faibles.

pH échantillon 2–10
Température échantillon/réactifs ..... 15–25 °C
Des températures différentes influencent l'exactitude des résultats.

Remarque
Mélanger la cuve après hydrolyse améliore sensiblement la qualité du résultat.

IT LCK 349
Fosforo totali / **Fosfati** orto

Si prega di verificare la "Data di Edizione" (vedi tabella dati) e di leggere le "Note". Avvertenze e data di scadenza sulla confezione.

Principio
Ioni fosfato formano in soluzione acida con ioni molibdato e antimonio un complesso antimonilfosfomolibdato che con acido ascorbico si riduce in blu di fosfomolibdato.

Applicazione
Acqua potabile, acque di superficie, acque di scarico, acqua di caldaia, analisi di processo

Interferenze
Gli ioni elencati in ***T1*** sono stati verificati singolarmente fino alle concentrazioni specificate e non causano interferenze. Non sono stati verificati eventuali effetti cumulativi e l'influenza di altri ioni.

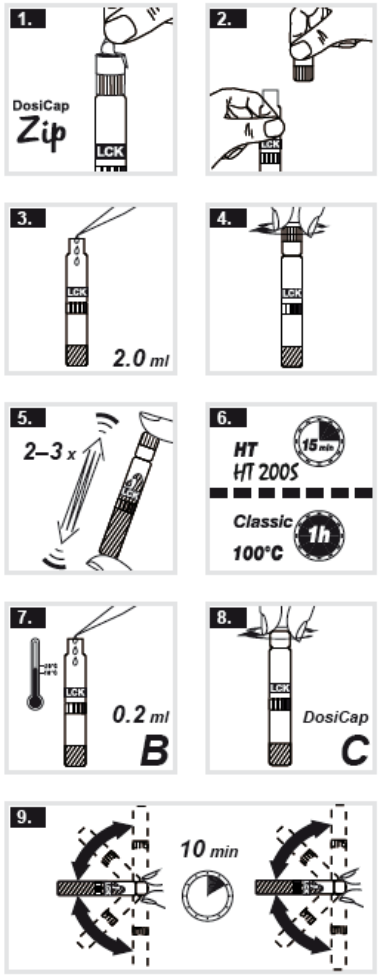
I risultati sono da verificare con un controllo (diluizione e/o soluzione additiva).

Eliminazione interferenze
Se sono presenti acidi fosfonici, la durata dell'idrolisi nel termostato deve essere di ***2 ore***, sempre a ***100°C***, in modo da prevenire sottostime (vedere la metodica di determinazione del fosforo totale).

pH campione 2–10
Temperatura campione/reagenti ..... 15–25 °C
Variazioni della temperatura influenzano la correttezza del valore misurato.

Note
Invertendo la cuvetta dopo l'idrolisi si migliora l'affidabilità del risultato.

AD 349 P / Druckfarbe blau / 1



1. – 9.
Gesamt-Phosphor
Phosphore total
Fosforo totali
Fosfor totaal
Total Phosphorus

3.. 7. – 9.
Ortho-Phosphat
Orthophosphate
Ortofosfati
Orthofosfaat
Orthophosphate

DE

1. Siegelfolie von dem aufgeschraubten **DosiCap® Zip** ***vorsichtig*** abziehen.
2. **DosiCap® Zip** abschrauben.
3. ***2.0 ml*** Probe pipettieren.
4. **DosiCap® Zip** aufschrauben; Riffelung oben.
5. Kräftig schütteln.
6. Im Thermostaten erhitzen.
   HT 200 S: 15 min im Standardprogramm ***HT***
   Thermostat: 60 min bei ***100°C***
7. In erkaltete Küvette pipettieren:
   0.2 ml Reagenz ***B*** (LCK 349 B).
   Reagenz B nach Gebrauch ***sofort*** verschließen.
8. ***Graues*** **DosiCap®** C (LCK 349 C) auf die Küvette schrauben.
9. Küvette schwenken, dabei mehrfach auf den Kopf drehen. Nach ***10 min*** Küvette noch einmal schwenken, außen gut säubern und auswerten.

FR

1. Enlevez ***délicatement*** la feuille de protection du **DosiCap Zip** détachable.
2. Dévissez le **DosiCap Zip**.
3. Pipetter ***2.0 ml*** d'échantillon.
4. Vissez le **DosiCap Zip**; dirigeant le cannelage vers le haut.
5. Secouer énergiquement.
6. Chauffer dans le thermostat.
   HT 200 S: 15 min avec le programme standard ***HT***
   Thermostat: 60 min à ***100°C***
7. Pipetter dans la cuve une fois refroidie:
   0.2 ml de réactif ***B*** (LCK 349 B).
   Fermer ***immédiatement*** le réactif B après emploi.
8. Visser un **DosiCap C** (LCK 349 C) ***gris*** sur la cuve.
9. Mélanger le contenu de la cuve en la retournant plusieurs fois de suite. Attendre ***10 min***, mélanger de nouveau, bien nettoyer l'extérieur de la cuve et mesurer.

IT

1. Rimuovere ***con attenzione*** il foglio di alluminio.
2. Svitare il **DosiCap Zip**.
3. Pipettare ***2.0 ml*** di campione.
4. Avvitare il **DosiCap Zip**; scanalatura esterna verso l'alto.
5. Agitare energicamente.
6. Riscaldare nel termostato.
   HT 200 S: 15 min nel programma standard ***HT***
   Termostato: 60 min a ***100°C***
7. Pipettare nella cuvetta raffreddata:
   0.2 ml di reattivo ***B*** (LCK 349 B).
   Dopo aver prelevato il reattivo B, richiudere ***immediamente***.
8. Avvitare un **DosiCap C** ***(capsula grigia)*** (LCK 349 C).
9. Mescolare capovolgendo la cuvetta più volte. Dopo ***10 min*** mescolare nuovamente, pulire bene la cuvetta esternamente e leggere.

NL

1. Afdekfolie ***voorzichtig*** verwijderen.
2. **DosiCap Zip** afschroeven.
3. ***2.0 ml*** monster pipetteren.
4. **DosiCap Zip** opschroeven; geribbelde zijde naar boven.
5. Krachtig schudden.
6. In het thermostaat verhitten.
   HT 200 S: 15 min in standaard-programma ***HT***
   Thermostaat: 60 min bij ***100°C***
7. In afgekoelde kuvet pipetteren:
   0.2 ml reagens ***B*** (LCK 349 B). De reagens B-fles na gebruik ***onmiddelijk*** dicht draaien.
8. Een ***grijze*** **DosiCap** C (LCK 349 C) op het kuvet schroeven.
9. Kuvet zwenken en daarbij meerdere malen op zijn kop houden. Na ***10 min*** het kuvet opnieuw zwenken, van buiten goed reinigen en meten.

EN

1. ***Carefully*** remove the foil from the screwed-on **DosiCap Zip**.
2. Unscrew the **DosiCap Zip**.
3. Pipette ***2.0 ml*** sample.
4. Screw the **DosiCap Zip** back; fluting at the top.
5. Shake firmly.
6. Heat in the thermostat.
   HT 200 S: in standard program ***HT*** for ***15 min***
   Thermostat: 60 min at ***100°C***
7. Pipette into the cooled cuvette:
   0.2 ml Reagent ***B*** (LCK 349 B).
   Close Reagent B ***immediately*** after use.
8. Screw a ***grey*** **DosiCap** C (LCK 349 C) onto the cuvette.
9. Invert a few times. After ***10 min*** invert a few times more, thoroughly clean the outside of the cuvette and evaluate.

A.13 WORKING PROCEDURE LCK 350

HACH LANGE
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LCK 350

2.0–20.0 mg/l PO_4-P / 6.0–60.0 mg/l PO_4
4.5–45.0 mg/l P_2O_5

Houdbaarheid / Storage: +15 °C ..... +25 °C

ACHTUNG / ATTENTION / ATTENZIONE / LET OP / NB

(DE) Wichtiger Hinweis für die Auswertung!

Ohne Hydrolyse *wird nur das (gelöste)* ***ortho-Phosphat*** *erfasst.*
Das Ergebnis Ihrer ortho-Phosphat-Bestimmung können Sie angeben als: mg/l PO_4-P (z.B. für die Prozessanalyse), mg/l PO_4 (z.B. für Trink- und Kesselwasseruntersuchungen), mg/l P_2O_5 (z.B. für Bodenuntersuchungen).

Mit Hydrolyse *wird grundsätzlich der* ***Gesamt-Phosphor*** *(Gesamt-P, P_{gesamt}) erfasst.*
Das Ergebnis Ihrer Gesamt-Phosphor-Bestimmung können Sie angeben als:
mg/l P_{ges} = Displayanzeige mg/l PO_4-P *(z.B. für die Grenzwertüberwachung im Abwasser), mg/l PO_4 (z.B. für Trink- und Kesselwasseruntersuchungen), mg/l P_2O_5 (z.B. für Bodenuntersuchungen).*

(FR) Remarque importante pour l'interprétation des résultats!

Sans hydrolyse*, seul l'****orthophosphate*** *(dissous) est détecté.*
Le résultat de votre détermination de l'orthophosphate peut s'exprimer en: mg/l PO_4-P (p. ex. pour les analyses en mode contenu), mg/l PO_4 (p. ex. pour les analyses d'eau potable et d'eau de chaudière), mg/l P_2O_5 (p. ex. pour les analyses de sols).

Avec hydrolyse*, c'est principalement le* ***phosphore total*** *(P total, P_{total}) qui est détecté.*
Le résultat de votre détermination du phosphore total peut s'exprimer en: ***mg/l P_{total} = affichage mg/l PO_4-P*** *(p. ex. pour le contrôle des valeurs limites dans les eaux de rejet), mg/l PO4 (p. ex. pour les analyses d'eau potable et d'eau de chaudière), mg/l P_2O_5 (par exemple pour les analyses de sols).*

(IT) Indicazioni importanti per l'analisi!

Senza idrolisi *vengono determinati solo gli* ***ortofosfati*** *(disciolti).*
Il risultato della determinazione di ortofosfato può essere espresso come: mg/l PO_4-P (per es. per analisi di processo), mg/l PO_4 (per es. per acqua potabile, acqua di caldaia), mg/l P_2O_5 (per es. per analisi di terreni).

Con idrolisi *viene determinato essentialmente il* ***fosforo totale.***
Il risultato della determinazione di fosforo totale può essere espresso come: ***mg/l P_{tot} = display mg/l PO_4-P*** *(per es. per determinazione dei valori soglia nelle acqua di scarico), mg/l PO_4 (per es. per acqua potabile, acqua di caldaia), mg/l P_2O_5 (per es. per analisi di terreni).*

(NL) Belangrijke richtlijn voor de uitwaardering!

Zonder hydrolyse *wordt alleen het (opgeloste)* ***orthofosfaat*** *bepaald.*
Het resultaat van uw orthofosfaat bepaling kan u weergeven als: mg/l PO_4-P (b.v. voor procesanalyse), mg/l PO_4 (b.v. voor drinkwater- en ketelwateronderzoek), mg/l P_2O_5 (b.v. voor grondonderzoek).

Met hydrolyse *wordt in principe het* ***totaal fosfor*** *(Totaal P, P_{totaal}) bepaald.*
Het resultaat van uw totaal fosfor bepaling kan u weergeven als: ***mg/l P_{tot} = Display mg/l PO_4-P*** *(b.v. voor grensbewaking van het afvalwater), mg/l PO_4 (b.v. voor drinkwater- en ketelwateronderzoek), mg/l P_2O_5 (b.v. voor grondonderzoek).*

(EN) Important information for the evaluation!

Without hydrolysis*, only the (dissolved)* ***orthophosphate*** *is measured.*
The result of the orthophosphate measurement can be expressed as: mg/l PO_4-P (e.g. for process analysis), mg/l PO_4 (e.g. for analyses of drinking water or boiler water), mg/l P_2O_5 (e.g. for soils analyses)

With hydrolysis*, all of the* ***phosphorus*** *(Total-P, P_{total}) is measured.*
The result of the total phosphorus measurement can be expressed as: ***mg/l P_{tot} = Display mg/l PO_4-P*** *(e.g. for monitoring threshold values in waste water), mg/l PO_4 (e.g. for analyses of drinking water or boiler water),mg/l P_2O_5 (e.g. for soils analyses).*

NL

LCK 350
Fosfor totaal / **Fosfaat** ortho

Let a.u.b. op de "Uitgave datum" (zie datatabel). Veiligheidsadvies en houdbaarheidsdatum op de verpakking.

Principe
Fosfaat-ionen reageren in zure oplossing met molybdaat- en antimoon-ionen; dit geeft een antimonylfosformolybdaat-complex, dat door ascorbinezuur wordt gereduceerd tot fosformolybdeenblauw.

Toepassingsgebied
Afvalwater, drinkwater, ketelwater, oppervlaktewater, procesanalyse

Storingen
De, in ***T1*** genoemde ionen, zijn tot aan de aangegeven concentratie afzonderlijk onderzocht en storen niet. De invloed van het cummulatief effect en invloed van andere ionen is niet door ons onderzocht.

De meetresultaten zijn via een plausibiliteits-onderzoek te controleren (verdunning en/of standaardadditie).

Opheffen van storingen
Bij aanwezigheid van fosfonzuren moet de verwarmingstijd van de hydrolyse (zie de werkwijze voor de bepaling van fosfor totaal) worden verlengd tot ***2 uur*** bij een temperatuur van ***100°C*** in de thermostaat, teneinde te voorkomen dat te lage resultaten worden gevonden.

pH-waarde monster 2–10
Temperaturen monster/reagentia ..... 15–25 °C
Afwijkende temperaturen beïnvloeden de nauwkeurigheid van het resultaat.

EN

LCK 350
Phosphorus total / **Phosphate** ortho

Please check the "Edition Date" (see data table). Safety advice and expiry date on package.

Principle
Phosphate ions react with molybdate and antimony ions in an acidic solution to form an antimonyl phosphomolybdate complex, which is reduced by ascorbic acid to phosphomolybdenum blue.

Range of Application
Waste water, drinking water, boiler water, surface water, process analysis

Interferences
The ions listed in ***T1*** have been individually checked up to the given concentrations and do not cause interference. We have not determined cumulative effects and the influence of other ions.

The measurement results must be subjected to plausibility checks (dilute and/or spike the sample).

Removal of Interferences
If phosphonic acids are present the time for hydrolysis in the thermostat must be increased to ***2 h*** at ***100°C*** in order to prevent low-bias results (see procedure for the determination of total phosphorus).

pH sample 2–10
Temperature sample/reagents ..... 15–25 °C
In case of not working at the right recommended temperature an incorrect result may be obtained.

HACH LANGE
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LCK 350

2.0–20.0 mg/l PO_4-P / 6.0–60.0 mg/l PO_4
4.5–45.0 mg/l P_2O_5

Lagerhinweis / Stabilité / Conservazione: +15 °C ..... +25 °C

T1

5000 mg/l:	SO_4^{2-}
2000 mg/l:	Cl^-
1000 mg/l:	K^+, Na^+, Ca^{2+}
500 mg/l:	Mg^{2+}, NO_3^-
50 mg/l:	Co^{2+}, Fe^{2+}, Fe^{3+}, Zn^{2+}, Cu^{2+}, Ni^{2+}, I^-, NO_2^-, Cd^{2+}, Sn^{4+}, NH_4^+, Mn^{2+}, Al^{3+}, Hg^{2+}, Pb^{2+}, SiO_2
25 mg/l:	Ag^+
10 mg/l:	Cr^{3+}
5 mg/l:	Cr^{6+}

Datentabelle / Table des données / Tabella dati / Datatabel / Data table

LP2W	***10/2009***
PO_4-P • F1 = 0 • F2 = 25.0 • K = -1.09	
PO_4 • F1 = 0 • F2 = 76.7 • K = -3.35	
CADAS 30/30S/50/50S	***10/2009***
PO_4-P • λ: 890 nm • Pro.: 1 • F1 = 0 • F2 = 17.98 • K = -2.212	
PO_4 • λ: 890 nm • Pro.: 1 • F1 = 0 • F2 = 55.14 • K = -6.785	
P_2O_5 • λ: 890 nm • Pro.: 1 • F1 = 0 • F2 = 41.31 • K = -5.081	
ISIS 6000/9000	***10/2009***
PO_4-P • λ: 695 nm • Pro.: 1 • F1 = 0 • F2 = 24.51 • K = -1.979	
PO_4 • λ: 695 nm • Pro.: 1 • F1 = 0 • F2 = 75.15 • K = -6.068	
P_2O_5 • λ: 695 nm • Pro.: 1 • F1 = 0 • F2 = 56.29 • K = -4.543	
CADAS 100/LPG 158/LPG 210	***10/2009***
PO_4-P • λ: 850 nm • F1 = 20.16 • F2 / K = -0.983	
PO_4 • λ: 850 nm • F1 = 61.80 • F2 / K = -3.019	
P_2O_5 • λ: 850 nm • F1 = 46.18 • F2 / K = -2.256	
CADAS 200	***10/2009***
PO_4-P • E1W1 • C1 = E1•F1-F2 • W1 = 850 nm • F1 = 20.38 • F2 = 2.128	
PO_4 • E1W1 • C1 = E1•F1-F2 • W1 = 850 nm • F1 = 62.48 • F2 = 6.531	
P_2O_5 • E1W1 • C1 = E1•F1-F2 • W1 = 850 nm • F1 = 46.80 • F2 = 4.886	
DR2800 / DR3800	***10/2009***
PO_4-P • F1 = 17.975 • F2 = 2.208 • λ: 890 nm	
DR5000	***10/2009***
PO_4-P • F1 = 20.603 • F2 = 2.104 • λ: 850 nm	

DE — **LCK 350**
Phosphor gesamt / **Phosphat** ortho

Bitte "Ausgabedatum" (s. Datentabelle) beachten. Sicherheitshinweise und Verfallsdatum auf der Packung.

Prinzip
Phosphationen reagieren in saurer Lösung mit Molybdat- und Antimonionen zu einem Antimonylphosphormolybdat-Komplex, der durch Ascorbinsäure zu Phosphormolybdänblau reduziert wird.

Anwendungsbereich
Oberflächen-, Trink-, Kessel-, Abwasser, Prozessanalytik

Störungen
Die in ***T1*** aufgeführten Ionen wurden bis zu den angegebenen Konzentrationen einzeln überprüft und stören nicht. Die summarische Wirkung sowie der Einfluss weiterer Ionen wurden von uns nicht ermittelt.

Messergebnisse sind durch eine Plausibilitätskontrolle zu überprüfen (Verdünnung und/oder Aufstockung).

Beseitigung von Störungen
Bei Anwesenheit von Phosphonsäuren muss die Temperierungszeit der Hydrolyse (siehe Arbeitsgang zur Bestimmung von Gesamt-Phosphor) auf ***2 h*** bei ***100°C*** im Thermostaten erhöht werden, um Minderbefunde zu vermeiden.

pH-Wert Probe 2–10
Temperatur Probe/Reagenzien ..... 15–25 °C
Abweichende Temperaturen beeinflussen die Ergebnisrichtigkeit.

FR — **LCK 350**
Phosphore total / **Phosphate** ortho

Vérifier la date d'édition (voir table des données). Conseils de securité et date de péremption sur l'emballage.

Principe
Les ions phosphate réagissent en solution acide avec les ions molybdate et antimoine pour donner un complexe de phosphore molybdate d'antimoine. Celui-ci est réduit par l'acide ascorbique en bleu de phosphoremolybdène.

Domaine d'application
Eaux de rejet, eaux potables, eaux de chaudière, eaux de surface, analyses en mode continu

Perturbations
Les ions mentionnés dans ***T1*** ont été vérifiés séparément, ils n'interferent pas jusqu'aux concentrations indiquées. Nous n'avons cependant pas étudié l'effet cumulatif et l'influence d'ions supplémentaires.

Les résultat de mesures sont à vérifier par un contrôle de plausibilité (dilution et/ou addition).

Solutions aux perturbations
En présence d'acides phosphoniques, le temps d'équilibrage de la température de l'hydrolyse (voir du mode opératoire pour la détermination du phosphore total) devra être augmenté à ***2 h*** à ***100°C*** dans le thermostat pour éviter des résultats trop faibles.

pH échantillon 2–10
Température échantillon/réactifs ..... 15–25 °C
Des températures différentes influencent l'exactitude des résultats.

IT — **LCK 350**
Fosforo totali / **Fosfati** orto

Si prega di verificare la "Data di Edizione" (vedi tabella dati).Avvertenze e data di scadenza sulla confezione.

Principio
Ioni fosfato formano in soluzione acida con ioni molibdato e antimonio un complesso antimonilfosfomolibdato che con acido ascorbico si riduce in blu di fosfomolibdato.

Applicazione
Acqua potabile, acque di superficie, acque di scarico, acqua di caldaia, analisi di processo

Interferenze
Gli ioni elencati in ***T1*** sono stati verificati singolarmente fino alle concentrazioni specificate e non causano interferenze. Non sono stati verificati eventuali effetti cumulativi e l'influenza di altri ioni.

I risultati sono da verificare con un controllo (diluizione e/o soluzione additiva).

Eliminazione interferenze
Se sono presenti acidi fosfonici, la durata dell'idrolisi nel termostato deve essere di ***2 ore***, sempre a ***100°C***, in modo da prevenire sottostime (vedere la metodica di determinazione del fosforo totale).

pH campione 2–10
Temperatura campione/reagenti ..... 15–25 °C
Variazioni della temperatura influenzano la correttezza del valore misurato.

AD 350 M / Druckfarbe schwarz / 1