Graduation Thesis

Potential of advanced wastewater treatment processes to remove pharmaceutical compounds under PILLS/SLIK Project

Waterschap Groot Salland

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Preface

This report is the summary of my bachelor thesis work, done at Waterschap Groot Salland, from February to July 2011. It was focused on hospital wastewater treatment. This report is also the last part of my Bachelor degree at Van Hall Larenstein, University of Applied Sciences.

Groot Salland strives for sustainable management of the water system (both ground and surface water) and the water chain (drinking water supplies, sewage, water purification). In addition, they take account of the sometimes conflicting concerns of nature, agriculture and recreation as much as possible. I, as a fourth year student with the major of International Water Management, seized an opportunity to participate an international project regarding to wastewater treatment. In the end, a final bachelor thesis report is carried out.

Abstract

This research was conducted during 01.02.2011 and 31.07.2011 in the SLIK (Sanitaire Lozingen Isala klinieken) project of Waterboard Groot Salland. The study was mainly to compare the effect of three water treatment methods in Parameters of wastewater treatments plant (WWTP). The wastewater sample came from the Isala Clinic in Zwolle, which was contaminated by pharmaceuticals, with an average inflow of 200 m^3 per day. The designed flow for WWTP is 10m^3/h. From the calculated concentrations at different sampling points (SP), elimination efficiencies show very different. Membrane bioreactor combined with results showed that MBR could filter most of 99 kinds of pharmaceutical compounds. Some compounds, for instance paracetamol is almost eliminated to 100%. But to eliminate the rest contaminations, UV/H_2O_2 and ozone techniques showed effective performance: UV disinfection is most effective for treating a high clarity purified reverse osmosis distilled water, but the wastewater flow rate can be neither too high nor too low; for the high flow rate water; Ozone has a very strong oxidizing power with a short reaction time, which is the more effective method for advanced step water treatment. Granular Activated carbon (GAC) serving as a post treatment eliminates most compounds completely or at a high rate.

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1 Introduction

1.1 Background

With the development of human society, there is a fact cannot be neglected: industrial-produced pharmaceuticals help our society as a whole to prevent or cure diseases. Large quantities of various pharmaceutically active substances are manufactured today for the protection of humans and animals. In recent years, the public concerns more about micro pollutants in water, which brings a great challenge to wastewater treatment. In order to reach good elimination rates, tracing back to the source should be taken into account.

The hospital wastewater contains pharmaceuticals and disinfectants in high concentrations (e.g. Hartmann et al. 1998, Kümmerer 2001), as well as pathogens and antibiotic resistant bacteria (Blanch et al. 2003, Guardabassi et al 1998). The relevant groups of pharmaceuticals are antibiotics, which contribute to the spread of antibiotic resistance (Kümmerer 2001), cytostatics, which are potentially ecotoxic (Gebel et al. 1997, Jolibois and Gguerbet 2006, Tauxe-Wuersch 2005). However, as a matter of fact, the type of compounds and their actual amount are still unclear. Still, negative influence of hospital wastewater on the aquatic environment cannot be ignored.

SLIK (Sanitaire Lozingen Isala klinieken) project, which is one of six partners within the PILLS project, other partners are Emschergenossenschaft (DE), the Centre de Recherche Public Henri Tudor (LU), the Eawag (CH), the Glasgow Caledonian University (GB) and the Université de Limoges (FR). The PILLS project, "Pharmaceutical Input and Elimination from Local Point Sources", aims to address the contribution made by hospitals and care homes to the pharmaceutical burden in aquatic system. It focuses on elimination at source, monitoring a range of pharmaceutical compounds in hospital waste water and trialing advanced treatment of hospital effluent. The SLIK, known as Sanitary Discharges Isala Clinics, like all projects within PILLS, focuses on hospital wastewater. This kind of water contains higher concentrations of pharmaceuticals than household wastewater. Concentrations of many pharmaceuticals can be analyzed chemically. However, the effects of, not only individual pharmaceuticals on ecosystems but also pharmaceutical compounds are often poorly known. In addition to pharmaceuticals, hospital wastewater contains a lot of disinfectants. The ecological consequences of these substances are often unknown. In this study, the flow scheme can be simply described as: a membrane bioreactor (MBR) combined with preliminary filter as pre-treatment and a

reactor with granular activated carbon (GAC) is subsequently applied as a post treatment step. Further, UV/H_2O_2 and ozonation are planned as advanced post treatment steps in the project.

1.2 Research Objectives

This SLIK project was conducted to achieve a stable operation of a wastewater treatment pilot plant at the Isala Clinic in Zwolle. The objective of this bachelor thesis is to evaluate the elimination efficiency of 99 kinds of pharmaceutical compounds regard to conventional and advanced wastewater treatment techniques. These 99 kinds of pharmaceutical compounds belong to different therapeutic groups (i.e. Alimentary tract and metabolism, Anti-infective for systemactic use, Antineoplastic and immunomodulating agents, Cardiovacular system, Genito urinary system and sex hormones, Metabolite, Musculo-skeletal system, Nervous system, Respiratory system, Sensory organs and Various). This evaluation should be done by literature pilot study and desktop analysis of lab results. It was desirable to compare the results reality with the results of theoretically. The thesis includes the main research question:

What is the elimination efficiency of the different wastewater treatment techniques used in the SLIK project in Zwolle.

With the following research questions:

- What are the major pharmaceutical compounds in the influent and the effluent?
- What kind(s) of pharmaceuticals can be removed completely (less than 0.1 µg/l)?
- What kind(s) of pharmaceutical concentration still remains relatively high in effluent?
- Which of the techniques (Ozone or UV/ H_2O_2) is more promising in future wastewater treatment?

Methodology used throughout this thesis combined with literature research, practical work and desktop analysis.

1.3 Thesis Outline

This thesis is structured in six chapters. Chapter two discuss the method used. The next chapter mainly describes literature review of each wastewater treatment techniques which will be used to analyze pharmaceutical compounds. Chapter four presents the results of elimination efficiency for each pharmaceutical compound for each technique. Following, chapter five is the discussion part, contains the problems met in the data analysis. Chapter six is the conclusion of all the work performed, also with recommendations.

2 Method

Methodology used thoughout this bachelor thesis consisted of theoretical study requiring literature research, practical work and desktop analysis. Articles found on the internet are the most commonly used research material for this study, particially with documents of PILLS project conference. Google scholar and Wageningen digital library were frequently used to find articles on the internet. The experiemtal work is all about sampling which is supported by theoretical background. Results are carried out by desktop analysis, data is processed by excel, results are mutural comparison between the different techniques. The parameters that are shown below comes from SLIK project documents which are not published.

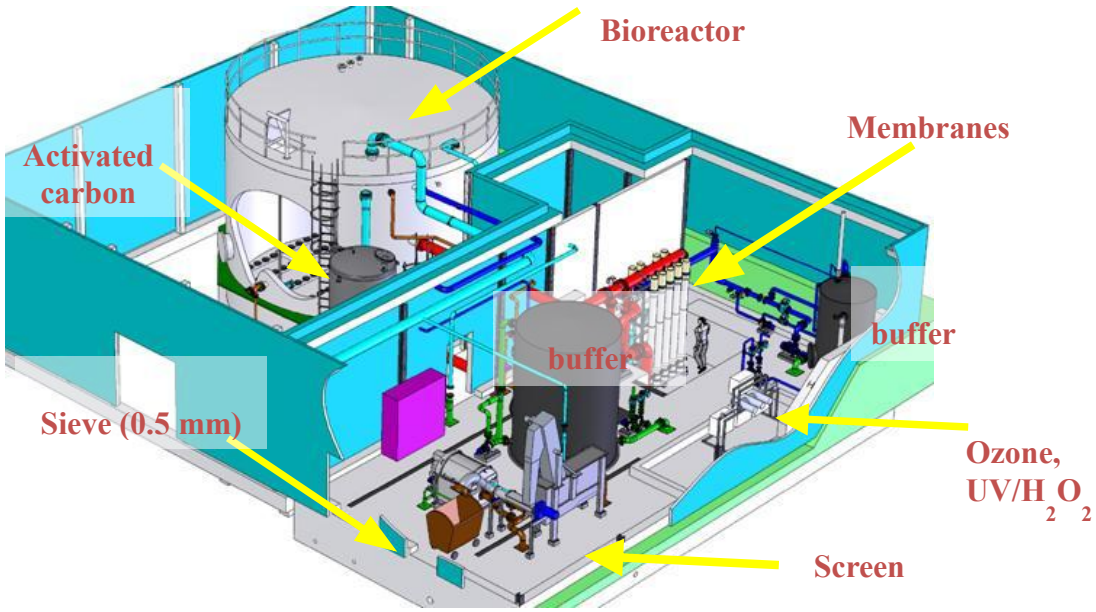
2.1 Pilot Plant Discription

Fig. 1. The location of SLIK project and Waterboard Groot Salland (http://maps.google.nl January 17, 2012*)*

Fig. 2 SLIK (PILLS meeting January 22nd, 2009, Zwolle, The Netherlands.)

Figure 1 and 2 illustrate the location and the appearance of SLIK (Sanitaire Lozingen Isala klinieken) project. The pilot plant of WGS treats the wastewater from Isala clinics located in zwolle. The Isala clinics is developing a new building with about 1100 beds in total. The wastewater is discharged continuously from the sewer canal of the hospital to wastewater treatment plant with an average water flow of 200 m^3 per day. The average flow of the wastewater is currently generated as8.5 m^3/h during the weekdays and 5.5m^3/h during the weekend. The designed flow for the demonstration treatment plant is 10m^3/h, which means it is a full-scale treatment of the hospital wastewater. Not all the treatments are designed for a flow of 10m^3/h: UV/H_2O_2 treatment and ozone treatment are designed with the flow of 1m^3/h.

Fig.3. Flow scheme of the Pilot Plant at the Isala Clinics in Zwolle with indicated all possible sampling points (PILLS meeting January 22nd, 2009, Zwolle, The Netherlands.)



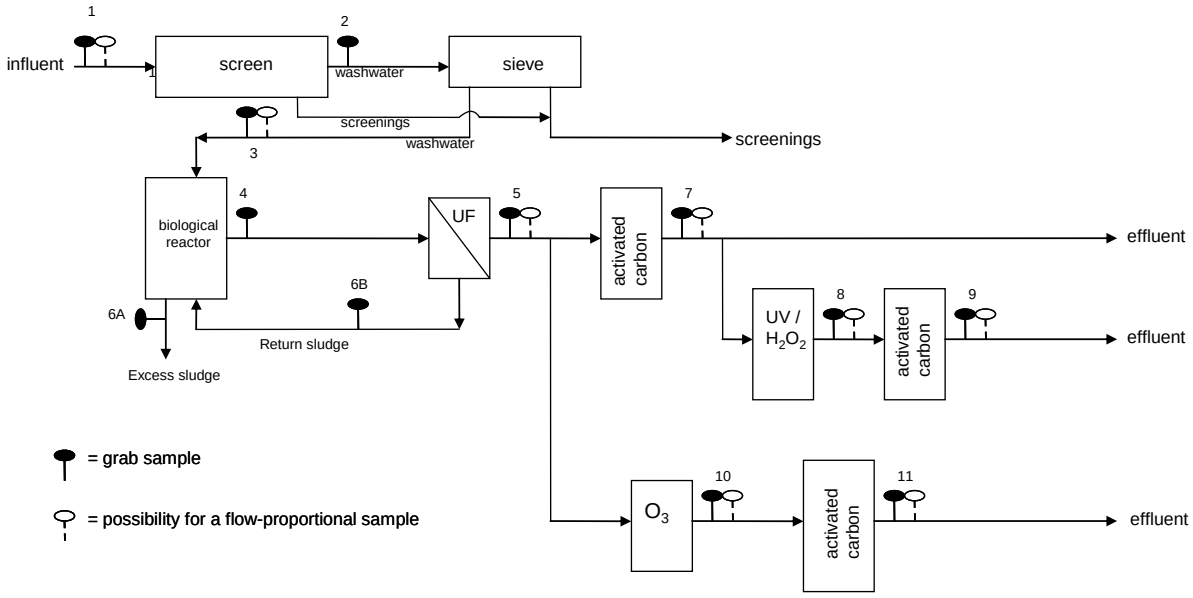


Figure 3 describes the schematic flow chart of the Pilot Plant including one pre-treatment (sieve). The Pilot Plant basically consists of several treatment steps: one mechanical step (screen), three biologically active steps (UV/H_2O_2, ozone, MBR), and three post-treatments. The water follows a normal path through all sections (inflow from Lsala Clinics→mechanical step→biological step→post treatment or further UV/H_2O_2 or ozone. All the techniques of the pilot plants are characterized by a relative high degree of complexity as the focus of this research is to eliminate of pharmaceutical compounds. The core technology MBR followed by advanced physical-chemical (UV/H_2O_2, ozone and activated carbon) treatment methods.

2.2 Techniques of wastewater treatments plant (WWTP)

2.2.1 Pre-treatment

Coarse screens with the size of 6mm are used to remove large coarse particulates. Fine screens are installed with a pore size of approximately 0.5 mm in order to remove smaller particulates including like hair to protect the membranes of the MBR. The screens are installed in parallel in case one fails.

2.2.2 Main biological treatment

The biological treatment comprises a biological reactor with an external membrane unit. The side-stream MBR has the following characteristics:

- The total volume is 200m^3. The reactor can be fully aerobic or 65% aerobic (130m^3) and 35% (70m^3) anoxic for the removal of Nitrogen (N).
- Sludge loading rate is 0.04kg BOD/ (kg TSS.d).
- Sludge concentration is 8-12 gMLSS/l.
- Ultra-filtration (UF) membranes are used with a pore size of 0.01 µm and the flux through the membranes is 35L*(m^2 h)$^{-1}$.

2.2.3 Advanced treatment

From the permeate buffer, part of the permeate (1.0 m^3/h) goes to an ozone treatment unit. The volume of this reactor is 1.0 m^3, providing a contact time of 60 minutes; the ozone production for this scale is 10-40 g/h. After the ozone unit, the wastewater goes to a GAC system with similar small-scale dimensions in order to remove metabolites/non-oxidized pharmaceuticals or any harmful oxidation by-products. The activated carbon system is designed based on an empty bed contact time (EBCT) of 60 minutes. The other, main part of the permeate (>9 m^3/h) goes to a full-scale GAC system with an EBCT of 60 minutes as well.

A small part (1.0 m^3/h) of the effluent from the full-scale GAC goes to the UV/H_2O_2 oxidation process. The UV/ H_2O_2 process is designed with a medium pressure lamp and a reactor volume of 5L. The UV/ H_2O_2 effluent is treated again by GAC with the same dimensions as the small-scale GAC unit after ozonation.

2.3 Sampling point descriptions

In order to compare different advanced treatments (MBR, UV/H_2O_2 and ozone), the sampling points 3, 5, 7, 8, and 10 are chosen. All the samples will be cooled during sampling and mixed to composite samples if necessary. (See figure 3, lower part)

2.3.1 SP3 - influent of MBR.

SP 3 was chosen at the influent of bio-reactor and should give an overview of how much of each pharmaceutical compound enters in the WWTP.

2.3.2 SP5- effluent of UF

At SP 5, substances are recovered which are not eliminated in the MBR and will appear in the post-treatment. Samples are mixed with SP4 (effluent from bio-reactor). Generally the composite samples will be taken twice a week (middle week and weekend).

This sample point, with the full scale ($10m^3/h$), is chosen as the core wastewater treatment point. It is proposed to collect the sample composite from SP5. Effluent will be analyzed twice a week.

2.3.3 SP7-Effluent of MBR after GAC

This sampling point (also full scale with $10m^3/h$) provides information on polishing potential of biologically treated effluent with granular activated carbon. The AC column is designed for a constant flow, in contrary to MBR configuration. The frequency is as the same as SP5.

2.3.4 SP 8- effluent of UV/H_2O_2

The scale of SP 8 is $1m^3/h$. The potential of advanced oxidation technique UV/H_2O_2 to remove remaining pharmaceuticals (if any) from the train MBR-GAC will be tested in this point. As the "polishing" techniques are in general characterized by short retention times and stable performance related to set parameters (contact time and dose of oxidant), the grab samples should be sufficient.

2.3.5 SP 10-effluent of ozone

The effluent of small scale (also $1m^3/h$) MBR-ozone, it is expected to be characterized by a high purification efficiency for pharmaceuticals. The pharmaceuticals measurement frequency can be lowered.

2.4 Data handling-calculation of elimination efficiencies

To evaluate the elimination efficiency of the 99 kinds of pharmaceutical compounds, the method is based on measured concentrations. In the end average elimination efficiency and its standard deviation for each compound is determined.

The equations will be:

Elimination efficiency of MBR= (SP3-SP5)/SP 3*100% (1)

Elimination efficiency of GAC= (SP5-SP7)/SP 5*100% (2)

Elimination efficiency of UV/H_2O_2= (SP5- SP8)/SP 5*100% (3)

Elimination efficiency of OZONE = (SP5-SP10)/SP 5*100% (4)

3 Wastewater treatment techniques in the SLIK pilot plant

3.1 Screening

During the screening, no significant removal of pharmaceuticals is expected. This was confirmed in a study of (Carballa and Carmen Garcia-Jares 2003) where no significant reduction of, for example, ibuprofen was observed during screening process in a wastewater treatment plant.

3.2 Membrane bioreactor

Membrane bioreactor (MBR) is the combination of a membrane process like microfiltration or ultrafiltration with a suspended growth bioreactor (http://en.wikipedia.org/ January 18, 2012). In the study where the removal efficiencies of activated sludge, MBR and fixed bed reactor were compare no significant differences were observed. Since the molecular size of the substances are at 100 times smaller (at least) than the pore size of the membranes, it can be concluded that micro and ultrafiltration membranes cannot remove pharmaceutical compounds by sieving. A study is made on the behavior of ibuprofen during the membrane bioreactor process. During the conversion of ibuprofen in MBR process, two isomers of hydroxyl-ibuprofen were detected. In the effluent of the membrane bioreactor on of these metabolites were detected, and the removal efficiency of ibuprofen and its metabolites were stated as approximately 99% (Quintana et al, 2005). Similar results, over 90% removal efficiency of ibuprofen in MBR were achieved in several other studies (Quintana and Reemtsma, 2004).

3.3 Activated carbon

Activated Carbon is commonly applied to eliminate micro pollutants. Activated carbon can be implemented as a powdered feed (PAC) or in granular form using packed bed filter (GAC). The removal of target compounds depends on the properties of the pharmaceutical (charge, hydrophobicity, and size), the properties of the activated carbon (pore structure, pore surface chemistry) and the water matrix. The wastewater composition is especially vital with regarding to the dissolved organic compounds (Ternes, Meisenheimer et al., 2002).

The efficiency of activated carbon is reduced in the presence of natural organic matter. These organic compounds compete for binding sites on the activated carbon and can block pores in the activated carbon (Snyder, Adham et al. 2007). PAC effectively removed most pharmaceuticals for more than 80% at a contact time of 5 hours and a PAC dosage of 35 mg/L using treated river water. Only iopromide and ibuprofen were removed for about 68% and 77% respectively. For a lower PAC concentration, (5mg/L) a clearly lower removal percentage was observed for pharmaceuticals. The experiments show as well, that greater contact times resulted in great removal (Snyder, Adham et al. 2007). It was observed that GAC has as well a potational to remove pharmaceuticals efficiently in a drinking water treatment system. Breakthrough points of the pharmaceuticals were vary. It is suggested that, based on drinking water experiences, minimal contact time should be 15-20 minutes and after $40m^3$ water/kg AC or 30 g DOC/kg AC the AC has to be exchanged or regenerated (Ternes and Joss 2006). For the efficiency of PAC or GAC for the treatment of effluents of WWTPS, the required dosage or regeneration time are important.

3.4 Ozone techniques

Ozone is an oxidant used widely for the disinfection of drinking water but also for wastewater polishing. The very first use in water treatment was in the late 1800s and, with recent improvements in technology, now it is becoming an attractive water treatment alternative. Ozone can react directly with dissolved organic substances or it can form secondary oxidants, like -OH (Staehelin and Hoigne 1985). Decompositions of ozone via reactions with -OH and organic substances yield hydroylradicals. The produced -OH radicals not only can oxidize the pollutants (alkyl groups of organic compounds) but also can be scavenged by organic substances or bicarbonates (Chen 1997).

The oxidative activity and selectivity of ozone is dependent on the organic compounds that have to be oxidized (Chen 1997). Ozone is a very selective oxidant, which reacts with specific functional groups (Huber, Gobel et al. 2005). Ozone generally reacts faster with deprotonated species. Therefore, its reactivity with ozone is pH depend (Huber, Canonica et al. 2003). Ozone reacts as well selectively with double bonds. Also phenolic groups can react with ozone (Huber, Canonica et al. 2003). Groups as alcohol, aldehydes, ketones, iodine and chloride decrease the reaction with ozone (Ternes, 2006). Pharmaceuticals like

bezafibrate, diclofenac, sulfamethoxazole and carbamazepine possess these specific groups reacting with ozone (Huber, Canonica et al. 2003).

The ozone dosages applied in post treatment of wastewater will probably result in the formation of by-products and oxidation products. Ozonation of wastewater will lead to partial oxidation of the organic compounds and therefore organic oxidation products are expected in the effluent of the oxidation unit. These products can be toxic or persistent to biodegradation. However, research found reduced toxicity of some pharmaceuticals after ozonation (Ternes and Joss 2006). Generally, ozone dosages of 2-5 mg/l should be sufficient for the removal of 90-99% of pharmaceuticals in wastewater containing < 8 mg DOC/L. For DOC levels of 23 mg DOC/L, the ozone dosage will be in the range of 5-10 mg/L. (Ternes and Joss 2006)

3.5 UV/H_2O_2

Another technique to oxidize organic compounds is the application of UV and H_2O_2. The H_2O_2 can be photolyzed with UV to -OH. The wavelength of the UV should be short (e.g. 185nm) in order to effectively photolyse H_2O_2. At wavelengths of 254 nm, the photolyses of H_2O_2 is by far less effective than of ozone (Yuan, Hu et al. 2009). In the application of UV and UV/ H_2O_2 was studied in a 500 ml reactor for the removal of pharmaceuticals (ibuprofen). With a low pressure UV-lamp emitting light at 254 nm, it was found that only with an extremely high UV fluence (1272 MJ/ cm^2) 27.4% of the initial ibuprofen could be directly photolyzed in deionized water. Additionally, H_2O_2 of 0.29 mm, increased the oxidation efficiency to the reduction of all pharmaceutical concentrations below detection limit at UV fluence of 509 MJ/cm (Yuan Hu et al. 2009).

4 Elimination efficiencies measured in the SLIK pilot plant

The measured concentrations of each sample at all five sampling points are shown in Appendix 1 Data pharmaceuticals. During the data handling process, not all of the pharmaceutical compounds can be shown due to the value of certain compounds are too low, and these values are treated as 0.

4.1 MBR- Elimination efficiency

Fig. 4 Influent and effluent concentrations of MBR.

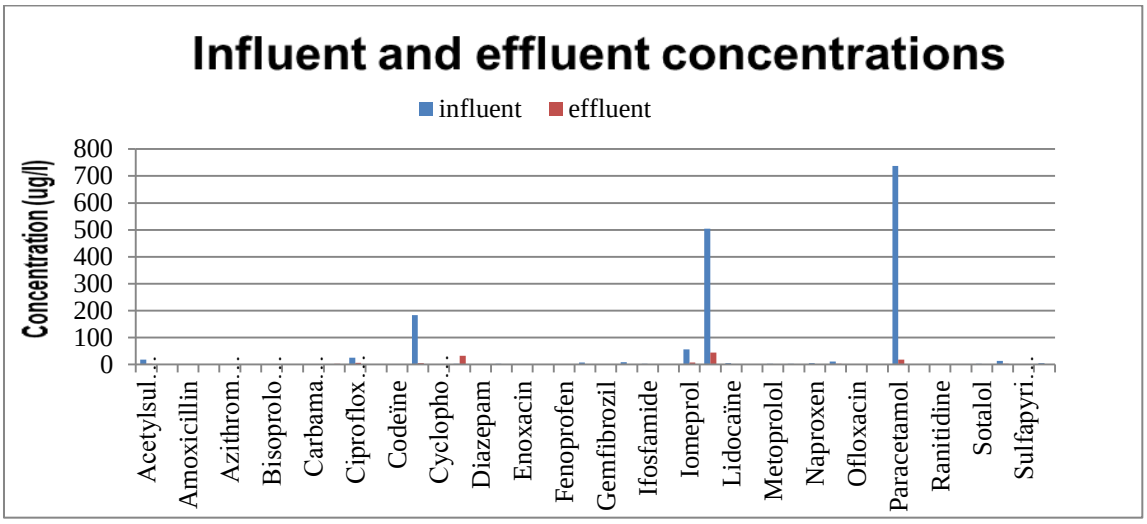
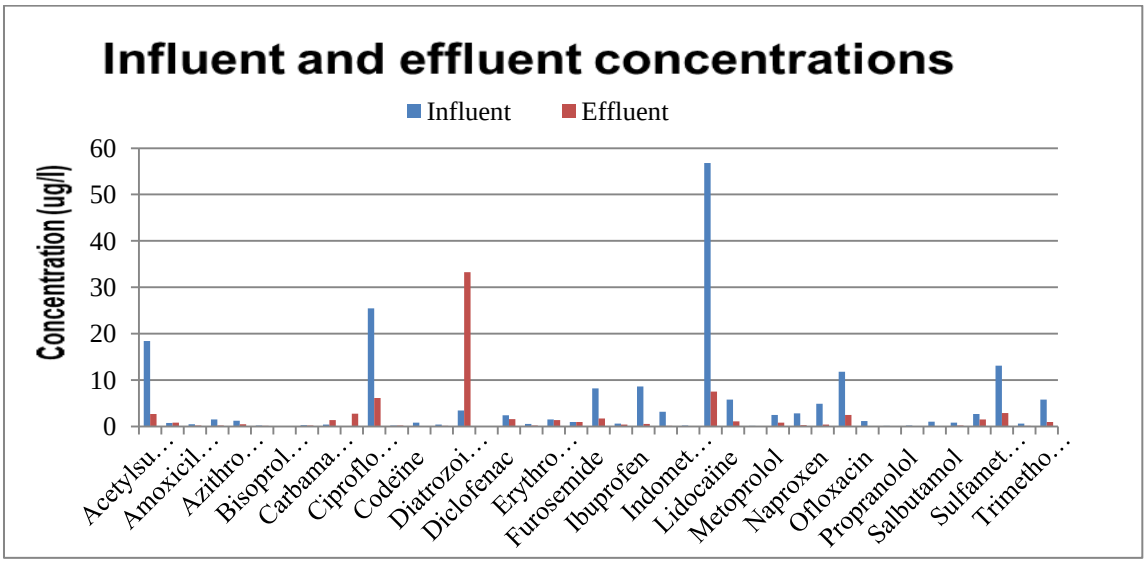


Fig. 5 Influent and effluent concentrations of MBR (range from 0-60 µg/l).



In figure 4 the compounds and their elimination efficiencies calculated with equation 1 are shown. Figure 5 is different from figure 4 that only indicates the influent and effluent concentrations from 0 to 60 µg/l, which is easily to compare with following figures because of the same range.

Table 1 Elimination efficiency of pharmaceuticals in MBR.

Elimination efficiency	Compounds
>80%	Lidocaïne, Trimethoprim, Atenolol, Acetylsulfamethoxazole, Iomeprol, Ibuprofen, Metronidazole, Ranitidine, Naproxen, Ioxithalamic acid, Codeïne, Ifosfamide, Coffeïne, Ofloxacin, Paracetamol
50-80%	Metoprolol, Amoxicillin, Salbutamol, Ciprofloxacin, Furosemide, Sulfapyridine, Sulfamethoxazole, Lidocaïne, Norfloxacin, Enoxacin, Diazepam
20-50%	Oseltamivir , Lincomcycin, Clarithromycin, Bezafibrate, Capecitabine, Diclofenac, Gemfibrozil, Cyclophosphanide, Indomethacine, Azithromycin , Sotalol , Propranolol
0-20%	Fenoprofen, Clarithromycin, Erythromycin
<0%	Cefotaxim, Diatrozoic acid, Carbamazepine, Amiodaron

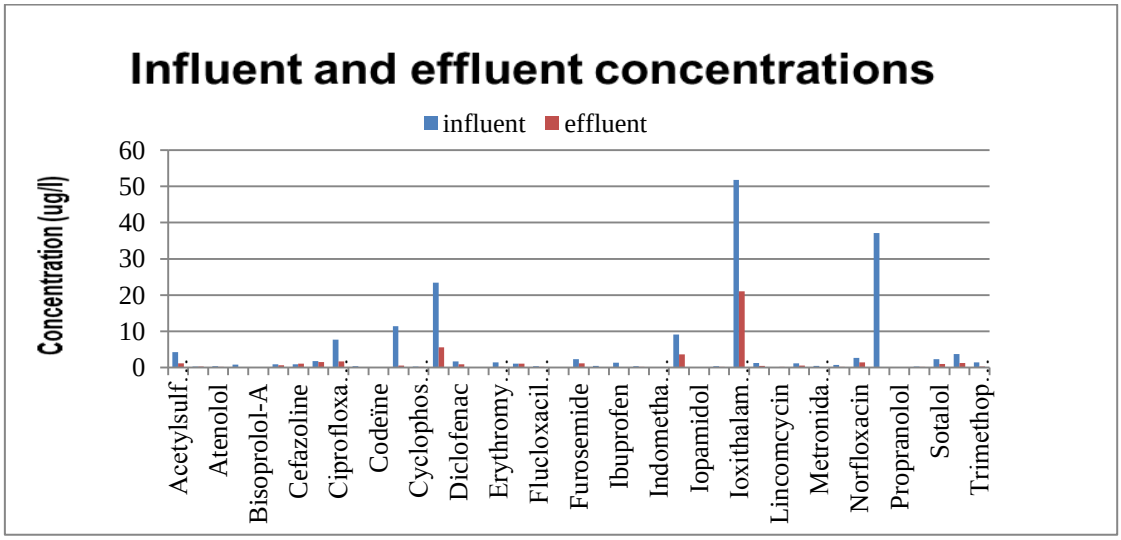
Some degradable or sorptive compounds are eliminated almost completely in the MBR, and many other compounds are eliminated by more than 50%.

For some compounds, such as Paracetamol, very good elimination efficiency (97.47%) is shown. Paracetamol is one of the compounds that have a high degradability (Ternes and Joss 2006). From literature values (Appendix 3), it can be seen that Ketoprofen, Ranitidine, Ofloxacin, Atenolol, Metoprolol, and Clofibric acid, the elimination efficiency in the MBR is much higher than in the conventional WWTPs.

Still there are some compounds that are not or insufficiently removed by the MBR (Sulfadiazine,Erythromycin, Cefotaxim, Amiodaron, etc.), which makes clear that only MBR is not sufficient to treat hospital wastewater. Post treatment plays an important role as additional steps. However, an MBR is still recommendable as one treatment step due to its high treatment efficiency for common pharmaceutical compounds.

4.2 GAC-Elimination efficiency

Fig. 6 Influent and effluent concentrations of GAC.



In figure 5 the compounds and their elimination efficiencies calculated with equation 2 are shown.

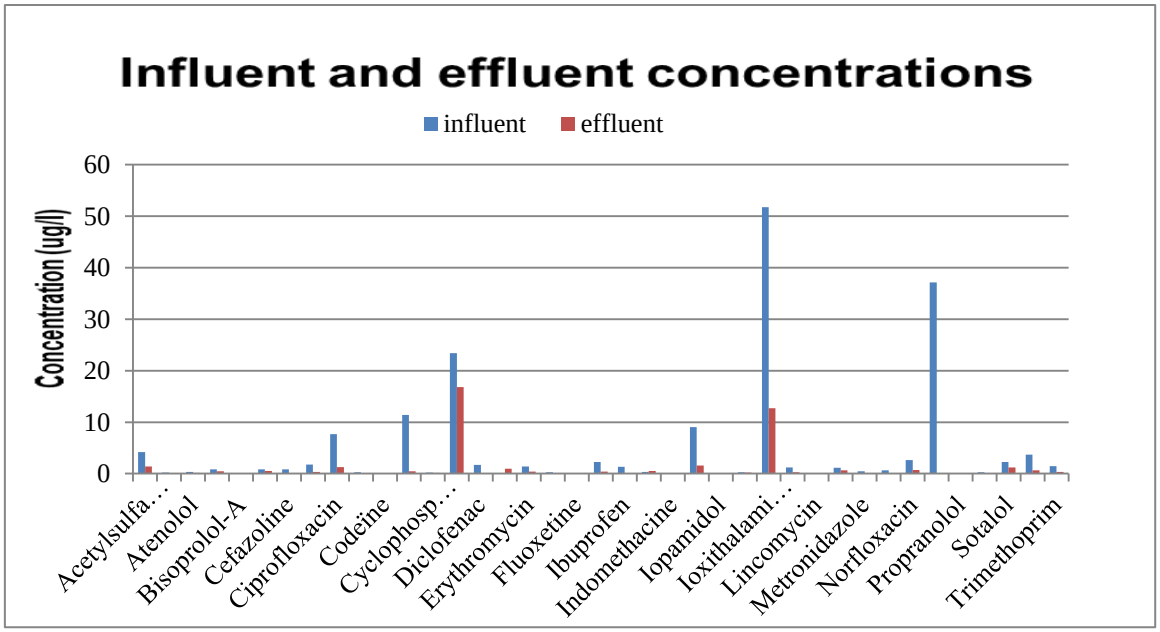
Table 2 Elimination efficiency of pharmaceuticals in GAC.

Elimination efficiency	Compounds
>80%	Trimethoprim, Metronidazole, Azithromycin, Indomethacine, Erythromycin, Clarithromycin, Coffeïne, Gemfibrozil, Ibuprofen, Paracetamol
50-80%	Furosemide, Salbutamol, Metoprolol, Sotalol, Ioxithalamic acid, Iomeprol, Lidocaïne, Sulfamethoxazole, Acetylsulfamethoxazole, Diatrizoic acid, Codeïne, Ciprofloxacin, Naproxen
20-50%	Carbamazepine, Propranolol, Cyclophosphanide, Dimetridazole, Iopamidol, Flucloxacillin, Iopromide, Ifosfamide, Fluoxetine, Norfloxacin, Atenolol, Diclofenac, Bisoprolol-A
0-20%	Fenoprofen, Cefotaxim
<0%	Lincomcycin, Cefazoline, Amoxicillin

For the elimination of most compounds, GAC shows very effective. Most compounds are removed. The elimination efficiency of Paracetamol is 99.77%, which shows very good elimination efficiency. However, most calculated elimination efficiencies would be higher in reality because most concentrations measured in the effluent of GAC were below the limit of quantification (LOQ). It still can be said that, GAC as a post treatment step is efficient for pharmaceutical elimination.

4.3 UV/H_2O_2- Elimination efficiency

Fig. 7 Influent and effluent concentrations of UV/H_2O_2.



In figure 6 the compounds and their elimination efficiencies calculated with equation 3 are shown.

Table 3 Elimination efficiency of pharmaceuticals in UV/H_2O_2.

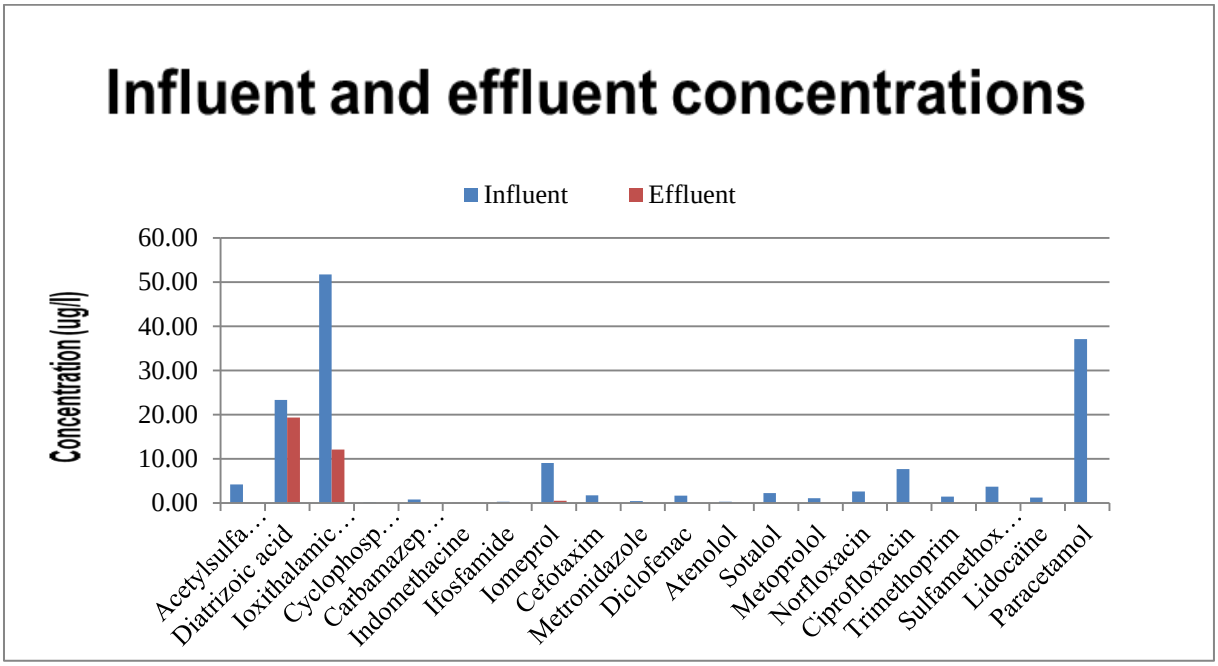
Elimination efficiency	Compounds
>80%	Flucloxacillin, Cefotaxim, Furosemide, Iomeprol, Metronidazole, Sulfamethoxazole, Ciprofloxacin, Cefazoline, Naproxen, Diclofenac, Coffeïne, Ibuprofen, Paracetamol
50-80%	Amoxicillin, Atenolol, Salbutamol, Clarithromycin, Acetylsulfamethoxazole, Indomethacine, Erythromycin, Norfloxacin, Ioxithalamic acid, Trimethoprim, Codeïne, Lidocaïne
20-50%	Cyclophosphanide, Iopamidol, Iopromide, Diatrozoic acid, Carbamazepine, Azithromycin, Propranolol, Lincomycin, Metoprolol, Sotalol, Fluoxetine
<0%	Dimetridazole, Ifosfamide, Bisoprolol-A

The influent mainly contains Ciprofloxacin (7.680 µg/l), Iomeprol (9.057 µg/l), Caffeine (11.385 ug/l), Diatrozoic acid (23.380 µg/l), Paracetamol (37.135 µg/l) and Ioxithalamic acid (51.760 µg/l). Compared with effluent of Sotalol (1.222 µg/l), Ciprofloxacin (1.253 µg/l), Acetylsulfamethoxazole (1.414 µg/l), Iomeprol (1.564 µg/l), Ioxithalamic acid (12.68 µg/l) and Diatrozoic acid()16.8 µg/l. Although the elimination efficiency of those compounds shows good (above 50%), the concentrations of them in effluent are still relatively high. Paracetamol is the compound which shows the highest elimination efficiency (99.79%).

It also can be seen that the elimination efficiency of Dimetridazole, Ifosfamide and Bisoprolol are all below 0, especially, the effluent concerntration of Dimetridazole is 57times higher than the influent.

4.4 Ozone- Elimination efficiency

Fig. 8 Influent and effluent concentrations of ozone.



In figure 7 the compounds and their elimination efficiencies calculated with equation 4 are shown.

Table 4 Elimination efficiency of pharmaceuticals in ozone.

Elimination efficiency	Compounds
>80%	Ifosfamide, Cyclophosphanide, Indomethacine, Iomeprol, Metronidazole, Carbamazepine, Atenolol, Sotalol, Diclofenac, Metoprolol, Cefotaxim, Trimethoprim, Norfloxacin, Acetylsulfamethoxazole, Ciprofloxacin, Sulfamethoxazole, Lidocaïne, Paracetamol
50-80%	Ioxithalamic acid
0-20%	Diatrozoic acid

Compared with UV/H_2O_2 elimination efficiency, what can be seen is that all the calculated values are all above 20%, except the lowest value (Diatrozoic acid 17.05%) is shown much lower than that in UV/H_2O_2 (28.14%).

There are certain compounds, such as Metoprolol and Atenolol, which cannot even eliminate by conventional wastewater treatment (see Appendix 3), the elimination efficiency are 97.80% and 96.71%, respectively. The values are also much higher than UV/H_2O_2 elimination efficiency (43.13% and 54.61, respectively). Generally, ozonation shows a significant result, that the elimination efficiency of each pharmaceutical is higher than GAC and UV/H_2O_2.

The rest compounds have either higher elimination efficiencies or have both concentrations (influent and effluent from ozone) <LOQ and no real elimination efficiency can be defined.

5 Discussion

As maybe seen from tables above, the elimination efficiencies of certain pharmaceutical compounds are below 0%, particularly in MBR, which means the concentration of influent is higher than effluent. There is no actual explanation for these by-products, it could be related to many possible situations: the sampling procedure, analysis of the pharmaceuticals or other processes. Some pharmaceuticals, it is known that are excreted from the human body in conjugated form. In the MBR, these conjugated forms can conjugate back resulting in the original pharmaceuticals. In this way the formation of by-product of pharmaceuticals is possible in a WWTP. But it does not happen for instance for ifosfamide. Therefore, further studies should be planned to assess the risk of production of unwanted by-products.

It is worth to paying attention that, for certain pharmaceutical compounds, although it is shown good elimination efficiency, the effluent concentration is still relatively high. Taking Ioxithalamic acid as an example, the elimination efficiency in UV/H_2O_2 is 75.5%, which achieves very good result. However, its effluent concentration is 12.68 µg/l. It has the same situation in ozone (see figure 8).

On the contrary, like Dimetridazole, it is shown that the elimination efficiency is below 0% (see table 3) in UV/H_2O_2, but the effluent concentration is lower than most of other compounds, which is 0.93 µg/l.

Before the treated discharge into municipal sewage water system, the concentrations should be detected and in an accepted safty range. Table 5 includes the maximum concentrations of certain different pharmaceuticals that have been detected in sewage effluent (Jones 2001).

Table 5. Different pharmaceuticals detected in sewage effluent.

Analyte	Maximum concentration detected (µg/l)	UV/H_2O_2 effluent (µg/l)	Ozone effluent (µg/l)
Carbamazepine	6.3	1.25	0.8
Cyclophosphanide	0.02	0.72	0.3
Ifosfamide	2.9	0.25	0.03
Indomethacine	0.6	0.65	0.01
Metoprolol	2.2	0.02	0.03
Paracetamol	6.0	0.11	0.01

Compared with the maximum concentration, the effluent concentration of Cyclophosphanide in both UV/H_2O_2 (0.72 µg/l) and Ozone (0.3 µg/l) are much higher than it detected in sewage effluent (0.02 µg/l, see table 5). Only the effluent concentration of Indomethacine in UV/H_2O_2 (0.65 µg/l) is slightly higher than it detected in sewage effluent (0.6 µg/l). For other pharmaceuticals, the effluent concentration are much lower than it detected in general sewage effluent, therefore, it could be said that it is safe to discharge into municipal sewage system.

6 Conclusions and Recommendations

6.1 Conclusions

From what has been discussed above, it may safely draw a conclusion that, the quality of effluent is much better than influent through different wastewater treatment techniques, which means the concentrations of most pharmaceutical compounds declined dramatically. MBR test result is particularly important rather than any other advanced techniques (UV/ H_2O_2 and ozone), because this technique is installed as the first advanced technique to eliminate pharmaceutical compounds and also, it is already wildly applied in wastewater treatment plant.

What can be found in influent are 99 different kinds of pharmaceutical compounds (targets), after three treatment methods, the major pharceutical compounds in effluent are Diatrizoic acid (5.55 µg/l) and Ioxithalamic acid (21.01 µg/l) in MBR, Diatrizoic acid (16.80 µg/l) and Ioxithalamic acid (12.68 µg/l) in UV/ H_2O_2, Diatrizoic acid (19.39µg/l) and Ioxithalamic acid (12.11 µg/l) in ozone, respectively.

For these compounds can be regarded as remove compeletly: Bisoprolol-A (0.02 µg/l), Diazepam (0.02 µg/l), Codeine (0.05 µg/l), Lincomycin (0.06 µg/l), Ranitidine (0.07 µg/l), Propranolol (0.08 µg/l), Ofloxacin (0.08 µg/l), Indomethacine (0.1 µg/l) in MBR. Clarithromycin (0.1 µg/l), Flucloxacillin (0.06 µg/l), Lincomcycin (0.06 µg/l), Metronidazole (0.08 µg/l), Bisoprolol-A (0.03 µg/l), Indomethacine (0.03 µg/l), Propranolol (0.06 µg/l), Diclofenac (0.08 µg/l), Ibuprofen (0.04 µg/l), Naproxen (0.08 µg/l), Codeïne (0.02 µg/l), Fluoxetine (0.01 µg/l), Paracetamol (0.08 µg/l), Iopamidol 0.02 µg/l) in UV/H_2O_2. Acetylsulfamethoxazole (0.05 µg/l), Cyclophosphanide (0.03 µg/l), Carbamazepine (0.08 µg/l), Indomethacine (0.01 µg/l), Ifosfamide (0.03 µg/l), Cefotaxim(0.07 µg/l), Metronidazole(0.02 µg/l), Diclofenac (0.06 µg/l), Atenolol (0.01 µg/l), Sotalol (0.06 µg/l), Metoprolol (0.03 µg/l), Norfloxacin (0.05 µg/l), Trimethoprim (0.02 µg/l), Sulfamethoxazole (0.04 µg/l), Lidocaïne (0.01 µg/l), Paracetamol (0.01 µg/l) in ozone.

For those compounds which still remain relatively high concentrations are not only include major pharmaceutical compounds, but also include: Acetylsulfamethoxazole (1.41 µg/l), Ciprofloxacin (1.25 µg/l), Sotalol (1.22 µg/l), Iomeprol (1.56 µg/l) in UV/H_2O_2. Iomeprol (0.52 µg/l) in ozone.

Treatment of hospital wastewater faces many challenges. Chemical compounds of pharmaceuticals and disinfectants, resistant bacteria occur in hospital wastewater that should be removed. When involved in the PILLS project, experience was gained on what technologies are most suitable for hospital wastewater treatment. It could be addressed that the biological treatment of hospital wastewater is feasible. The biological treatment is important as first treatment step, but does not eliminate pharmaceuticals sufficiently. Only addition with advanced steps, thus a better elimination can be achieved.

Moreover, the efficiency of the oxidation systems is influenced by the water quality (presence of organic compounds). This is also valid for the activated carbon and the tight membrane filtration.

The optimal treatment concept for the removal of pharmaceuticals in hospital wastewater is likely to be determined by the costs of the advanced treatment processes. Due to the limited knowledge available of e.g. the costs, the most optimal treatment concept is difficult to define at this moment.

Last but not least, since hospital wastewater is highly contaminated with pathogens, the treatment should also focus on how to eliminate them. Even though MBR is a good barrier, a further disinfection step is advisable. Furthermore, hospital wastewater is a source for antibiotic resistant and multi-resistant bacteria, which should be eliminated as well.

6.2 Recommendations

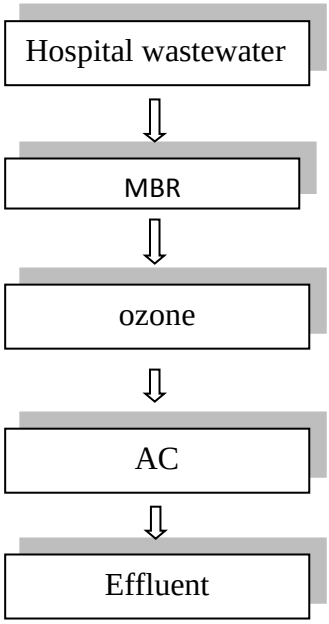


Fig.9 Future hospital wastewater treatment frame

Two technologies are suitable to achieve good elimination of pharmaceutical compounds: UV/H_2O_2 and ozone. Both technologies have strengths and weaknesses. UV disinfection is most effective for treating a high clarity purified reverse osmosis distilled water. The flow rate is a problem: if the flow is too high, water will pass through without enough UV exposure; if the flow is too low, heat may build up and damage the UV lamp (GADGIL, A., 1997). Ozone has a very strong oxidizing power with a short reaction time, and

reduces most organic compounds to carbon dioxide, water and a little heat. For both treatment processes, no chemicals are added to the water.

Taking the results above into account, figure 9 would be the promising future hospital wastewater treatment frame recommended by the author. The recommended treatment concept consists of pre-treatment, main biological treatment (MBR), followed by oxidation technique (ozone), and activated carbon as a post treatment. The treatment of hospital wastewater to reduce the pharmaceuticals released in the environment requires biological treatment as a main treatment and advanced tertiary treatment steps. Biological treatment will in general remove pharmaceuticals partially. Ozone treatment should be applied when enhanced removal of pharmaceuticals is aimed for, which has shown to remove pharmaceuticals to a large extent. GAC, as a post treatment technology, the compounds are adsorbed onto the GAC surface and not transformed. The loaded GAC needs to be separated from the treated wastewater and disposed properly, e.g. by incineration.

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Internet resource

Webpage of pilot plant location: http://maps.google.nl/maps?q=water+board+groot+salland&um=1&ie=UTF-8&ei=eag5T_TxCsiV-waR0dmsBw&sa=X&oi=mode_link&ct=mode&cd=3&ved=0CBIQ_AUoAg

Webpage of MBR: http://en.wikipedia.org/wiki/Membrane_bio_reactor

Webpage of PILLS project: http://www.event-planung.eu/emscher/pills/index.php?id=126

Webpage of SLIK project location:

http://maps.google.nl/maps?q=water+board+groot+salland&um=1&ie=UTF-8&ei=eag5T_TxCsiV-waR0dmsBw&sa=X&oi=mode_link&ct=mode&cd=3&ved=0CBIQ_AUoAg

Webpage of SLIK project: http://www.wgs.nl/schoon-water/slik/

Appendix

1. Data of pharmaceuticals

Measured concentrations for each mixed sample at different Sampling Points.

1.1 Measured concentrations for each sample at SP3 (influent of MBR).

Therapeutic group	**Test name**	**analyte**	Unit	22-Feb	22-Mar	19-Apr	12 - May
Cardiovacular system	Pharmaceutische componenten Groep I positief	Amiodaron	µg/l		<0,1	1.2	0.3
Cardiovacular system	Pharmaceutische componenten Groep I positief	Atenolol	µg/l	1.3	1.6	1.5	1.4
Cardiovacular system	Pharmaceutische componenten Groep I positief	Betaxolol	µg/l	<0,1	<0,1	<0,1	<0,1
Cardiovacular system	Pharmaceutische componenten Groep I positief	Bezafibrate	µg/l	<0,1	<0,1	0.2	0.22
Cardiovacular system	Pharmaceutische componenten Groep I positief	Bisoprolol-A	µg/l	<0,1	<0,1	<0,1	<0,1
Cardiovacular system	Pharmaceutische componenten Groep I positief	Clofibrate	µg/l	<0,5	<0,5	<0,5	<0,5
Respiratory system	Pharmaceutische componenten Groep I positief	Codeïne	µg/l	1.2	0.63	0.43	1.3
Musculo-skeletal system	Pharmaceutische componenten Groep I positief	Diclofenac	µg/l	2.4	2.3	2.3	3
Cardiovacular system	Pharmaceutische componenten Groep I positief	Enalpril	µg/l	<0,5	<0,5	<0,5	<0,5
Cardiovacular system	Pharmaceutische componenten Groep I positief	Fenofibrate	µg/l	<0,1	<0,1	<0,1	<0,1
Musculo-skeletal system	Pharmaceutische componenten Groep I positief	Fenoprofen	µg/l	<1	<1	<1	<1
Cardiovacular system	Pharmaceutische componenten Groep I positief	Indomethacine	µg/l	0.22	<0,1	<0,1	<0,1
Musculo-skeletal system	Pharmaceutische componenten Groep I positief	Ketoprofen	µg/l	<0,1	<0,1	<0,1	<0,1
Cardiovacular system	Pharmaceutische componenten Groep I positief	Lidocaïne	µg/l	11	1.3	7.2	3.5
Cardiovacular system	Pharmaceutische componenten Groep I positief	Methyl-dopa	µg/l	NTB	NTB	NTB	
Cardiovacular system	Pharmaceutische componenten Groep I positief	Metoprolol	µg/l	2.7	2.9	2	2.7
Musculo-skeletal system	Pharmaceutische componenten Groep I positief	Naproxen	µg/l	4.8	5.5	5.3	4
Nervous system	Pharmaceutische	Paracetamol	µg/l	980	26	620	960

	componenten Groep I positief						
Cardiovacular system	Pharmaceutische componenten Groep I positief	Pentoxifilline	µg/l	<0,1	<0,1	<0,1	<0,1
Nervous system	Pharmaceutische componenten Groep I positief	Phenacetin	µg/l	<0,1	<0,1	<0,1	<0,1
Nervous system	Pharmaceutische componenten Groep I positief	Phenazone	µg/l	<0,1	<0,1	<0,1	<0,1
Cardiovacular system	Pharmaceutische componenten Groep I positief	Pindolol	µg/l	<0,1	<0,1	<0,1	<0,1
Cardiovacular system	Pharmaceutische componenten Groep I positief	Propranolol	µg/l	0.15	0.22	0.18	<0,1
Nervous system	Pharmaceutische componenten Groep I positief	Propyphenazone	µg/l	<0,1	<0,1	<0,1	<0,1
Cardiovacular system	Pharmaceutische componenten Groep I positief	Sotalol	µg/l	2.7	3.9	1.3	2.1
Antineoplastic and immunomodulating agents	Pharmaceutische componenten Groep II positief	Capecitabine	µg/l	<0,1	0.25	0.31	0.26
Nervous system	Pharmaceutische componenten Groep II positief	Carbamazepine	µg/l	0.65	0.38	0.2	0.44
Respiratory system	Pharmaceutische componenten Groep II positief	Clenbuterol	µg/l	<0,1	<0,1	<0,1	<0,1
Nervous system	Pharmaceutische componenten Groep II positief	Coffeïne	µg/l	240	14	280	200
Antineoplastic and immunomodulating agents	Pharmaceutische componenten Groep II positief	Cyclophosphanide	µg/l	0.28	0.69	<0,1	0.1
Nervous system	Pharmaceutische componenten Groep II positief	Diazepam	µg/l	0.1	<0,1	<0,1	<0,1
Genito urinary system and sex hormones	Pharmaceutische componenten Groep II positief	Estrone	µg/l	<0,5	<0,5	<0,5	<0,5
Nervous system	Pharmaceutische componenten Groep II positief	Fluoxetine	µg/l	<0,1	<0,1	<0,1	<0,1
Antineoplastic and immunomodulating agents	Pharmaceutische componenten Groep II positief	Ifosfamide	µg/l	<0,1	3.2	<0,1	<0,1
	Pharmaceutische componenten Groep II positief	Malachite Green	µg/l	<0,1	<0,1	<0,1	<0,1
Sensory organs	Pharmaceutische componenten Groep II positief	Oxymetazoline	µg/l	<0,1	<0,1	<0,1	<0,1
Nervous system	Pharmaceutische componenten Groep II positief	Primidone	µg/l	<0,1	<0,1	<0,1	<0,1
Alimentary tract and metabolism	Pharmaceutische componenten Groep II positief	Ranitidine	µg/l	2.6	0.4	0.53	0.45
Respiratory system	Pharmaceutische componenten Groep II positief	Salbutamol	µg/l	0.75	1.1	0.43	0.91
Antineoplastic and	Pharmaceutische	Tamoxifen	µg/l	<0,1	<0,1	<0,1	<0,1

immunomodulating agents	componenten Groep II positief						
Respiratory system	Pharmaceutische componenten Groep II positief	Terbutalin	µg/l	<0,1	<0,1	<0,1	<0,1
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Diatrozoic acid	µg/l	3.5	9.4	2.5	0.59
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iohexol	µg/l	<0,2	9.5	<0,2	<0,2
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iomeprol	µg/l	180	16	29	26
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iopamidol	µg/l	<0,1	<0,1	<0,1	<0,1
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iopanoic acid	µg/l	<0,1	<0,1	<0,1	<0,1
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iopromide	µg/l	<0,2	<0,2	<0,2	<0,2
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iothalamic acid	µg/l	<0,5	<0,5	<0,5	<0,5
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Ioxithalamic acid	µg/l	330	680	630	380
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Acetylsulfamethoxazole	µg/l	14	28	6.7	25
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Amoxicillin	µg/l	0.42	0.45	1.2	<0,2
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Azithromycin	µg/l	1.1	2.2	0.23	1.6
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Cefazoline	µg/l	<0,1	<0,1	<0,1	<0,1
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Cefotaxim	µg/l	0.1	<0,1	<0,1	<0,1
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Cefuroxime	µg/l	<0,1	<0,1	<0,1	<0,1
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Chlorotetracycline	µg/l	<0,1	<0,1	<0,1	<0,1
Anti-infectives for	Pharmaceutische	Ciprofloxacin	µg/l	41	22	21	18

systematic use	componenten Groep IV positief						
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Clarithromycin	µg/l	<0,1	0.13	<0,1	0.28
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Cloxacillin	µg/l	<0,1	<0,1	<0,1	<0,1
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Dapson	µg/l	<0,1	<0,1	<0,1	<0,1
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Dicloxacillin	µg/l	<0,1	<0,1	<0,1	<0,1
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Dimetridazole	µg/l	<0,1	<0,1	<0,1	<0,1
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Enoxacin	µg/l	1.1	<0,5	<0,5	<0,5
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Enrofloxacin	µg/l	<0,5	<0,5	<0,5	<0,5
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Erythromycin	µg/l	1.4	1.5	1.5	1.7
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Flucloxacillin	µg/l	<0,1	<0,1	<0,1	<0,1
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Flumequine	µg/l	<0,5	<0,5	<0,5	<0,5
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Lincomcycin	µg/l	0.15	<0,1	0.12	<0,1
Anti-parasitic agents, insecticides, repellents	Pharmaceutische componenten Groep IV positief	Mebendazole	µg/l	<0,1	<0,1	<0,1	<0,1
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Metronidazole	µg/l	4.8	2.4	0.73	3.5
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Norfloxacin	µg/l	8	7.3	15	17
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Ofloxacin	µg/l	<0,5	<0,5	1.2	<0,5
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV	Oleandromycin	µg/l	<0,1	<0,1	<0,1	<0,1

	positief						
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Oseltamivir	µg/l	0.14	<0,1	<0,1	<0,1
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Oxacillin	µg/l	<0,1	<0,1	<0,1	<0,1
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Oxolinic acid	µg/l	<0,5	<0,5	<0,5	<0,5
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Oxytetracycline	µg/l	<0,2	<0,2	<0,2	<0,2
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Penicillin G	µg/l	NTB	<0,2	<0,2	<0,2
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Penicillin V	µg/l	<0,2	<0,2	<0,2	<0,2
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Ronidazole	µg/l	<0,1	<0,1	<0,1	<0,1
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Roxithromycin	µg/l	<0,1	<0,1	<0,1	<0,1
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Spiramycin	µg/l	<0,5	<0,5	<0,5	<0,5
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Sulfachinoxalin	µg/l	<0,1	<0,1	<0,1	<0,1
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Sulfachloropyrazidine	µg/l	<0,2	<0,2	<0,2	<0,2
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Sulfadiazine	µg/l	<0,2	<0,2	<0,2	<0,2
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Sulfadimethoxine	µg/l	<0,2	<0,2	<0,2	<0,2
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Sulfamerazine	µg/l	<0,2	<0,2	<0,2	<0,2
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Sulfamethazine	µg/l	<0,2	<0,2	<0,2	<0,2
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Sulfamethoxazole	µg/l	13	14	5.4	20
Anti-infectives for	Pharmaceutische	Sulfapyridine	µg/l	0.43	0.33	0.26	1.4

systematic use	componenten Groep IV positief						
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Tetracycline	µg/l	<0,1	<0,1	<0,1	<0,1
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Tiamuline	µg/l	<0,1	<0,1	<0,1	<0,1
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Trimethoprim	µg/l	3.2	5.9	2.2	12
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Tylosin	µg/l	<0,2	<0,2	<0,2	<0,2
Anti-infectives for systematic use	Pharmaceutische componenten Groep V negatief	Chloramphenicol	µg/l	<0,1	<0,1	<0,1	<0,1
Metabolite	Pharmaceutische componenten Groep V negatief	Clofibric acid	µg/l	<0,1	<0,1	<0,1	<0,1
Cardiovacular system	Pharmaceutische componenten Groep V negatief	Furosemide	µg/l	9	8.6	7.9	7.3
Cardiovacular system	Pharmaceutische componenten Groep V negatief	Gemfibrozil	µg/l	0.86	0.14	1.1	0.45
Musculo-skeletal system	Pharmaceutische componenten Groep V negatief	Ibuprofen	µg/l	8.5	11	7.5	7.6
	TOC	Totaal Organisch Koolstof (TOC)	mg/l	150	120	130	120

1.2 Measured concentrations for each sample at SP5 (effluent of MBR).

Therapeutic group	**Test name**	**analyte**	Unit	22-Feb	08-Mar	15-Mar	16-Mar	23-Mar	19-Apr	26-Apr	12-May	17-May	30-May
Cardiovacular system	Pharmaceutische componenten Groep I positief	Amiodaron	µg/l	0.08	0.1	<0,1	0.72	0.02	0.02	<0,01	<0,01	0.03	0.03
Cardiovacular system	Pharmaceutische componenten Groep I positief	Atenolol	µg/l	1.4	2.7	1.3	23	6.4	3.2	1	0.84	0.84	1.3
Cardiovacular system	Pharmaceutische componenten Groep I positief	Betaxolol	µg/l	0.37	0.3	0.1	0.66	0.14	0.2	0.04	0.06	0.06	0.3

Cardiovascular system	Pharmaceutische componenten Groep I positief	Bezafibrate	µg/l	0.89	1.8	1.8	2.3	0.93	0.1	0.03	0.06	0.06	0.08
Cardiovascular system	Pharmaceutische componenten Groep I positief	Bisoprolol-A	µg/l	1.2	0.82	1	<0,1	0.48	2.4	0.05	0.18	0.44	1.1
Cardiovascular system	Pharmaceutische componenten Groep I positief	Clofibrate	µg/l	1	0.91	0.76	0.2	1.9	3.2	0.92	1.1	1.7	5.7
Respiratory system	Pharmaceutische componenten Groep I positief	Codeïne	µg/l	4.7	5.6	4.3	33	5.9	5.7	5.4	4.7	3.4	4.1
Musculo-skeletal system	Pharmaceutische componenten Groep I positief	Diclofenac	µg/l	0.07	0.57	0.35	0.83	0.12	<0,01	0.02	<0,01	0.1	<0,01
Cardiovascular system	Pharmaceutische componenten Groep I positief	Enalpril	µg/l	0.23	0.25	<0,5	<0,5	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Cardiovascular system	Pharmaceutische componenten Groep I positief	Fenofibrate	µg/l	2.2	2.4	2.1	1.3	1.1	0.31	<0,05	<0,05	0.14	<0,05
Musculo-skeletal system	Pharmaceutische componenten Groep I positief	Fenoprofen	µg/l	0.21	0.1	0.22	<0,1	0.12	0.16	0.05	0.08	0.08	1.6
Cardiovascular system	Pharmaceutische componenten Groep I positief	Indomethacine	µg/l	0.11	<0,01	<0,1	<0,1	<0,01	0.16	0.18	0.04	0.02	0.07
Musculo-skeletal system	Pharmaceutische componenten Groep I positief	Ketoprofen	µg/l	0.4	0.07	0.12	3.3	0.13	0.12	0.02	0.04	0.08	0.07
Cardiovascular system	Pharmaceutische componenten Groep I positief	Lidocaïne	µg/l	1.6	1.9	1.3	10	1.5	2.1	2.2	2.3	1.5	2.1
Cardiovascular system	Pharmaceutische componenten Groep I positief	Methyl-dopa	µg/l	0.07	0.06	0.06	<0,5	0.06	<0,05	0.08	0.11	0.07	0.08
Cardiovascular system	Pharmaceutische componenten Groep I positief	Metoprolol	µg/l	0.15	0.14	<0,1	<0,1	0.03	<0,01	<0,01	<0,01	<0,01	<0,01
Musculo-	Pharmace	Naproxen	µg	2.1	2	1.1	23	2.3	1.9	1	0.7	0.7	2.1

skeletal system	utische componenten Groep I positief		/l								6	5	
Nervous system	Pharmaceutische componenten Groep I positief	Paracetamol	µg/l	0.06	0.05	<0,2	0.68	0.05	0.07	<0,02	0.07	0.32	0.05
Cardiovascular system	Pharmaceutische componenten Groep I positief	Pentoxifilline	µg/l	2.6	3	0.62	5	0.76	0.62	0.51	0.26	0.21	0.73
Nervous system	Pharmaceutische componenten Groep I positief	Phenacetin	µg/l	<0,01	<0,01	<0,1	0.41	0.02	<0,01	<0,01	<0,01	<0,01	<0,01
Nervous system	Pharmaceutische componenten Groep I positief	Phenazone	µg/l	0.16	0.54	<0,1	0.27	0.4	0.23	0.11	0.09	0.1	0.08
Cardiovascular system	Pharmaceutische componenten Groep I positief	Pindolol	µg/l	0.03	0.01	<0,1	<0,1	0.62	<0,01	<0,01	0.87	0.21	0.17
Cardiovascular system	Pharmaceutische componenten Groep I positief	Propranolol	µg/l	<0,01	NTB	<0,1	0.82	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Nervous system	Pharmaceutische componenten Groep I positief	Propyphenazone	µg/l	0.08	0.2	0.12	1.5	0.26	0.3	0.08	0.05	0.22	0.23
Cardiovascular system	Pharmaceutische componenten Groep I positief	Sotalol	µg/l	<0,01	<0,01	<0,1	0.13	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Antineoplastic and immunomodulating agents	Pharmaceutische componenten Groep II positief	Capecitabine	µg/l	2.2	3	0.46	8.5	3	2.2	0.66	0.21	0.68	1.6
Nervous system	Pharmaceutische componenten Groep II positief	Carbamazepine	µg/l	<0,01	NTB	<0,01	0.86	<0,01	<0,01	<0,01	<0,01	<0,01	0.02
Respiratory system	Pharmaceutische componenten Groep II positief	Clenbuterol	µg/l	0.11	0.08	<0,1	0.2	0.04	<0,01	<0,01	<0,01	<0,01	<0,01
Nervous system	Pharmaceutische componenten Groep II positief	Coffeïne	µg/l	6.6	0.96	0.48	1.6	0.11	0.66	0.08	0.12	0.84	0.7
Antineoplastic and	Pharmaceutische	Cyclophosphanide	µg/l	0.93	0.84	1.3	2.7	2.3	1.4	0.42	0.24	0.53	0.7

immunomodulating agents	componenten Groep II positief												
Nervous system	Pharmaceutische componenten Groep II positief	Diazepam	µg/l	0.11	0.11	0.12	0.12	0.13	0.14	0.11	0.06	0.05	0.06
Genito urinary system and sex hormones	Pharmaceutische componenten Groep II positief	Estrone	µg/l	2.5	3.7	1.7	2.6	5.6	1.4	1.1	0.93	1.6	1.3
Nervous system	Pharmaceutische componenten Groep II positief	Fluoxetine	µg/l	1.6	1.8	0.92	2.7	1.9	1.7	1.5	1.4	1.2	2.1
Antineoplastic and immunomodulating agents	Pharmaceutische componenten Groep II positief	Ifosfamide	µg/l	0.07	0.04	<0,01	6.3	0.12	0.01	<0,01	<0,01	<0,01	<0,01
	Pharmaceutische componenten Groep II positief	Malachite Green	µg/l	0.24	0.11	<0,2	4.9	0.23	0.08	0.02	0.04	0.12	0.2
Sensory organs	Pharmaceutische componenten Groep II positief	Oxymetazoline	µg/l	0.57	0.52	0.68	0.29	0.47	0.47	0.62	0.94	1.3	2.4
Nervous system	Pharmaceutische componenten Groep II positief	Primidone	µg/l	0.27	0.34	0.92	110	0.5	0.41	0.3	0.42	0.34	0.35
Alimentary tract and metabolism	Pharmaceutische componenten Groep II positief	Ranitidine	µg/l	0.01	0.01	<0,1	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	0.01
Respiratory system	Pharmaceutische componenten Groep II positief	Salbutamol	µg/l	0.29	0.04	0.14	370	0.58	0.14	0.03	0.04	0.04	0.05
Antineoplastic and immunomodulating agents	Pharmaceutische componenten Groep II positief	Tamoxifen	µg/l	0.08	0.02	<0,1	0.47	0.03	<0,01	0.02	0.02	0.02	0.02
Respiratory system	Pharmaceutische componenten Groep II positief	Terbutalin	µg/l	0.34	0.24	0.15	0.89	0.31	0.19	0.1	0.06	0.12	0.23
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Diatrozoic acid	µg/l	6.9	4.6	4.2	1.2	11	4.6	130	13	9.3	49
Various (incl X-ray	Pharmaceutische	Iohexol	µg/l	<0,02	<0,02	<0,2	<0,2	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02

CM)	componenten Groep III positief												
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iomeprol	µg/l	11	0.71	0.75	44	4.2	15	0.81	1.4	3.4	9.3
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iopamidol	µg/l	35	22	10	200	30	130	11	7.6	13	59
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iopanoic acid	µg/l	<0,01	<0,01	<0,1	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iopromide	µg/l	<0,01	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iothalamic acid	µg/l	<0,01	<0,01	<0,1	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Ioxithalamic acid	µg/l	<0,01	<0,01	<0,1	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Acetylsulfamethoxazole	µg/l	0.02	<0,01	<0,1	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Amoxicillin	µg/l	<0,01	<0,01	<0,1	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Azithromycin	µg/l	0.02	<0,01	<0,1	<0,1	0.02	0.02	0.01	0.01	0.02	0.02
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Cefazoline	µg/l	<0,05	<0,05	<0,5	<0,5	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Anti-infectives for	Pharmaceutische componen	Cefotaxim	µg/l	<0,05	<0,05	<0,5	<0,5	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05

systematic use	ten Groep IV positief												
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Cefuroxime	µg/l	<0,01	0.02	<0,1	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Chlorotetracycline	µg/l	<0,01	<0,01	<0,1	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Ciprofloxacin	µg/l	<0,05	<0,05	<0,5	<0,5	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Clarithromycin	µg/l	<0,02	<0,02	<0,2	<0,2	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Cloxacillin	µg/l	NTB	NTB	<0,2	<0,2	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Dapson	µg/l	<0,02	<0,02	<0,2	<0,2	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Dicloxacillin	µg/l	<0,01	<0,01	<0,1	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Dimetridazole	µg/l	<0,01	<0,01	<0,1	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Enoxacin	µg/l	<0,5	<0,05	<0,5	<0,5	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Enrofloxacin	µg/l	0.02	<0,01	<0,2	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systematic	Pharmaceutische componenten Groep	Erythromycin	µg/l	<0,02	<0,02	<0,2	<0,2	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02

use	IV positief												
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Flucloxacillin	µg/l	<0,02	<0,02	<0,2	0.48	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Flumequine	µg/l	<0,02	<0,02	<0,2	<0,2	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Lincomcycin	µg/l	<0,02	<0,02	<0,2	<0,2	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02
Anti-parasitic agents, insecticides, repellents	Pharmaceutische componenten Groep IV positief	Mebendazole	µg/l	0.08	<0,02	<0,2	<0,2	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Metronidazole	µg/l	<0,01	<0,01	<0,1	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Norfloxacin	µg/l	<0,01	<0,01	<0,1	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Ofloxacin	µg/l	<0,02	<0,02	<0,2	<0,2	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Oleandromycin	µg/l	<0,01	<0,01	<0,1	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Oseltamivir	µg/l	<0,01	<0,01	<0,1	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Oxacillin	µg/l	<0,01	<0,01	<0,1	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV	Oxolinic acid	µg/l	0.01	0.02	<0,1	<0,1	0.04	0.01	<0,01	<0,01	<0,01	<0,01

	positief												
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Oxytetracycline	µg/l	<0,05	<0,05	<0,5	<0,5	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Penicillin G	µg/l	<0,05	<0,05	<0,5	<0,5	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Penicillin V	µg/l	<0,01	NTB	<0,1	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Ronidazole	µg/l	NTB	NTB	NTB	NTB	NTB	NTB	NTB			
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Roxithromycin	µg/l	<0,01	<0,01	<0,1	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Spiramycin	µg/l	<0,01	<0,01	<0,1	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Sulfachinoxalin	µg/l	<0,05	<0,05	<0,5	<0,5	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Sulfachloropyrazidine	µg/l	<0,01	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Sulfadiazine	µg/l	<0,1	<0,1	<1	<1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Sulfadimethoxine	µg/l	<0,01	<0,01	<0,1	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Sulfamerazine	µg/l	0.01	0.02	<0,1	<0,1	0.02	0.02	0.02	0.02	0.02	0.02

Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Sulfamethazine	µg/l	<0,01	<0,01	<0,1	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Sulfamethoxazole	µg/l	0.01	0.01	<0,1	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Sulfapyridine	µg/l	0.04	<0,01	<0,1	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	0.02
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Tetracycline	µg/l	0.06	<0,01	<0,1	<0,1	<0,01	<0,01	0.02	<0,01	<0,01	<0,01
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Tiamuline	µg/l	<0,01	<0,01	<0,1	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Trimethoprim	µg/l	<0,01	0.03	<0,1	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Tylosin	µg/l	<0,01	<0,01	<0,1	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systematic use	Pharmaceutische componenten Groep V negatief	Chloramphenicol	µg/l	0.06	0.01	<0,1	<0,1	0.01	<0,01	<0,01	<0,01	0.02	0.03
Metabolite	Pharmaceutische componenten Groep V negatief	Clofibric acid	µg/l	<0,01	<0,01	<0,1	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Cardiovacular system	Pharmaceutische componenten Groep V negatief	Furosemide	µg/l	<0,02	<0,02	<0,2	<0,2	<0,02	<0,02	<0,02	<0,02	0.3	<0,02
Cardiovacular system	Pharmaceutische componenten Groep V negatief	Gemfibrozil	µg/l	<0,05	<0,05	<0,5	<0,5	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Musculo-skeletal system	Pharmaceutische componenten Groep V negatief	Ibuprofen	µg/l	<0,01	<0,01	<0,1	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01

	TOC	Totaal Organisch Koolstof (TOC)	mg/l	9.9	9.4	7.9	120	9.4	9.1	8.8	9	8.7	9.1

1.3 Measured concerntrations for each sample at SP7 (effluent of GAC).

Therapeutic group	**Test name**	**analyte**	Unit	22-Feb	8 - Mar	15-Mar	19-Apr	26-Apr	17 - May
Cardiovacular system	Pharmaceutische componenten Groep I positief	Amiodaron	µg/l	<0,01	NTB	<0,1	<0,1	<0,1	<0,01
Cardiovacular system	Pharmaceutische componenten Groep I positief	Atenolol	µg/l	<0,01	<0,01	<0,1	0.33	0.03	0.11
Cardiovacular system	Pharmaceutische componenten Groep I positief	Betaxolol	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01
Cardiovacular system	Pharmaceutische componenten Groep I positief	Bezafibrate	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01
Cardiovacular system	Pharmaceutische componenten Groep I positief	Bisoprolol-A	µg/l	<0,01	<0,01	<0,1	0.01	<0,01	<0,01
Cardiovacular system	Pharmaceutische componenten Groep I positief	Clofibrate	µg/l	<0,05	<0,05	<0,5	<0,05	<0,05	<0,05
Nervous system	Pharmaceutische componenten Groep I positief	Codeïne	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	0.02
Musculo-skeletal system	Pharmaceutische componenten Groep I positief	Diclofenac	µg/l	<0,01	<0,01	<0,1	1.3	<0,01	0.41
Cardiovacular system	Pharmaceutische componenten Groep I positief	Enalapril	µg/l	<0,05	<0,05	<0,5	<0,05	<0,05	<0,05
Cardiovacular system	Pharmaceutische componenten Groep I positief	Fenofibrate	µg/l	<0,01	NTB	<0,1	<0,01	<0,01	<0,01
Musculo-skeletal system	Pharmaceutische componenten Groep I positief	Fenoprofen	µg/l	<0,1	<0,1	<1	<0,1	<0,1	<0,1

Cardiovacular system	Pharmaceutische componenten Groep I positief	Indomethacine	µg/l	<0,01	<0,01	<0,1	0.01	<0,01	<0,01
Musculo-skeletal system	Pharmaceutische componenten Groep I positief	Ketoprofen	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01
Cardiovacular system	Pharmaceutische componenten Groep I positief	Lidocaïne	µg/l	<0,01	<0,01	<0,1	0.38	<0,01	0.46
Cardiovacular system	Pharmaceutische componenten Groep I positief	Metoprolol	µg/l	<0,01	<0,01	<0,1	0.73	<0,01	0.27
Musculo-skeletal system	Pharmaceutische componenten Groep I positief	Naproxen	µg/l	<0,02	<0,02	<0,2	0.14	<0,02	0.14
Nervous system	Pharmaceutische componenten Groep I positief	Paracetamol	µg/l	<0,01	<0,01	<0,1	0.14	<0,01	0.03
Cardiovacular system	Pharmaceutische componenten Groep I positief	Pentoxifilline	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01
Nervous system	Pharmaceutische componenten Groep I positief	Phenacetin	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01
Nervous system	Pharmaceutische componenten Groep I positief	Phenazone	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01
Cardiovacular system	Pharmaceutische componenten Groep I positief	Pindolol	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01
Cardiovacular system	Pharmaceutische componenten Groep I positief	Propranolol	µg/l	<0,01	<0,01	<0,1	0.1	<0,01	0.04
Nervous system	Pharmaceutische componenten Groep I positief	Propyphenazone	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01
Cardiovacular system	Pharmaceutische componenten Groep I positief	Sotalol	µg/l	<0,01	<0,01	<0,1	0.96	<0,01	1
Antineoplastic	Pharmaceutis	Capecitabine	µg/	<0,0	<0,0	<0,1	<0,0	<0,0	<0,0

and immunomodulating agents	che componenten Groep II positief		l	1	1		1	1	1
Nervous system	Pharmaceutische componenten Groep II positief	Carbamazepine	µg/l	<0,01	<0,01	<0,1	0.41	<0,01	0.76
Respiratory system	Pharmaceutische componenten Groep II positief	Clenbuterol	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01
Nervous system	Pharmaceutische componenten Groep II positief	Coffeïne	µg/l	<0,01	<0,1	0.72	0.39	<0,1	0.3
Antineoplastic and immunomodulating agents	Pharmaceutische componenten Groep II positief	Cyclophosphanide	µg/l	<0,01	<0,01	<0,1	0.23	<0,01	0.07
Nervous system	Pharmaceutische componenten Groep II positief	Diazepam	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01
Genito urinary system and sex hormones	Pharmaceutische componenten Groep II positief	Estrone	µg/l	<0,05	<0,05	<0,5	<0,05	<0,05	<0,05
Nervous system	Pharmaceutische componenten Groep II positief	Fluoxetine	µg/l	<0,01	<0,01	<0,1	0.01	<0,01	0.01
Antineoplastic and immunomodulating agents	Pharmaceutische componenten Groep II positief	Ifosfamide	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	0.18
	Pharmaceutische componenten Groep II positief	Malachite Green	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01
Sensory organs	Pharmaceutische componenten Groep II positief	Oxymetazoline	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01
Nervous system	Pharmaceutische componenten Groep II positief	Primidone	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01
Alimentary tract and metabolism	Pharmaceutische componenten Groep II positief	Ranitidine	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01
Respiratory system	Pharmaceutische	Salbutamol	µg/l	<0,01	<0,01	<0,1	0.19	<0,01	0.06

	componenten Groep II positief								
Antineoplastic and immunomodulating agents	Pharmaceutische componenten Groep II positief	Tamoxifen	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01
Respiratory system	Pharmaceutische componenten Groep II positief	Terbutalin	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Diatrozoic acid	µg/l	<0,05	<0,05	<0,5	4.2	<0,05	6.9
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iohexol	µg/l	<0,02	<0,02	<0,2	<0,02	<0,02	<0,02
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iomeprol	µg/l	<0,02	<0,02	<0,2	4.8	<0,02	2.4
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iopamidol	µg/l	<0,01	<0,01	<0,1	0.02	<0,01	0.01
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iopanoic acid	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iopromide	µg/l	<0,02	<0,02	<0,2	<0,02	<0,02	0.17
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iothalamic acid	µg/l	<0,05	<0,05	<0,5	<0,05	<0,05	<0,05
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Ioxithalamic acid	µg/l	<0,05	<0,05	0.13	57	<0,05	5.9
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Acetylsulfamethoxazole	µg/l	<0,01	<0,01	<0,1	1.8	<0,01	0.49
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Amoxicillin	µg/l	<0,02	<0,02	<0,2	0.39	<0,02	0.06
Anti-infectives for systemactic use	Pharmaceutische componenten	Azithromycin	µg/l	<0,01	<0,01	<0,1	0.1	<0,1	<0,01

	Groep IV positief								
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Cefazoline	µg/l	<0,01	<0,01	<0,1	1.6	<0,01	0.46
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Cefotaxim	µg/l	<0,01	<0,01	<0,1	2.1	<0,01	0.82
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Cefuroxime	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Chlorotetracycline	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Ciprofloxacin	µg/l	<0,01	0.02	<0,1	4.3	0.01	2.4
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Clarithromycin	µg/l	<0,01	<0,01	<0,1	0.01	<0,01	0.04
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Cloxacillin	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Dapson	µg/l	<0,01	<0,1	<0,1	<0,1	<0,1	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Dicloxacillin	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Dimetridazole	µg/l	<0,01	<0,01	<0,1	0.01	<0,01	0.01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Enoxacin	µg/l	<0,05	<0,05	<0,5	<0,05	<0,05	<0,05
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Enrofloxacin	µg/l	<0,05	<0,05	<0,5	<0,05	<0,05	<0,05
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV	Erythromycin	µg/l	<0,05	<0,05	<0,5	0.12	<0,05	0.12

	positief								
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Flucloxacillin	µg/l	<0,01	<0,01	<0,1	0.23	<0,01	0.1
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Flumequine	µg/l	<0,05	<0,05	<0,5	<0,05	<0,05	<0,05
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Lincomycin	µg/l	<0,01	<0,01	<0,1	0.12	<0,01	<0,01
Anti-parasitic agents, insecticides, repellents	Pharmaceutische componenten Groep IV positief	Mebendazole	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Metronidazole	µg/l	<0,01	<0,01	<0,1	0.09	<0,01	0.06
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Norfloxacin	µg/l	<0,01	<0,01	<0,1	1.6	<0,01	1.2
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Ofloxacin	µg/l	<0,05	<0,05	<0,5	<0,05	<0,05	<0,05
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Oleandromycin	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Oseltamivir	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Oxacillin	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Oxolinic acid	µg/l	<0,05	<0,05	<0,5	<0,05	<0,05	<0,05
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Oxytetracycline	µg/l	<0,02	<0,02	<0,2	<0,02	<0,02	<0,02
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Penicillin G	µg/l	NTB	NTB	<0,2	<0,02	<0,02	<0,02

Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Penicillin V	µg/l	<0,02	<0,02	<0,2	<0,02	<0,02	<0,02
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Ronidazole	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Roxithromycin	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Spiramycin	µg/l	<0,5	<0,05	<0,5	<0,05	<0,05	<0,05
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Sulfachinoxalin	µg/l	<0,01	<0,1	<0,2	<0,1	<0,1	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Sulfachloropyrazidine	µg/l	<0,02	<0,1	<0,2	<0,1	<0,1	<0,02
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Sulfadiazine	µg/l	<0,02	<0,1	<0,2	<0,1	<0,1	<0,02
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Sulfadimethoxine	µg/l	<0,02	<0,1	<0,2	<0,1	<0,1	<0,02
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Sulfamerazine	µg/l	<0,02	<0,1	<0,2	<0,1	<0,1	<0,02
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Sulfamethazine	µg/l	<0,02	<0,1	<0,2	<0,1	<0,1	<0,02
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Sulfamethoxazole	µg/l	<0,02	<0,1	<0,2	1.2	<0,1	<0,02
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Sulfapyridine	µg/l	<0,02	<0,1	<0,2	<0,1	<0,1	<0,02
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Tetracycline	µg/l	<0,01	<0,01	<0,1	<0,01	<0,01	<0,01
Anti-infectives	Pharmaceutis	Tiamuline	µg/	<0,0	<0,0	<0,1	<0,0	<0,0	<0,0

for systemactic use	che componenten Groep IV positief		l	1	1		1	1	1
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Trimethoprim	µg/l	<0,01	<0,01	<0,1	0.43	<0,01	0.1
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Tylosin	µg/l	<0,02	<0,02	<0,2	<0,02	<0,02	<0,02
Anti-infectives for systemactic use	Pharmaceutische componenten Groep V negatief	Chloramphenicol	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Metabolite	Pharmaceutische componenten Groep V negatief	Clofibric acid	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Cardiovacular system	Pharmaceutische componenten Groep V negatief	Furosemide	µg/l	<0,01	<0,01	<0,01	1.9	<0,01	0.28
Cardiovacular system	Pharmaceutische componenten Groep V negatief	Gemfibrozil	µg/l	<0,01	NTB	<0,01	0.01	<0,01	<0,01
Musculo-skeletal system	Pharmaceutische componenten Groep V negatief	Ibuprofen	µg/l	<0,01	<0,01	<0,01	0.03	<0,01	0.01
	TOC	Totaal Organisch Koolstof (TOC)	mg/l	0.81	0.89	2.2	7.3	1.9	6.4

1.4 Measured concentrations for each sample at SP8 (effluent of UV/H_2O_2).

Therapeutic group	**Test name**	**analyte**	Unit	22-Feb	8-Mar	15-Mar	23-Mar	19-Apr	26-Apr	12-May	17-May
Cardiovacular system	Pharmaceutische componenten Groep I positief	Amiodaron	µg/l	<0,1	NTB	<0,01	0.05	<0,1	<0,01	<0,1	<0,01
Cardiovacular system	Pharmaceutische componenten Groep I positief	Atenolol	µg/l	<0,01	<0,01	<0,01	0.2	0.24	0.04	0.04	0.17
Cardiovacular system	Pharmaceutische componenten Groep I positief	Betaxolol	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01

Cardiovacular system	Pharmaceutische componenten Groep I positief	Bezafibrate	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Cardiovacular system	Pharmaceutische componenten Groep I positief	Bisoprolol-A	µg/l	<0,01	<0,01	<0,01	0.03	<0,01	<0,01	<0,01	<0,01
Cardiovacular system	Pharmaceutische componenten Groep I positief	Clofibrate	µg/l	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Nervous system	Pharmaceutische componenten Groep I positief	Codeïne	µg/l	<0,01	<0,01	<0,01	0.02	<0,01	0.01	0.02	0.02
Musculo-skeletal system	Pharmaceutische componenten Groep I positief	Diclofenac	µg/l	<0,01	<0,01	<0,01	0.02	0.02	0.1	0.03	0.22
Cardiovacular system	Pharmaceutische componenten Groep I positief	Enalapril	µg/l	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Cardiovacular system	Pharmaceutische componenten Groep I positief	Fenofibrate	µg/l	<0,01	NTB	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Musculo-skeletal system	Pharmaceutische componenten Groep I positief	Fenoprofen	µg/l	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
Cardiovacular system	Pharmaceutische componenten Groep I positief	Indomethacine	µg/l	<0,01	<0,01	<0,01	0.03	<0,01	<0,01	<0,01	<0,01
Musculo-skeletal system	Pharmaceutische componenten Groep I positief	Ketoprofen	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Cardiovacular system	Pharmaceutische componenten Groep I positief	Lidocaïne	µg/l	<0,01	<0,01	<0,01	0.15	0.31	0.04	0.1	0.63
Cardiovacular system	Pharmaceutische componenten Groep I positief	Metoprolol	µg/l	<0,01	<0,01	<0,01	1.9	0.54	0.26	0.15	0.38
Musculo-skeletal system	Pharmaceutische componenten Groep I positief	Naproxen	µg/l	<0,02	<0,02	<0,02	0.11	0.07	<0,02	0.03	0.11
Nervous	Pharmaceuti	Paracetamol	µg/	<0,	<0,	<0,	0.25	0.04	0.03	0.03	0.04

system	sche componente n Groep I positief		l	01	01	01					
Cardiovacular system	Pharmaceutische componente n Groep I positief	Pentoxifilline	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Nervous system	Pharmaceutische componente n Groep I positief	Phenacetin	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Nervous system	Pharmaceutische componente n Groep I positief	Phenazone	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Cardiovacular system	Pharmaceutische componente n Groep I positief	Pindolol	µg/l	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Cardiovacular system	Pharmaceutische componente n Groep I positief	Propranolol	µg/l	<0,01	<0,01	<0,01	0.09	0.07	0.06	0.03	0.04
Nervous system	Pharmaceutische componente n Groep I positief	Propyphenazone	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	0.01	<0,01	<0,01
Cardiovacular system	Pharmaceutische componente n Groep I positief	Sotalol	µg/l	<0,01	<0,01	<0,01	3.1	0.6	0.67	0.54	1.2
Antineoplastic and immunomodulating agents	Pharmaceutische componente n Groep II positief	Capecitabine	µg/l	<0,01	<0,01	<0,01	0.01	<0,01	<0,01	<0,01	<0,01
Nervous system	Pharmaceutische componente n Groep II positief	Carbamazepine	µg/l	<0,01	<0,01	<0,01	0.37	0.32	0.43	0.71	0.78
Respiratory system	Pharmaceutische componente n Groep II positief	Clenbuterol	µg/l	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Nervous system	Pharmaceutische componente n Groep II positief	Coffeïne	µg/l	<0,01	<0,1	<0,1	0.61	0.5	0.35	0.51	0.44
Antineoplastic and immunomodulating agents	Pharmaceutische componente n Groep II positief	Cyclophosphanide	µg/l	<0,01	<0,01	<0,01	0.36	0.24	0.09	0.08	0.09
Nervous system	Pharmaceutische	Diazepam	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01

	componente n Groep II positief										
Genito urinary system and sex hormones	Pharmaceutische componente n Groep II positief	Estrone	µg/l	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Nervous system	Pharmaceutische componente n Groep II positief	Fluoxetine	µg/l	<0,01	<0,01	<0,01	0.01	<0,01	<0,01	<0,01	0.01
Antineoplastic and immunomodulating agents	Pharmaceutische componente n Groep II positief	Ifosfamide	µg/l	<0,01	<0,01	<0,01	0.6	<0,01	<0,01	0.74	0.2
	Pharmaceutische componente n Groep II positief	Malachite Green	µg/l	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Sensory organs	Pharmaceutische componente n Groep II positief	Oxymetazoline	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Nervous system	Pharmaceutische componente n Groep II positief	Primidone	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Alimentary tract and metabolism	Pharmaceutische componente n Groep II positief	Ranitidine	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Respiratory system	Pharmaceutische componente n Groep II positief	Salbutamol	µg/l	<0,01	<0,01	<0,01	0.22	0.13	0.06	0.04	0.09
Antineoplastic and immunomodulating agents	Pharmaceutische componente n Groep II positief	Tamoxifen	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Respiratory system	Pharmaceutische componente n Groep II positief	Terbutalin	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Various (incl X-ray CM)	Pharmaceutische componente n Groep III positief	Diatrozoic acid	µg/l	<0,05	<0,05	<0,05	7.5	1.8	63	5.4	6.3
Various (incl X-ray CM)	Pharmaceutische componente n Groep III positief	Iohexol	µg/l	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	0.03
Various (incl X-ray CM)	Pharmaceutische componente	Iomeprol	µg/l	<0,02	<0,02	<0,02	1.9	2.2	0.31	0.81	2.6

	n Groep III positief										
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iopamidol	µg/l	<0,01	<0,01	<0,01	0.01	0.02	<0,01	<0,01	0.03
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iopanoic acid	µg/l	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iopromide	µg/l	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	0.23
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iothalamic acid	µg/l	<0,05	<0,05	<0,05	0.22	0.15	0.15	0.21	0.12
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Ioxithalamic acid	µg/l	<0,05	<0,05	<0,05	19	28	4.6	4.2	7.6
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Acetylsulfamethoxazole	µg/l	<0,01	<0,01	<0,01	4.1	1.2	0.49	0.65	0.63
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Amoxicillin	µg/l	<0,02	<0,02	<0,02	0.1	0.23	<0,02	0.04	0.05
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Azithromycin	µg/l	<0,1	<0,01	<0,01	1.6	0.14	0.03	<0,1	0.1
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Cefazoline	µg/l	<0,01	<0,01	<0,01	0.06	0.15	<0,01	0.03	0.19
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Cefotaxim	µg/l	<0,01	<0,01	<0,01	0.22	0.32	0.15	0.26	0.68
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Cefuroxime	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Chlorotetracycline	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componente	Ciprofloxacin	µg/l	<0,01	0.02	<0,01	1.6	1.2	1.7	1.2	1.8

	n Groep IV positief										
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Clarithromycin	µg/l	<0,01	<0,01	<0,01	0.1	<0,01	<0,01	<0,01	0.1
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Cloxacillin	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Dapson	µg/l	<0,1	<0,1	<0,01	<0,1	<0,1	<0,01	<0,1	<0,01
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Dicloxacillin	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Dimetridazole	µg/l	<0,01	<0,01	<0,01	0.97	0.7	0.46	0.77	1.8
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Enoxacin	µg/l	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Enrofloxacin	µg/l	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Erythromycin	µg/l	<0,05	<0,05	<0,05	0.87	0.1	<0,05	<0,05	0.15
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Flucloxacillin	µg/l	<0,01	<0,01	<0,01	0.06	0.11	0.02	0.04	0.06
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Flumequine	µg/l	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Lincomycin	µg/l	<0,01	<0,01	<0,01	<0,01	0.08	0.11	0.02	0.01
Anti-parasitic agents, insecticides, repellents	Pharmaceutische componenten Groep IV positief	Mebendazole	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV	Metronidazole	µg/l	<0,01	<0,01	<0,01	0.11	0.07	<0,01	0.04	0.08

	positief										
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Norfloxacin	µg/l	<0,01	<0,01	<0,01	0.6	0.59	0.82	0.7	0.9
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Ofloxacin	µg/l	<0,05	<0,05	<0,05	0.06	<0,05	0.06	0.06	0.05
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Oleandromycin	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Oseltamivir	µg/l	<0,01	<0,01	<0,01	0.02	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Oxacillin	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Oxolinic acid	µg/l	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Oxytetracycline	µg/l	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Penicillin G	µg/l	NTB	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Penicillin V	µg/l	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Ronidazole	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Roxithromycin	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Spiramycin	µg/l	<0,5	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Sulfachinoxalin	µg/l	<0,1	<0,1	<0,01	<0,1	<0,1	<0,01	<0,1	<0,01

Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Sulfachloropyrazidine	µg/l	<0,1	<0,1	<0,02	<0,1	<0,1	<0,02	<0,1	<0,02
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Sulfadiazine	µg/l	<0,1	<0,1	<0,02	<0,1	<0,1	<0,02	<0,1	<0,02
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Sulfadimethoxine	µg/l	<0,1	<0,1	<0,02	<0,1	<0,1	<0,02	<0,1	<0,02
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Sulfamerazine	µg/l	<0,1	<0,1	<0,02	<0,1	<0,1	<0,02	<0,1	<0,02
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Sulfamethazine	µg/l	<0,1	<0,1	<0,02	<0,1	<0,1	<0,02	<0,1	<0,02
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Sulfamethoxazole	µg/l	<0,1	<0,1	<0,02	1.1	0.46	0.55	0.51	0.56
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Sulfapyridine	µg/l	<0,1	<0,1	<0,02	<0,1	<0,1	<0,02	<0,1	0.19
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Tetracycline	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Tiamuline	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Trimethoprim	µg/l	<0,01	<0,01	<0,01	0.63	0.35	0.3	0.18	0.14
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Tylosin	µg/l	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02
Anti-infectives for systemactic use	Pharmaceutische componenten Groep V negatief	Chloramphenicol	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Metabolite	Pharmaceutische componenten Groep V negatief	Clofibric acid	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Cardiovacular	Pharmaceuti	Furosemide	µg/	<0,	<0,	<0,	0.73	0.71	0.17	0.08	0.36

system	sche componente n Groep V negatief		l	01	01	01					
Cardiovacular system	Pharmaceuti sche componente n Groep V negatief	Gemfibrozil	µg/l	<0,01	NTB	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Musculo-skeletal system	Pharmaceuti sche componente n Groep V negatief	Ibuprofen	µg/l	<0,01	<0,01	<0,01	0.1	0.02	<0,01	<0,01	0.01
	TOC	Totaal Organisch Koolstof (TOC)	Mg/l	0.87	2.3	0.93	9	8	8.1	7.6	8.6

1.5 Measured concentrations for each sample at SP10 (effluent of Ozone).

Therapeutic group	**Test name**	**analyte**	Unit	8-mar	12-may	13:30 30-May	14:30 30-May	31-May	9:30 31-May	10:30 31-May	11:30 31-May	12:30 31-May	13:30 31-May	8:30 1-Jun	11:00 1-Jun	13:00 1-Jun	15:00 1-Jun
Cardiovacular system	Pharmaceutische componenten Groep I positief	Amiodaron	µg/l	NTB	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Cardiovacular system	Pharmaceutische componenten Groep I positief	Atenolol	µg/l	<0,01	<0,01	0.01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	0.01	<0,01	<0,01
Cardiovacular system	Pharmaceutische componenten Groep I positief	Betaxolol	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Cardiovacular system	Pharmaceutische componenten Groep I positief	Bezafibrate	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Cardiovacular system	Pharmaceutische componenten Groep I positief	Bisoprolol-A	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Cardiovacular system	Pharmaceutische	Clofibrate	µg/l	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05

	componenten Groep I positief																	
Nervous system	Pharmaceutische componenten Groep I positief	Codeïne	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Musculo-skeletal system	Pharmaceutische componenten Groep I positief	Diclofenac	µg/l	<0,01	0.06	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Cardiovascular system	Pharmaceutische componenten Groep I positief	Enalapril	µg/l	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Cardiovascular system	Pharmaceutische componenten Groep I positief	Fenofibrate	µg/l	NTB	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Musculo-skeletal system	Pharmaceutische componenten Groep I positief	Fenoprofen	µg/l	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
Cardiovascular system	Pharmaceutische componenten Groep I positief	Indomethacine	µg/l	0.01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Musculo-skeletal system	Pharmaceutische componenten Groep I positief	Ketoprofen	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Cardiovascular system	Pharmaceutische componenten Groep I positief	Lidocaïne	µg/l	<0,01	0.01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Cardiovascular system	Pharmaceutische componenten Groep I positief	Metoprolol	µg/l	<0,01	0.02	0.04	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	0.02	0.03	0.02	0.02

Musculo-skeletal system	Pharmaceutische componenten Groep I positief	Naproxen	µg/l	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02
Nervous system	Pharmaceutische componenten Groep I positief	Paracetamol	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	0.01	<0,01	<0,01
Cardiovascular system	Pharmaceutische componenten Groep I positief	Pentoxifilline	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Nervous system	Pharmaceutische componenten Groep I positief	Phenacetin	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Nervous system	Pharmaceutische componenten Groep I positief	Phenazone	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Cardiovascular system	Pharmaceutische componenten Groep I positief	Pindolol	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Cardiovascular system	Pharmaceutische componenten Groep I positief	Propranolol	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Nervous system	Pharmaceutische componenten Groep I positief	Propyphenazone	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Cardiovascular system	Pharmaceutische componenten Groep I positief	Sotalol	µg/l	<0,01	0.06	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Antineoplastic and immuno	Pharmaceutische compo	Capecitabine	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01

modulating agents	nenten Groep II positief																
Nervous system	Pharmaceutische componenten Groep II positief	Carbamazepine	µg/l	<0,01	0.08	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Respiratory system	Pharmaceutische componenten Groep II positief	Clenbuterol	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Nervous system	Pharmaceutische componenten Groep II positief	Coffeïne	µg/l	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
Antineoplastic and immunomodulating agents	Pharmaceutische componenten Groep II positief	Cyclophosphanide	µg/l	0.04	0.02	0.02	<0,01	0.02	0.01	0.02	0.01	0.02	0.01	0.03	0.06	0.04	0.05
Nervous system	Pharmaceutische componenten Groep II positief	Diazepam	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Genito urinary system and sex hormones	Pharmaceutische componenten Groep II positief	Estrone	µg/l	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Nervous system	Pharmaceutische componenten Groep II positief	Fluoxetine	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Antineoplastic and immunomodulating agents	Pharmaceutische componenten Groep II	Ifosfamide	µg/l	<0,01	0.17	0.04	0.02	0.03	0.01	0.02	0.01	0.01	0.01	0.02	0.02	0.01	0.01

	positief																
	Pharmaceutische componenten Groep II positief	Malachite Green	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Sensory organs	Pharmaceutische componenten Groep II positief	Oxymetazoline	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Nervous system	Pharmaceutische componenten Groep II positief	Primidone	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Alimentary tract and metabolism	Pharmaceutische componenten Groep II positief	Ranitidine	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Respiratory system	Pharmaceutische componenten Groep II positief	Salbutamol	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Antineoplastic and immunomodulating agents	Pharmaceutische componenten Groep II positief	Tamoxifen	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Respiratory system	Pharmaceutische componenten Groep II positief	Terbutalin	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Diatrozoic acid	µg/l	1.4	5.1	30	22	22	13	16	16	17	17	29	31	26	26
Various (incl X-	Pharmaceutisc	Iohexol	µg/	<0,0	0.04	<0,0	<0,0	<0,0	<0,0	<0,0	<0,0	<0,0	<0,0	<0,0	<0,0	<0,0	<0,0

ray CM)	he componenten Groep III positief		l	2		2	2	2	2	2	2	2	2	2	2	2	2	2
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iomeprol	µg/l	0.05	0.36	2.8	1.3	0.34	0.23	0.35	0.33	0.34	0.34	0.08	0.21	0.27	0.32
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iopamidol	µg/l	0.04	0.02	0.1	0.1	0.06	0.04	0.05	0.06	0.07	0.07	0.1	0.14	0.18	0.2
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iopanoic acid	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iopromide	µg/l	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iothalamic acid	µg/l	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Ioxithalamic acid	µg/l	4	2.5	28	16	10	6.3	9.7	9.4	11	9.7	13	18	14	18
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Acetylsulfamethoxazole	µg/l	0.01	0.09	0.12	0.02	0.01	<0,01	<0,01	<0,01	<0,01	<0,01	0.03	0.08	0.05	0.04
Anti-infectives for systemactic use	Pharmaceutische componenten	Amoxicillin	µg/l	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02

	Groep IV positief																
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Azithromycin	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Cefazoline	µg/l	<0,01	0.01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Cefotaxim	µg/l	<0,01	0.07	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Cefuroxime	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Chlorotetracycline	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Ciprofloxacin	µg/l	<0,01	0.26	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	0.05	0.1	0.05	0.08
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Clarithromycin	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Cloxacillin	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01

Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Dapson	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Dicloxacillin	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Dimetridazole	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Enoxacin	µg/l	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Enrofloxacin	µg/l	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Erythromycin	µg/l	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Flucloxacillin	µg/l	<0,01	<0,01	0.04	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Flumequine	µg/l	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Anti-infectives for	Pharmaceutische	Lincomycin	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01

systemac tic use	compo nenten Groep IV positief																	
Anti-parasitic agents, insecticides, repellents	Pharma ceutisc he compo nenten Groep IV positief	Mebendazole	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systemac tic use	Pharma ceutisc he compo nenten Groep IV positief	Metronidazole	µg/l	<0,01	<0,01	0.02	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	0.03	0.01	0.01
Anti-infectives for systemac tic use	Pharma ceutisc he compo nenten Groep IV positief	Norfloxacin	µg/l	<0,01	0.11	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	0.02	0.05	0.02	0.04
Anti-infectives for systemac tic use	Pharma ceutisc he compo nenten Groep IV positief	Ofloxacin	µg/l	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Anti-infectives for systemac tic use	Pharma ceutisc he compo nenten Groep IV positief	Oleandromycin	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systemac tic use	Pharma ceutisc he compo nenten Groep IV positief	Oseltamivir	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systemac tic use	Pharma ceutisc he compo nenten Groep IV positief	Oxacillin	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systemac tic use	Pharma ceutisc he compo nenten Groep	Oxolinic acid	µg/l	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05

	IV positief																
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Oxytetracycline	µg/l	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Penicillin G	µg/l	<0,02	<0,02	<0,02	<0,02	NTB	NTB	NTB	NTB	NTB	NTB	<0,02	<0,02	<0,02	<0,02
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Penicillin V	µg/l	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Ronidazole	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Roxithromycin	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Spiramycin	µg/l	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Sulfachinoxalin	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Sulfachloropyrazidine	µg/l	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02
Anti-	Pharma	Sulfadiazin	µ	<0	<0	<0	<0	<0	<0	<0	<0	<0	<0	<0	<0	<0	<0

infectives for systemactic use	ceutische componenten Groep IV positief	e	g/l	,02	,02	,02	,02	,02	,02	,02	,02	,02	,02	,02	,02	,02	,02	,02
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Sulfadimethoxine	µg/l	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Sulfamerazine	µg/l	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Sulfamethazine	µg/l	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Sulfamethoxazole	µg/l	<0,02	0.05	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	0.02	<0,02	<0,02
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Sulfapyridine	µg/l	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Tetracycline	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Tiamuline	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Anti-infectives for systemac	Pharmaceutische compo	Trimethoprim	µg/l	<0,01	0.02	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01

tic use	nenten Groep IV positief																
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Tylosin	µg/l	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02
Anti-infectives for systemactic use	Pharmaceutische componenten Groep V negatief	Chloramphenicol	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Metaboliete	Pharmaceutische componenten Groep V negatief	Clofibric acid	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Cardiovacular system	Pharmaceutische componenten Groep V negatief	Furosemide	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Cardiovacular system	Pharmaceutische componenten Groep V negatief	Gemfibrozil	µg/l	NTB	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Musculo-skeletal system	Pharmaceutische componenten Groep V negatief	Ibuprofen	µg/l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
	TOC	Totaal Organisch Koolstof (TOC)	mg/l	10	7	8.3	7.7	7.4	5.5	5.8	6.4	6.6	6.4	6.8	7.5	7	6.9

2. Calculated elimination efficiencies in each treatment technique.

Elimination efficiency (el.eff.) calculated for each sample and their average el.eff. with the standard deviation.

Ave: Average

St.Dev: Standard Deviation

El.eff.: Elimination efficiency

2.1 MBR-Elimination efficiency

Therapeutic group	**Test name**	**analyte**	Influent		Effluent		El.eff. (%)
			Ave	Stdev	Ave	stdev	
Nervous system	Pharmaceutische componenten Groep I positief	Phenazone	#DIV/0!	#DIV/0!	0.01	0	#DIV/0!
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Dimetridazole	#DIV/0!	#DIV/0!	0.02	0.00488	#DIV/0!
Nervous system	Pharmaceutische componenten Groep II positief	Fluoxetine	#DIV/0!	#DIV/0!	0.02	0.003536	#DIV/0!
Cardiovacular system	Pharmaceutische componenten Groep I positief	Bisoprolol-A	#DIV/0!	#DIV/0!	0.02	0.014142	#DIV/0!
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Dapson	#DIV/0!	#DIV/0!	0.02	#DIV/0!	#DIV/0!
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Oleandromycin	#DIV/0!	#DIV/0!	0.02	#DIV/0!	#DIV/0!
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Sulfachinoxalin	#DIV/0!	#DIV/0!	0.02	#DIV/0!	#DIV/0!
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iopamidol	#DIV/0!	#DIV/0!	0.03	0.020736	#DIV/0!
Nervous system	Pharmaceutische componenten Groep II positief	Primidone	#DIV/0!	#DIV/0!	0.03	0.014142	#DIV/0!
Respiratory system	Pharmaceutische componenten Groep II positief	Terbutalin	#DIV/0!	#DIV/0!	0.03	#DIV/0!	#DIV/0!
Nervous system	Pharmaceutische componenten Groep I positief	Propyphenazone	#DIV/0!	#DIV/0!	0.04	0.028284	#DIV/0!
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Sulfamethazine	#DIV/0!	#DIV/0!	0.08	#DIV/0!	#DIV/0!
Anti-infectives for systemactic use	Pharmaceutische componenten	Flucloxacillin	#DIV/0!	#DIV/0!	0.29	0.49	#DIV/0!

	Groep IV positief						
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iopromide	#DIV/0!	#DIV/0!	0.3	#DIV/0!	#DIV/0!
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Cefazoline	#DIV/0!	#DIV/0!	0.85	0.71	#DIV/0!
Nervous system	Pharmaceutische componenten Groep II positief	Diazepam	0.10	#DIV/0!	0.01	0.00	90.00
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Lincomcycin	0.14	0.02	0.10	0.06	28.40
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Oseltamivir	0.14	#DIV/0!	0.11	0.07	23.81
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Cefotaxim	0.15	0.07	1.74	1.62	-1059.33
Cardiovacular system	Pharmaceutische componenten Groep I positief	Bezafibrate	0.18	0.05	0.13	#DIV/0!	29.09
Cardiovacular system	Pharmaceutische componenten Groep I positief	Indomethacine	0.19	0.03	0.11	0.07	44.40
Cardiovacular system	Pharmaceutische componenten Groep I positief	Propranolol	0.19	0.07	0.10	0.03	48.45
Antineoplastic and immunomodulating agents	Pharmaceutische componenten Groep II positief	Capecitabine	0.31	0.07	0.22	0.28	30.08
Antineoplastic and immunomodulating agents	Pharmaceutische componenten Groep II positief	Cyclophosphanide	0.39	0.25	0.22	0.16	43.01
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Clarithromycin	0.41	0.37	0.29	0.31	28.80
Nervous system	Pharmaceutische componenten Groep II positief	Carbamazepine	0.43	0.18	0.83	0.62	-92.09
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Sulfapyridine	0.62	0.46	0.17	0.23	72.78
Cardiovacular system	Pharmaceutische componenten Groep V negatief	Gemfibrozil	0.68	0.38	0.44	0.59	35.48
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Amoxicillin	0.68	0.36	0.22	0.19	67.33
Cardiovacular system	Pharmaceutische componenten Groep I positief	Amiodaron	0.77	0.45	0.82	#DIV/0!	-6.03
Respiratory system	Pharmaceutische componenten Groep I positief	Codeïne	0.80	0.37	0.09	0.16	89.33
Respiratory system	Pharmaceutische	Salbutamol	0.83	0.22	0.26	0.24	68.12

	componenten Groep II positief						
Alimentary tract and metabolism	Pharmaceutische componenten Groep II positief	Ranitidine	0.98	0.84	0.14	0.26	85.47
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Enoxacin	1.10	#DIV/0!	0.24	0.01	78.18
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Ofloxacin	1.20	#DIV/0!	0.07	0.02	93.85
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Erythromycin	1.48	0.15	1.36	0.91	7.82
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Azithromycin	1.49	0.85	0.81	0.88	45.83
Cardiovacular system	Pharmaceutische componenten Groep I positief	Atenolol	1.55	0.24	0.30	0.43	80.39
Musculo-skeletal system	Pharmaceutische componenten Groep I positief	Diclofenac	2.47	0.33	1.68	0.49	31.81
Cardiovacular system	Pharmaceutische componenten Groep I positief	Metoprolol	2.55	0.33	1.14	0.81	55.45
Cardiovacular system	Pharmaceutische componenten Groep I positief	Sotalol	2.67	0.92	2.24	1.45	15.89
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Metronidazole	2.95	1.51	0.44	1.01	85.23
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Diatrizoic acid	3.10	3.26	23.38	39.89	-654.60
Antineoplastic and immunomodulating agents	Pharmaceutische componenten Groep II positief	Ifosfamide	3.20	#DIV/0!	0.32	0.35	90.05
Musculo-skeletal system	Pharmaceutische componenten Groep I positief	Naproxen	4.90	0.58	0.66	1.59	86.53
Cardiovacular system	Pharmaceutische componenten Groep I positief	Lidocaïne	5.10	3.72	1.22	1.95	76.18
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Trimethoprim	5.66	3.83	1.43	1.58	74.72
Musculo-skeletal system	Pharmaceutische componenten Groep V negatief	Ibuprofen	8.18	1.76	1.31	2.79	84.01
Cardiovacular system	Pharmaceutische componenten Groep V negatief	Furosemide	8.26	0.67	2.25	2.43	72.75
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iohexol	9.50	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Norfloxacin	11.46	4.32	2.65	2.61	76.88
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Sulfamethoxazole	15.08	6.82	3.70	6.81	75.46
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Acetylsulfamethoxazole	19.34	8.79	4.20	6.82	78.29
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Ciprofloxacin	27.00	9.67	7.68	8.93	71.56
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iomeprol	54.67	62.08	9.06	13.25	83.43
Nervous system	Pharmaceutische componenten Groep II positief	Coffeïne	168.80	107.04	11.39	34.65	93.26
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Ioxithalamic acid	444.00	204.28	51.76	63.81	88.34
Nervous system	Pharmaceutische componenten Groep I positief	Paracetamol	676.00	417.64	37.14	116.96	94.51
Cardiovacular system	Pharmaceutische componenten Groep I positief	Betaxolol	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Cefuroxime	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Anti-infectives for systematic use	Pharmaceutische componenten Groep V negatief	Chloramphenicol	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Chlorotetracycline	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Respiratory system	Pharmaceutische componenten Groep II positief	Clenbuterol	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Cardiovacular system	Pharmaceutische componenten Groep I positief	Clofibrate	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Metabolite	Pharmaceutische componenten Groep V negatief	Clofibric acid	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Cloxacillin	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Dicloxacillin	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Cardiovacular system	Pharmaceutische componenten Groep I positief	Enalpril	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Enrofloxacin	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Genito urinary system and sex hormones	Pharmaceutische componenten Groep II positief	Estrone	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Cardiovacular system	Pharmaceutische componenten Groep I positief	Fenofibrate	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Musculo-skeletal system	Pharmaceutische componenten Groep I positief	Fenoprofen	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Flumequine	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iopanoic acid	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iothalamic acid	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Musculo-skeletal system	Pharmaceutische componenten Groep I positief	Ketoprofen	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Anti-parasitic agents, insecticides, repellents	Pharmaceutische componenten Groep IV positief	Mebendazole	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Cardiovacular system	Pharmaceutische componenten Groep I positief	Methyl-dopa	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Oxacillin	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Oxolinic acid	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Sensory organs	Pharmaceutische componenten Groep II positief	Oxymetazoline	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Oxytetracycline	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Penicillin G	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Penicillin V	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Cardiovacular system	Pharmaceutische componenten Groep I positief	Pentoxifilline	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Nervous system	Pharmaceutische componenten Groep I positief	Phenacetin	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Cardiovacular system	Pharmaceutische componenten	Pindolol	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

	Groep I positief						
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Ronidazole	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Roxithromycin	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Spiramycin	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Sulfachloropyrazidine	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Sulfadiazine	0.48	#DIV/0!	0.48	#DIV/0!	0.00
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Sulfadimethoxine	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Sulfamerazine	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Antineoplastic and immunomodulating agents	Pharmaceutische componenten Groep II positief	Tamoxifen	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Tetracycline	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Tiamuline	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Tylosin	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
	Pharmaceutische componenten Groep II positief	Malachite Green	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

2.2 UV/H_2O_2- Elimination efficiency

			Influent		Effluent		El.eff.
Therapeutic group	**Test name**	**analyte**	Ave	Stdev	Ave	stdev	(%)
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Acetylsulfamethoxazole	4.20	6.82	1.41	1.53	66.32
Anti-infectives for systematic use	Pharmaceutische componenten Groep IV positief	Amoxicillin	0.22	0.19	0.11	0.09	52.91
Anti-infectives for systematic use	Pharmaceutische componenten	Azithromycin	0.81	0.88	0.47	0.76	41.93

	Groep IV positief						
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Cefazoline	0.85	0.71	0.11	0.08	87.39
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Cefotaxim	1.74	1.62	0.33	0.21	81.25
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Ciprofloxacin	7.68	8.93	1.25	0.28	83.68
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Clarithromycin	0.29	0.31	0.10	0.00	66.02
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Dimetridazole	0.02	0.00	0.94	0.51	-5383.33
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Erythromycin	1.36	0.91	0.37	0.43	72.64
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Flucloxacillin	0.29	0.49	0.06	0.03	80.08
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Lincomcycin	0.10	0.06	0.06	0.05	43.10
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Metronidazole	0.44	1.01	0.08	0.03	82.76
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Norfloxacin	2.65	2.61	0.72	0.14	72.75
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Sulfamethoxazole	3.70	6.81	0.64	0.26	82.82
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Trimethoprim	1.43	1.58	0.32	0.19	77.64
Antineoplastic and immunomodulating agents	Pharmaceutische componenten Groep II positief	Cyclophosphanide	0.22	0.16	0.17	0.12	21.82
Antineoplastic and immunomodulating agents	Pharmaceutische componenten Groep II positief	Ifosfamide	0.32	0.35	0.51	0.28	-61.26
Cardiovacular system	Pharmaceutische componenten Groep I positief	Atenolol	0.30	0.43	0.14	0.09	54.61
Cardiovacular system	Pharmaceutische componenten Groep I positief	Bisoprolol-A	0.02	0.01	0.03	#DIV/0!	-50.00
Cardiovacular system	Pharmaceutische componenten Groep V negatief	Furosemide	2.25	2.43	0.41	0.30	81.79
Cardiovacular system	Pharmaceutische componenten Groep I positief	Indomethacine	0.11	0.07	0.03	#DIV/0!	72.09
Cardiovacular system	Pharmaceutische componenten Groep I positief	Lidocaïne	1.22	1.95	0.25	0.24	79.75
Cardiovacular system	Pharmaceutische componenten Groep I positief	Metoprolol	1.14	0.81	0.65	0.72	43.13
Cardiovacular	Pharmaceutische	Propranolol	0.10	0.03	0.06	0.02	42.00

system	componenten Groep I positief						
Cardiovacular system	Pharmaceutische componenten Groep I positief	Sotalol	2.24	1.45	1.22	1.08	45.52
Musculo-skeletal system	Pharmaceutische componenten Groep I positief	Diclofenac	1.68	0.49	0.08	0.09	95.36
Musculo-skeletal system	Pharmaceutische componenten Groep V negatief	Ibuprofen	1.31	2.79	0.04	0.05	96.69
Musculo-skeletal system	Pharmaceutische componenten Groep I positief	Naproxen	0.66	1.59	0.08	0.04	87.88
Nervous system	Pharmaceutische componenten Groep II positief	Carbamazepine	0.83	0.62	0.52	0.21	36.80
Nervous system	Pharmaceutische componenten Groep I positief	Codeïne	0.09	0.16	0.02	0.00	79.41
Nervous system	Pharmaceutische componenten Groep II positief	Coffeïne	11.39	34.65	0.48	0.10	95.77
Nervous system	Pharmaceutische componenten Groep II positief	Fluoxetine	0.02	0.00	0.01	0.00	46.67
Nervous system	Pharmaceutische componenten Groep I positief	Paracetamol	37.14	116.96	0.08	0.10	99.79
Respiratory system	Pharmaceutische componenten Groep II positief	Salbutamol	0.26	0.24	0.11	0.07	58.94
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Diatrizoic acid	23.38	39.89	16.80	25.91	28.14
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iomeprol	9.06	13.25	1.56	0.97	82.73
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iopamidol	0.03	0.02	0.02	0.01	23.08
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iopromide	0.30	#DIV/0!	0.23	#DIV/0!	23.33
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Ioxithalamic acid	51.76	63.81	12.68	10.46	75.50

2.3 Ozone-Elimination efficiency

			Influent		Effluent		El.eff.
Therapeutic group	**Test name**	**analyte**	Ave	Stdev	Ave	stdev	(%)
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Acetylsulfamethoxazole	4.20	6.82	0.05	0.0387	98.81
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Cefotaxim	1.74	1.62	0.07	#DIV/0!	95.97

Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Ciprofloxacin	7.68	8.93	0.11	0.0876	98.59
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Metronidazole	0.44	1.01	0.02	0.0096	95.98
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Norfloxacin	2.65	2.61	0.05	0.037	98.19
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Sulfamethoxazole	3.70	6.81	0.04	0.0212	99.05
Anti-infectives for systemactic use	Pharmaceutische componenten Groep IV positief	Trimethoprim	1.43	1.58	0.02	#DIV/0!	98.60
Antineoplastic and immunomodulating agents	Pharmaceutische componenten Groep II positief	Cyclophosphanide	0.22	0.16	0.03	0.016	87.76
Antineoplastic and immunomodulating agents	Pharmaceutische componenten Groep II positief	Ifosfamide	0.32	0.35	0.03	0.0433	90.82
Cardiovacular system	Pharmaceutische componenten Groep I positief	Atenolol	0.30	0.43	0.01	0	96.71
Cardiovacular system	Pharmaceutische componenten Groep I positief	Indomethacine	0.11	0.07	0.01	#DIV/0!	90.70
Cardiovacular system	Pharmaceutische componenten Groep I positief	Lidocaïne	1.22	1.95	0.01	#DIV/0!	99.18
Cardiovacular system	Pharmaceutische componenten Groep I positief	Metoprolol	1.14	0.81	0.03	0.0084	97.80
Cardiovacular system	Pharmaceutische componenten Groep I positief	Sotalol	2.24	1.45	0.06	#DIV/0!	97.33
Musculo-skeletal system	Pharmaceutische componenten Groep I positief	Diclofenac	1.68	0.49	0.06	#DIV/0!	96.43
Nervous system	Pharmaceutische componenten Groep II positief	Carbamazepine	0.83	0.62	0.08	#DIV/0!	90.31
Nervous system	Pharmaceutische componenten Groep I positief	Paracetamol	37.14	116.96	0.01	#DIV/0!	99.97
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Diatrizoic acid	23.38	39.89	19.39	8.9606	17.05
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Iomeprol	9.06	13.25	0.52	0.7175	94.23
Various (incl X-ray CM)	Pharmaceutische componenten Groep III positief	Ioxithalamic acid	51.76	63.81	12.11	6.551	76.60

3 Mean removal of selected pharmaceuticals by the MBR and CAS processes.

Table 5 Mean removal of selected pharmaceuticals by the MBR and CAS processes

Compound	Elimination (%) in:	
	MBR[a]	CAS[b]
Analgesics and anti-inflammatory drugs		
Naproxen	99.3 (1.52)	85.1 (11.4)
Ketoprofen	91.9 (6.55)	51.5 (22.9)
Ibuprofen	99.8 (0.386)	82.5 (15.8)
Diclofenac	87.4 (14.1)	50.1 (20.1)
Indomethacin	46.6 (23.2)	23.4 (22.3)
Acetaminophen	99.6 (0.299)	98.4 (1.72)
Mefenamic acid	74.8 (20.1)	29.4 (32.3)
Propyphenazone	64.6 (13.3)	42.7 (19.0)
Anti-ulcer agents		
Ranitidine	95.0 (3.74)	42.2 (47.0)
Psychiatric drugs		
Paroxetine	89.7 (6.69)	90.6 (4.74)
Antiepileptic drugs		
Carbamazepine	No elimination[c]	No elimination
Antibiotics		
Ofloxacin	94.0 (6.51)	23.8 (23.5)
Sulfamethoxazole	60.5 (33.9)	55.6 (35.4)
Erythromycin	67.3 (16.1)	23.8 (29.2)
B-blockers		
Atenolol	65.5 (36.2)	No elimination
Metoprolol	58.7 (72.8)	No elimination
Diuretics		
Hydrochlorothiazide	66.3 (7.79)	76.3 (6.85)
Hypoglycaemic agents		
Glibenclamide	47.3 (20.1)	44.5 (19.1)
Lipid regulator and cholesterol lowering statin drugs		
Gemfibrozil	89.6 (23.3)	38.8 (16.9)
Bezafibrate	95.8 (8.66)	48.4 (33.8)
Clofibric acid	71.8 (30.9)	27.7 (46.9)
Pravastatin	90.8 (13.2)	61.8 (23.6)

^Values are averages, with relative standard deviations (%) in parentheses, for $n = 10^a$ or $n = 8^b$ samples

[c]Compounds were classified as "no elimination" if elimination was less than 10%