EDITORIAL

Welcome to the first issue of the E4Water newsletter. The E4Water newsletter will provide you with actual information on the project progress, especially at its case study sites and gives an overview on upcoming events and announcements.

It has been a year since E4Water started, and a lot of things have happened and a lot of work has been done since then. E4Water is a very applied project that needs a strong input from both, industry and research to get solutions for more “eco-efficiency”— ecological and economically efficient industrial water management. Our newsletters we will have a “series on the E4Water cases” where descriptions and actual actions of E4Water case study sites are presented. This issue presents 2 case studies: the Dow case in Terneuzen, Netherlands, and the Solvic case in Antwerp, Belgium. These cases give a good insight in how strong the partners in E4Water work together.

Now enjoy the newsletter and visit the web site www.e4water.eu in order to learn more about E4Water in general, and to get detailed information on upcoming events.

Your E4Water Team

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THE E4WATER PROJECT

An innovative approach to Industrial Water Management

Scarce fresh water resources as well as water stress in aquatic ecosystems are current issues in Europe and worldwide. They are the result of a myriad of environmental, political, economic, and social forces. But economic growth and increasing production are needed and of general interest. Looking at water related policies, it becomes clear that many European countries consider the eco-efficient and sustainable management of industrial water to be one of the main strategies for environmental protection. Innovative solutions in industrial water use can help decouple growth in production from water use, while taking into account local issues.

The chemical industry is a fundamental part of the European economy. It converts raw materials into thousands of different products and is both a major water user and a solution provider for the key strategic European process industry sectors, such as mining, industrial biotechnology, health, food, electronic, pulp and paper and energy. Thus, the chemical industry provides a high potential for increasing eco-efficiency in industrial water management.

E4Water is working towards a paradigm shift in industrial water treatment and management in the chemical industry. The project addresses crucial process industry needs, to overcome bottle necks and barriers for an integrated and energy efficient water management. International partners, namely industry stakeholders, research organisations and end users, are researching solutions to reduce water use, wastewater production and energy use with the objective of more eco-efficiency and sustainability in chemical industry. Many E4Water partners are active in the area of water management. The project is well connected to SusChem (European Technology Platform for Sustainable Chemistry) and WssTP (Water supply and sanitation Technology Platform), and is collaborating with water authorities.

www.e4water.eu
At the industrial case study sites E4Water aims to achieve a significant reduction in water use, in wastewater production as well as in energy use, leading to direct economic benefits.

E4Water builds on state-of-the-art and new basic R&D concepts. Their realization, improvement, utilization and validation, by early industrial adaptors is clearly innovative. E4Water achieves this by (1) developing and testing innovative materials, process technologies, tools and methodologies for an integrated water management, (2) providing an open innovation approach for testing E4Water developments with respect to other industries, (3) implementing and validating the developments in 6 industrial case studies, selected to represent a range of critical issues for the chemical industry and other process industries, (4) implementing improved tools for process efficiency optimization, linking water processes with production processes and with eco-efficiency assessment.

Today’s situation with limited recycling/reuse components and limited connections across sectors (the width of arrows is in both figures an indicator for the water demands).

E4Water: concept & route breakthrough in industrial water management

The E4Water concept, following an integrated, multi-disciplinary and holistic approach in different industrial scales and across sectors. The dashed lines indicate the impact by E4Water, CS (= case study) indicate where on site industrial pilot testing and demonstration are focused on, the number allows their identification.
The Dow Case: Mild desalination

A large scale symbiotic reuse concept: Mild desalination of water streams for optimum reuse in industry or agriculture at affordable costs

As a chemical site Dow Benelux in Terneuzen has a significant demand for fresh water to run its processes, with major applications in cooling and heating (via producing steam).

Situated at the river Scheldt estuary, this region suffers from an intrinsic lack of fresh water. For decades, fresh water for potable and industrial usage has been provided by Evides IW, who transport the water over long distances from the Biesbosch area (120 km) and from polder water run-off from Flanders in Belgium.

Together with its regional partners, the water company Evides, the City of Terneuzen, and the regional Waterboard Scheld-estromen, Dow Benelux has already developed an integrated water management system which recycles municipal and industrial wastewater within its processing facilities. After implementing this system, Dow is now able to run its facilities with 65% reuse water.

What is the issue?

To align demand and supply within the region, a consortium of multiple regional stakeholders has been formed to develop a strategy that maximizes the use of recycle water thereby ensuring fresh water availability for all users at affordable costs. Various water streams currently discharged to the river Scheldt have been selected based on their reuse potential, both from a quantitative and qualitative point of view. These comprise both industrial water streams, like excess treated wastewater and cooling tower blow down streams, and rural streams originating from farm land run-off, municipal discharges, and rain. However, all streams contain varying amounts of inorganic salts, which make them unfit for direct use. Hence, the aim of the E4Water case study at Dow is to develop commercial applications for a mild desalination of these different raw water streams.

Dow Benelux BV in Terneuzen, the Netherlands

Dow combines the power of science and technology with the “Human Element” to continuously improve those things that are essential to human progress. The company connects chemistry and innovation with the principles of sustainability. In this way many of the world’s most challenging problems are addressed, such as the need for clean water, energy saving, renewable energy generation and the improvement of agricultural productivity.

Dow’s various businesses for specialty chemicals, advanced materials, agricultural sciences and plastics are leading within the industry. They offer technology based products and services to clients in about 160 countries and in high growth sectors such as electronics, water, energy, coatings and agriculture. In 2012, Dow managed an annual turnover of $ 57 billion and globally employed approximately 54,000 people. The more than 5,000 products of Dow are produced in 188 locations in 36 countries all over the world. More information about Dow Global can be found on www.dow.com.

Daily 2,100 employees and about 700 contract workers in 7 locations and 23 plants in the Benelux make an important contribution to the activities of Dow.

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The Objective

In order to produce water for end users in industry or agriculture at an affordable price, the water quality has to meet the specifications of the targeted application. Typically many applications in both sectors require water with a salinity (expressed as conductivity) of less than 1 mS/cm. The objective is to reach a production cost below € 0.4/m³ at a volume of 3-4 million m³ of potential reuse water.

Evides IW has a production facility adjacent to the Dow site, called “DECO”, where they produce demineralized water and cooling tower make-up water for Dow. This is where the demo facilities for the mild desalination pilot will be installed.

Two parallel treatment trains will be equipped with pre-selected desalination techniques to treat a maximum of 100 m³ of raw influent, e.g. collected rain water and blow down from industrial cooling towers per day. The facility will run for a period of 2.5 years in order to determine the most appropriate and robust technology – this includes aspects like pre-treatment requirements, energy efficiency, product quality and flexibility, use of chemicals for cleaning, operational reliability, and overall cost level.

What has been done so far

During the first year of the project significant effort was devoted to a detailed characterization of the raw water streams, including inorganic and organic constituents, biological stability (especially with the collected rainwater streams), bio-degradability and fouling potential. Seasonal variations in biological parameters, temperature, nitrate levels for farm land run-off, etc. were monitored, as these were expected to have a significant impact on the performance of certain desalination techniques. All streams were sampled and analyzed on a bi-weekly basis.

FHNW (Univ of Applied Sciences NW Schweiz) have been focusing on using Ultrafiltration (UF), activated carbon (AC), and coagulation (CG) as generic pre-treatment processes for all raw waters. Besides the standard water analyses, the lab of FHNW performed so-called LC-OCD analyses, enabling them to distinguish between different organic fractions in the water samples, e.g. biopolymers, humic acids, etc. By applying varying pre-treatment techniques the impact of these fractions on the subsequent desalination technology can be influenced.

What will happen next?

At TU Delft, the treatment of various raw water samples by ED and CDI technologies is being tested, while TNO is evaluating the applicability of MD for various water types. Final product quality, pre-treatment requirements, and process stability (fouling potential, run lengths) were the main subjects of investigation. RO/NF membrane performance and fouling sensitivity will be evaluated by TU Delft and VITO using existing software models with multiple references. For IX, practical performance data provided by Evides will be used to simulate its performance regarding the treatment of the water types currently under investigation.

As a next step, a thorough pre-selection was made to choose eligible techniques suitable for application in “mild desalination”. A literature survey was carried out by TU Delft, with vital input from partners working on other work packages, like TNO, VITO, and UCM. As desalination is also pursued in the Solvic and Total case studies, the results of this study serve multiple users. For each of the desalination techniques a “Fact Sheet” was developed, comprising key performance parameters for product quality, treatment cost and energy efficiency – relevant reference cases were also included. Based on the data included in the fact sheets and using expert judgment from both practical and fundamental points of view, the following technologies have been selected for further evaluation at laboratory scale or through modeling: Reverse Osmosis / Nanofiltration (RO/NF), Electro Dialysis (ED), Capacitative Deionisation (CDI), Membrane Distillation (MD), and Ion Exchange (IX).

BSc and MSc students from various institutes (TU Delft, HZ Univ of Applied Sciences). A regular evaluation of pilot tests and paths forward will involve all Dow Case Study partners.

Experimental set-up at TU Delft (Photo: TU Delft)
The Solvic Case: “Industrial experimental garden”

Enhancing water reuse by global management and synergy identification on a multi-company site

The aim of the Solvic case is to enable synergy effects with neighborhood industries in the Port of Antwerp Chemical Cluster, focusing on waste water and cooling water streams with inorganic loads of up to > 5000 mg/l salts and variable flows of 25-120 m³/h. The site is located in a coastal region and faces pressure on fresh water uptake by regulatory demands (Flanders “Integral Water Policy” and “Rainwater Decree”). The aim is to come to a water management concept that is close to zero salt waste and zero liquid discharge.

Solvic NV – Belgium

Solvic NV is a 100% daughter of SolVin, a joint venture created in 1999 between SOLVAY SA (75%) and BASF (25%) for the production and marketing of resins and compounds of PVC (poly vinylchloride) and PVDC (polyvinylidene chloride) in Europe. In the Solvic-Lillo plant, located in the port of Antwerp in Belgium, the largest chemical/petrochemical cluster of Europe, since 1970, the main production is inorganic basic chemicals as chlorine, hydrogen, sodium hydroxide and sodium hypochlorite. There is a dense connection through pipelines between Solvic Lillo and its clients (BASF, Bayer, Ineos, Monsanto, Evonik etc.).

SOLVAY is an international chemical Group committed to sustainable development with a clear focus on innovation and operational excellence. It is realizing over 90% of its sales in markets where it is among the top 3 global leaders. Solvay offers a broad range of products that contribute to improving the quality of life and the performance of its customers in markets such as consumer goods, construction, automotive, energy, water and environment, and electronics. The Group is headquartered in Brussels, employs about 29,000 people in 55 countries and generated EUR 12.4 billion in net sales in 2012. Solvay SA (SOLB.BE) is listed on NYSE Euronext in Brussels and Paris (Bloomberg: SOLB.BB- Reuters: SOLBt.BR).

What is the issue?

Several leading companies are working together on the Solvic case study, the “Industrial experimental garden” (‘concept industrial testbed’) to enhance innovation with regard to water reuse in the chemical sector. Experimentation and demonstration of different technologies will be carried out under specific conditions, in an environment shielded from the hazards of testing in a production environment and will be accessible to external users.

The testbed will be used as a proof of concept or to test new modules before adding them to the relevant program/system. Apart from demonstration of new technologies, the testbed will also be used to demonstrate advanced water loop closure and to produce high flow high-quality process water for internal use.

The Objectives

The main goal of Solvic is to come to a water management that is close to zero salt waste and zero liquid discharge. The Solvic Case objectives are:

- Scenario evaluation and step wise implementation of the innovation plan to reach a gradual reduction of drinking water intake from 20% to 60%.
- A reduction in the emission load of the final effluent by replacing waste-generating steps or by applying advanced treatment options for the concentrate streams (application of waste design and zero waste concepts).
- The conversion of the demo unit into an ‘Industrial experimental garden’ to serve as an open infrastructure which companies can use to enhance innovation with regard to water reuse in the chemical sector, leading to a symbiotic cooperation.
The Challenges
The E4-water project is a collaboration of 19 international partners. Solvic works in close collaboration with its partners: Evides industriewater and VITO (Vlaamse Instelling voor Technologisch Onderzoek). Together we try to overcome various obstacles. To achieve the highest saving potentials, the current bottlenecks need to be solved. In terms of water reuse, the problem arises around the discharge or processing of the resulting concentrate flows (this is often the bottleneck in the implementation of a sustainable cycle closure). To face these challenges we need to:

- Create water loop interfaces, synergies and symbioses in our industry.
- Develop and test innovative materials and process technologies, as well as synergetic combinations of technologies and tools for an integrated water management that increases industrially relevant recycling/reuse. New upcoming technologies, like ultra-filtration (UF) and reverse osmosis (RO), will be used. New membranes will be adapted to specific contaminants, leading to advantages like higher flux, lower energy and lower fouling.
- Manage the variability of waste water streams as influent, the effluent quality and volumes in relation with the production needs and impacts on treatment of the concentrates.
- Provide an open innovation approach for testing the solutions developed to other industries to ensure robustness, wide applicability, cross-fertilization and exploitation of eco-efficient solutions.

What has been done so far?
Within the Solvic Case the Demo unit will be modular (three modules). The concepts of the first two modules are to demonstrate advanced water loop closure and to produce a flow high-quality process water for internal use from waste water, freatic water and dock water. The last module is to test the reuse of high salty waste waters from external partners directly in the Solvic production.

Currently the module 1 is started up and produces already from waste water and freatic water high-quality process water through ultra-filtration (UF) followed by reverse osmosis (1 stage RO). The second module, now in construction phase, will use dock water as feed and will also use as technology UF and (2 stage) RO. The last module is in design and engineering phase.

What will happen next?
For the near future we foresee the start-up of the second module in September 2013. The construction and start-up of the third module is scheduled for Q4 2013.

The success indicators as defined here above can be followed up once the three modules are fully running.

In the future we hope to accomplish our main objectives with the Demo unit at the Solvic Case.

- Development of selective treatment technologies and treatment trains unlocking barriers for recycling and reuse of industrial water streams and even the concentrates.

The success of the project will be followed up by indicators such as:
- Reduction of freshwater dependency
- Reduction of energy demand
- Realization of a symbiotic link to neighborhood industry
- Economic feasibility
E4WATER PARTNERS IN DEPTH

This section is dedicated to individual E4Water partners. Since the E4Water consortium is quite large and composed of different partners from various scientific fields, this section offers some of the partners with core tasks in the project a platform to present themselves in more detail. Process Industry is leading the way in this first newsletter issue.

Process Industry:
• Solvic NV (Belgium)
• Solvin SL (Spain)
• Dow Benelux BV (Netherlands)
• Procter & Gamble (Belgium)
• Total Petrochemicals SA (France)
• Cluster Biofuels Denmark CBD (Denmark)

Industrial Technology Provider:
• Ondeo Industrial Solutions SA (France)
• Evides Industriewater BV (Netherlands)

Applied Research:
• Technical University of Denmark DTU (Denmark)
• Technical University of Delft (TU Delft, Netherlands)
• Fachhochschule Nordwestschweiz FHNW (Switzerland)
• Complutense University Madrid (Spain)
• Technical University Berlin TUB (Germany)

RTD Center:
• Campden BRI (United Kingdom)
• IVL Swedish Environmental Research Institute (Sweden)
• TNO (Netherlands)
• Vito (Belgium)

Scientific Technical/chemical Process Industry Platform:
• Dechema e.V. (Germany)

Industry Association:
• Cefic (Belgium)

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E4Water Consortium at the kick-off meeting in Kalundborg

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ANNOUNCEMENT OF UPCOMING EVENTS -
Where you can meet E4Water

SUSCHEM Stakeholder Meeting 2013
14-15 May 2013, Brussels
www.suschem.org/event/suschem-2013-stakeholder-event.aspx

EUROANOFORUM 2013
18-20 June 2013, Dublin/Ireland
www.euronanoforum2013.eu

WorldWaterWeek 2013
1-6 September 2013, Stockholm/Sweden
www.worldwaterweek.org

ANQUE/DECHEMA Chem H2O 2013
Leading-Edge Conference on Sustainable Water Management: Chemical Industry setting the pace
Sponsored by E4Water amongst others
1-2 October 2013, Madrid/Spain
www.chemh2oconference2013.com

DWA/DECHEMA Industrietage Wassertechnik (in German)
13-14 November 2013 – Fulda/Germany
www.dwa.de

Since the section of the website on upcoming events is regularly updated we invite you to visit our website for most recent changes.

Disclaimer
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