

Scan of promising technologies in the SME network

Paul Ockier

Scan of promising technologies in the SME network

Paul Ockier



© 2006 TECHNEAU

TECHNEAU is an Integrated Project Funded by the European Commission under the Sixth Framework Programme, Sustainable Development, Global Change and Ecosystems Thematic Priority Area (contractnumber 018320). All rights reserved. No part of this book may be reproduced, stored in a database or retrieval system, or published, in any form or in any way, electronically, mechanically, by print, photoprint, microfilm or any other means without prior written permission from the publisher

This report is:
PU = Public

Contents

	Contents	1
1	Introduction	2
2	Treatment technologies	2
3	Monitoring and control technologies	4
4	Selected technologies for the TECHNEAU programme	5
5	Further actions	5
	Summary table of technologies	6
	Description of technologies	9

1 Introduction

EUCETSA is the European Committee of European Technology Suppliers Associations. In the TECHNEAU project it is responsible for performing a “promising technology scan” in the SME network. It has 14 member associations but France is missing so in order to reach as much SME’s as possible, other European and national associations were involved. Aqua Europa is a specific association to mention. Several associations put this issue on the agenda of their internal meetings, and there has been much coverage in many European and national newsletters. By reaching thousands of SME’s, much publicity was done for the TECHNEAU project. Some companies did not provide information on new products or technology because they wanted to keep it confidential.

The objective of the scan was to answer the following:

- Are we missing some technologies in the TECHNEAU programme?
- Can we involve some of these technologies in the programme?
- Creating first input to the TKI (TECHNEAU Knowledge Integrator) from the SME-network

We received information of 32 products or technologies. You can find them on the summary table.

In the detailed analysis, we follow the division of the TECHNEAU project. We have profiles related to Work Area 2 “Treatment technologies” and Work Area 3 “Monitoring and control technologies”.

2 Treatment technologies

Membrane processes

TECHNEAU background

Selected technology areas under TECHNEAU are:

- a pre-treatment filter, use of anti-scalants (WP 2.1 = Work Package 1 of Work Area 2)
- the oxidation-biodegradation-membrane (OBM) process (WP2.2)
- performance of inorganic (ceramic) membranes (WP2.3)

Important under TECHNEAU is also the treatment of concentrates of membrane filters and backwash water from conventional filters (WP2.3). TECHNEAU looks to treatment of backwash water by ceramic filters.

Collected technologies

- Enzyme based range of products dedicated to membrane cleaning (Realco)
- Biodegradable anti-scalants ((NovoPure)
- UF-membranes with multichannel hollow fibers: Multibore and Sevenbore
- InoCep, ceramic hollow fiber membranes
- AQUAporin, nanobiotechnological membrane technology purifying water to absolute pure water, 2th or 3th generation of development interesting for drinking water
- UF-membranes for backwash water treatment by Zenon
- Desalination by membrane distillation (Memstill)

Promising technologies

Realco and NovoPure anti-scalants because they are environmentally friendly

Multichannel hollow fibers membranes because of mechanical strength

Ceramic membranes because of thermal, chemical and mechanical resistance

Memstill membrane distillation with a low energy consumption

Selected for the TECHNEAU programme
Realco and NovoPure anti-scalants

Oxidation processes

TECHNEAU background

TECHNEAU will look to UV-based oxidation and the formation of oxidation by-products after chemical oxidation (WP2.4).

Collected technologies

- Ecodis is an electrochemical oxidation process.
- TA-Aqua+ is a physical oxidation process, the UV/TiO₂ oxidation process.

Promising technologies

Ecodis and TA-Aqua+ are oxidation processes without the addition of any chemicals.

Selected for the TECHNEAU programme

Ecodis is further under development.

Decentralised systems

TECHNEAU background

The TECHNEAU programme looks in WP2.5 to membrane technologies and new UV-diodes for decentralised systems.

Collected technologies

- The WaterPyramid purifies dirty water in a covered construction utilizing solar energy for evaporation followed by condensation.
- A Rainmaker is a windmill producing water in stead of electricity by condensating the available vapour from the air.
- A Perfector-E is a mobile unit consisting of a membrane filter followed by disinfection through UV.

Promising technologies

The WaterPyramid and the Rainmaker are promising because of the use of renewable energy.

Selected for the TECHNEAU programme

The selected promising technologies don't fit in the actual programme of TECHNEAU.

Other water treatment processes

Under this chapter we categorise processes not prioritised under the TECHNEAU project.

Collected technologies

Magnetic treatment

- Mimura, a resin crystal in a polymer formulation exhibiting a magnetic force field and transforming the inorganic metals to a safe organic state, around the pipes; applicable to homes

Electronic treatment

- Scalewatcher Enigma, electronic unit around the pipes preventing lime scale; applicable to homes

Electro-magnetic treatment

- Calc-Tech, treatment with permanent magnets around the pipes combined with an electrical field for water networks preventing lime scale

Crystallisation

- FACT, combination of crystallisation and cake filtration for water softening

Adsorption

- Uranex, Uranium removal with high selective adsorption material

Ion exchange

- Aqualite, filtration technology based on the natural mineral Aqualite

- Advanced Amberpack technology for nitrate removal; ion exchange with very efficient regeneration
- Nitreat, a nitrate removal process with ion exchange

Biological treatment

- Aquaerator, mixing and aeration technology for reservoirs
- Messner plate aerator, energy efficient solution for nitrification

Promising technologies

Some technologies put emphasize on efficiency gains.

CalcTech is a promising technology because it is flow independent.

FACT is promising because of cost reduction.

Selected for the TECHNEAU programme

None fits in the programme.

3 Monitoring and control technologies

Monitoring and control of source water

TECHNEAU background

On-line monitoring techniques with UV-Vis spectrometry, bioassays technology for endocrine disrupting compounds, concentration methods for pathogens (WP3.2)

Collected technologies

- Micromac-ToxScreen, bioassay with luminescent bacteria, online system for toxicity measurement
- TOXcontrol, uses luminescent bacteria, online system for toxicity measurement
- Optisense, measurement of refractive index changes of agent specific absorbents, real time monitoring, on site detection of eg pesticides
- Microarray immunochemical sensors using fluorescence detection, in-situ biochemical analysis with focus on cyanotoxins
- GeneDisc Cycler, real time PCR

Promising technologies

- Micromac-Toxscreen, TOXcontrol, microarray in-situ sensor, Optisense

Selected for the TECHNEAU programme

Micromac-Toxscreen, TOXcontrol and microarray in-situ sensor

Monitoring water treatment process

TECHNEAU background

Determination of AOC based on the growth of mixed microbial populations and molecular technology, UV-Vis spectrometry, identifying and quantifying membrane biofouling and cytometry (WP3.3)

Collected technologies

- Streaming potential technique to measure electrostatic and electrokinetic properties of membranes

Promising technologies

/

Selected for the TECHNEAU programme

/

Drinking water quality and monitoring changes during distribution

TECHNEAU background

FISH (Fluorescence in situ hybridisation) technique, electronic nose and electronic tongue technology and fish biomonitor , alarm system (WP3.4 and WP3.5)

Collected technologies

- AquaScope, in line FISH biomonitor
- microchip capillary electrophoresis as separation technology

- Electronic Nose (FOX) and Tongue (ASTREE)

Promising technologies

AquaScope

Electronic Nose and Tongue

Selected for the TECHNEAU programme

AquaScope because of automation

Electronic Nose and Tongue, last one already in the programme

4 Selected technologies for the TECHNEAU programme

In WP2.1: Realco and NovoPure anti-scalants

The products can be tested under task 2.1.1.e.

In WP2.4: Ecodis oxidation technology

Ecodis can be compared with UV/H₂O₂ and UV/TiO₂ processes under task 2.1.4.b.

In WP3.2: Micromac-Toxscreen, TOXcontrol toxicity measurement, microarray in-situ sensor of algal toxins

The toxicity monitors can be evaluated under task 3.2.3.a.

In WP3.4: AquaScope FISH monitor

AquaScope can assist task 3.4.1.c.

5 Further actions

An action plan has to be made of the selected technologies for the TECHNEAU programme.

We propose to integrate a selection of promising technologies in the TKI.

Summary table of technologies

Nr	Technology	Company	Country	State of development
1	Enzyme based range of products dedicated to membrane cleaning	Realco	Belgium	On the market
2	NovoPure: biodegradable antiscalants for membrane systems	Holland Novochem	The Netherlands	On the market
3	Multibore® membrane, ultrafiltration with multibore hollow fiber technology	Inge	Germany	Industrial application
4	Sevenbore, hollow fiber UF membrane with multi-channel hollow fibers	IMT	The Netherlands	Industrial application
5	InoCep, ceramic hollow fiber membranes	CEPARation	The Netherlands	Further development
6	AQUAporin, nanobiotechnological membrane technology	AQUAporin	Denmark	Early stage of development
7	Zenon, UF membrane technology for backwash water treatment	Zenon	The Netherlands	Industrial application
8	Memstill, desalination by membrane distillation	TNO Industry and Science	The Netherlands	Pilot plants
9	Ecodis®, disinfection, electrochemical oxidation process	Ecodis	Belgium	Further innovations
10	TA-Aqua+, oxidation process with UV/TiO ₂	Tour & Andersson	The Netherlands	Ready to market
11	WaterPyramid, evaporation with solar energy and condensation	Aqua-Aero Water Systems	The Netherlands	Ready to market

Nr	Technology	Company	Country	State of development
12	Rainmaker, windmill producing water fom air	Dutch Rainmaker	The Netherlands	Prototype
13	Perfector-E, mobile purification unit, membrane filtration followed by UV disinfection	Norit	The Netherlands	Industrial application
14	MIMURA, magnetic treatment changing the molecular structure	GICE	Australia	Further development
15	Scalewatcher Enigma, electronic treatment preventing lime scale	ETC	United Kingdom	Industrial application
16	Calc-Tech®, electro-magnetic treatment preventing lime scale	A-engineering	Belgium	Industrial application
17	FACT, combination of crystallization and cake filtration for water softening	TNO Industry and Science	The Netherlands	Pilot plants
18	Uranex, Uranium removal by adsorption	Krüger WABAG	Germany	First reference plant
19	Aqualite, filtration technology based on the natural mineral Aqualite	Josab	Sweden	Industrial application
20	Advanced Amberpack, a nitrate removal process by ion exchange	Christ Kennicott	United Kingdom	Industrial application
21	NITREAT, a nitrate removal process by ion exchange	ACWA	United Kingdom	Industrial application
22	Aquaerator, mixing and aeration technology for reservoirs	AMG	United Kingdom	On the market

Nr	Technology	Company	Country	State of development
23	Messner plate aerator for nitrification	Bosman Watermanagement	The Netherlands	Tests ongoing
24	Micromac-ToxScreen, online monitor using luminescent bacteria	SYSTEA	Italy	Field test ongoing
25	TOXcontrol, online biomonitor using luminescent bacteria	microLAN	The Netherlands	On the market
26	Optisense, optical biosensor for real time monitoring	Optisense	The Netherlands	Fine tuning of prototype
27	Microarray immunichemical sensors using fluorescence	Toxispot	Denmark	Under development
28	GeneDisc Cycler, real time PCR	Gene Systems	France	Industrial application
29	CAD ZetaCAD, streaming potential technique to measure properties of membranes	Wilten	The Netherlands	Industrial application
30	AquaScope, inline FISH biomonitor	Aqua Explorer	The Netherlands	Field test ongoing
31	Microchip capillary electrophoresis as separation technology	CapiliX	The Netherlands	Further optimization
32	Electronic Nose (FOX) and Tongue (ASTREE)	Alpha MOS	France	Industrial application

Description of technologies

1. Enzyme based range of products dedicated to membrane cleaning

Title and name of product or technology	
Enzyme based membrane cleaning	
Abstract	
<p>REALCO propose an enzyme based range of products dedicated to membrane cleaning. These products are used on various kind of filtration (dead-end, cross-flow), material (ceramic, organic) and application field (food industry, wastewater...). As an enzymes specialist for over 20 years, REALCO has the expertise and lab equipment to develop and propose tailor made solution for specific substrates or applications.</p>	
Description	
<p>REALCO, founded in 1968, is a SME company located in the scientific park of Louvain-La-Neuve. The company was involved in traditional products commercialization (detergents, disinfectant and descaling agent) for ten years before it developed its activity in biotechnologies applied to water treatment and cleaning. REALCO is now expert in developing process and manufacturing products based on enzymes or enzymes/bacterias complex (EBC). REALCO research on enzymes allowed to optimize their use in industrial cleaning (surfaces, CIP,...) and to get involved in a leading field like filtration membrane cleaning. REALCO propose responsible products which meet the specific needs of professionals in maintenance. These products are recommended for their cleaning performances, their safety for the operator and their non-aggressiveness for the machinery and tools. They also have a positive - and patented - impact on the environment.</p>	
Innovations and advantages	
<ul style="list-style-type: none"> - High cleaning performances - Optimal flow recovery - Energy savings (lower temperature) - Injuries risk reduction - Material preservation - Membrane lifetime increase (till 100%) - Safe for the environment 	
Current and potential domain of application	
<ul style="list-style-type: none"> - Food industry process (dairy, fruit juice, protein extraction/concentration, wine,...) - WasteWater treatment (MBR) - Water desalinization - Drinking water 	
Current state of development	
On the market	
Contact details	
Organisation	REALCO S.A.
Website	www.realco.be
Contact person	Mr Gauthier Boels
Address	Av Albert Einstein 15 B-1348 Louvain-La-Neuve Belgium
Phone	+32 10 45 30 00
Fax	+32 10 45 63 63
Email	g.boels@realco.be

2. NovoPure: biodegradable antiscalants for membrane systems

Title and name of product or technology	
NovoPure: Sustainable technology with biodegradable antiscalants for membrane systems	
Abstract	
As a result of a long term research project Holland Novochem developed the "NovoPure-technology", an environmental friendly product line of water treatment chemicals. NovoPure products are based on biopolymers. All components are biodegradable. The product line comprises corrosion-inhibitors, antiscalants and dispersing agents. For membrane systems specific antiscalants have been developed.	
Description	
<p>To prevent deposition of salts in RO or NF membrane systems small amounts of chemicals -antiscalants- are being dosed. Traditional programs comprise poorly or non biodegradable raw materials, like polyacrylates and phosphonates with high phosphorus levels. In the end the components are being discharged with the concentrate, and they burden the aquatic environment.</p> <p>NovoPure antiscalants are based on biopolymers from renewable sources. All components are biodegradable and the content of phosphorus and nitrogen is low. For production of drinking water a formulation is available with Kiwa-ATA certificate.</p>	
Innovations and advantages	
<p>Upon applying NovoPure, the environmental burden is strongly reduced compared to traditional antiscalant programs. Due to biodegradability and low phosphorus content NovoPure meets today's most severe criteria with respect to both environment and legislation. Based on biopolymers from renewable sources, the technology can be characterized as sustainable.</p> <p>Advantages of NovoPure:</p> <ul style="list-style-type: none"> - good performance at high recovery operations (equal to traditional antiscalants) - no promotion of biofouling in the membrane installation - performance remains stable for more than 24 hours during process stops 	
Current and potential domain of application	
Currently NovoPure is applied in both cooling water and process water since 2005. The first membrane application in drinking water production has started in 2006.	
Current state of development	
Development is directed towards application of NovoPure technology in desalination processes.	
Contact details	
Organisation	Holland Novochem BV
Website	www.novochem-group.eu or www.hollandnovochem.com
Contact person	Mrs. Irma Steemers
Address	Villawal 15, 3432 NX Nieuwegein P.O. Box 390, 3430 AJ Nieuwegein
Phone	+31 (0)30 602 15 33 or +31 (0)6 204 356 95
Fax	+31 (0)30 605 33 76
Email	i.steemers@hollandnovochem.com

3. Multibore membrane, ultrafiltration with multibore hollow fiber technology

Title and name of product or technology
<ul style="list-style-type: none"> - Multibore® membrane for the water treatment with Ultrafiltration technology of inge AG - dizzer® module series with Multibore® membrane for the water treatment with Ultrafiltration technology of inge AG
Abstract
Description

inge AG at a glance

The internationally active inge AG has its headquarter located in Greifenberg near Munich, Germany. The company manufactures and sells ultrafiltration membranes and modules for the treatment of drinking water, process water and waste water. It is the largest ultrafiltration corporation for water treatment in Germany and currently employs 55 people. In order to meet the increasing demand of the Asian markets, inge AG also maintains a sales office in China.

Compared to conventional water treatment methods, use of the ultrafiltration technology of inge AG offers numerous advantages: the modules can be easily and quickly installed in the system, the membrane fibres are extremely robust and stable. Since inge started its operations six years ago, it has not seen any fibre breakage case of its membranes. Such exceptional advantages ensure low operation costs of systems and thus mean lower investment costs from a long-term point of view. An additional important advantage is the security that it can provide for health: the small-pore sized filters of the patented Multibore® membrane which is developed by inge AG reliably reject particles, micro-organisms, bacteria and viruses out of the water, thus securing germ-free and clean drinking water.

Innovations and advantages
<p>Multibore® membrane</p> <p>Fibre breakage not possible</p> <ul style="list-style-type: none"> ▪ 7 single capillaries combined into one strong fiber ▪ approx. 30% of PES is replaced by a stronger, hydrophilic polymer ▪ very regular foam structure as active layer support ▪ active layer and foam structure are formed in a single production step (same material) – delamination not possible <p>Properties</p> <ul style="list-style-type: none"> ▪ pore size approx. 10 – 25 nm ▪ > 99,9999% rejection for bacteria ▪ ID capillary: 0,9 mm OD fibre: 4,3 mm ▪ pH resistance between pH 1 and pH 13 (no risk of irreversible organic fouling) <p>Because of the stability of the Multibore® fiber</p> <ul style="list-style-type: none"> ▪ no fiber breakage for the last 5 years ▪ no handling defects during module assembly ▪ avoidance of defects caused by interference ▪ no flexing due flow change ▪ membrane plants are easier to built

<p>(low risk of damages due to water hammers)</p> <ul style="list-style-type: none"> ▪ in case of a high fouling rate very high backwash pressures are possible ▪ <p>dizzer® module</p> <ul style="list-style-type: none"> ▪ annular gap is formed by an inner perforated thin tube ▪ no perforation in the area of the permeate connection to create a radial distribution first (just little holes for deaeration at the upper end) ▪ no o-ring sealing between feed/concentrate and permeate ▪ clean water permeability approx. 600 l/mh/bar ▪ module length 1,5 m (including endcaps 1,68 m) ▪ module diameter 250 mm (10 inch) 	
Current and potential domain of application	
Soon we will bring a new product on the market: t-rack (8 dizzer modules in one rack)	
Current state of development	
We are going to bring the t-rack in June on the market. If you need more information, do not hesitate to contact us.	
Contact details	
Organisation	inge AG
Website	www.inge.ag
Contact person	Tanja Gebhart (Assistant Marketing / Sales) tgebhart@inge.ag Wolfgang K. Distler (CEO) Dr. Peter Berg (CTO)
Address	Flurstraße 27 D - 86926 Greifenberg Germany
Phone	+49 8192 997-700
Fax	+49 8192 997-999
Email	info@inge.ag

4. Sevenbore, hollow fiber UF membrane with multi-channel hollow fibers

Title and name of product or technology
Hollow Fiber Ultrafiltration membrane with multi-channel hollow fibers
Abstract
<p>IMT BV, Zeewolde, The Netherlands has introduced a new revolutionary UF hollow fiber membrane, the so-called SevenBore. The newly developed production method enables IMT to secure the large scale production of a strong and reliable membrane, which now on the market. The membrane is a new generation of UF membranes which is stronger, more hydrophilic than the known single bore membranes. The membrane is used in PoU, PoE applications as well as large scale installations in municipal and industry.</p> <p>This in-side-out membrane is being used in water treatment in pressurized systems.</p>
Description
<p>The SevenBore membrane is a polymer membrane (PES) and contains 7 capillary channels with a diameter of 0,9 mm. The outer diameter of the fiber is 4,2 mm. The combined 7 capillaries makes the fiber very strong. (up to 20 times compared with PES singlebore membranes) At the same time IMT has successfully developed a recipe for the production of these membranes in which also the hydrophilicity has been increased compared to other existing membranes. This hydrophilicity has been influenced with the number of hydroxide groups in the polymeric mixture which is used as raw material for the production. IMT is fully focussed on the production of the membrane. The production method developed by IMT gives also the possibility to influence the pore size on the membrane surface. This enables IMT to deliver membrane elements with different permeability and Molecular Weight Cut Off.</p>
Innovations and advantages
<p>The SevenBore membrane is 20 times stronger than comparable Singlebore membranes</p> <ul style="list-style-type: none"> <input type="checkbox"/> <input type="checkbox"/> The SevenBore has a higher hydrophilicity and permeability. <input type="checkbox"/> <input type="checkbox"/> As the pore size can be influenced more dedicated applications can be developed, ie. Effluent treatment, Pretreatment RO, Surface water etc. <input type="checkbox"/> <input type="checkbox"/> The outer surface of the membrane is very open (almost the same as the inside foam structure) and therefore the resistance to leave the fiber is very low and much better than the existing membranes.
Current and potential domain of application
<p>PoE and PoU, in this application the strength of the fiber is very much of importance. Fiber breakage can not be accepted in this application. There are no engineers or skilled operators involved. The SevenBore is already successfully introduced in this market and more than 250 installations have been built. The reliability of the membrane is crucial in this application, which can not be covered by the weaker Singlebore.</p> <ul style="list-style-type: none"> <input type="checkbox"/> <input type="checkbox"/> In the large scale water treatment market it is a trend to use more and more UF as basic treatment in al kinds of water treatment processes. In these processes the SevenBore is seen as an improvement on the state of the art with the Singlebore membrane. The integrity of the systems is increase by using the multi-channel membrane fiber. Also in existing installation the membrane is replacing the old Singlebore membrane. <input type="checkbox"/> <input type="checkbox"/> Especially in large scale applications the upgraded specifications of the membrane a higher productivity and a lower chemical and energy consumption can be reached.
Current state of development
<ul style="list-style-type: none"> <input type="checkbox"/> <input type="checkbox"/> In the production, the up scaling and quality control are the main fields of interest. <input type="checkbox"/> <input type="checkbox"/> The materials used as raw material for the fiber is constantly discussed and ideas are tested in order to improve the specification of the membrane.

□□The design and assembly of membrane elements will be developed further as the materials used and the production method should enable IMT to develop a very efficient and low cost membrane for a broad spectrum of applications.

Contact details	
Organisation	IMT BV
Website	www.imtmembranes.com
Contact person	Bert Welkers
Address	Mast 25a Postbus 126 3890 AC Zeewolde The Netherlands
Phone	+31 36 5220090
Fax	+31 36 5236619
Email	bert@imtmembranes.nl

5. InoCep, ceramic hollow fiber membranes

Title and name of product or technology	
Product: Ceramic Hollow Fiber Membranes and Modules Product name: InoCep	
Abstract	
Hyflux CEPAration produces InoCep membranes, ceramic hollow fibre membranes & modules, for the filtration of all kinds of water and fluids.	
Description	
The products of Hyflux CEPAration are based on ceramic hollow fibre membranes & modules. You can find detailed information on the standard type of <u>fibres</u> , <u>modules</u> & <u> housings</u> as well as the <u>standard potting material</u> on our web-site. Filtration range: microfiltration, ultrafiltration and nanofiltration.	
Innovations and advantages	
The fibres and coatings are made of high purity aluminum oxide which is a generally accepted and approved high-tech ceramic material for filtration processes. The material is known for its superior thermal, chemical and mechanical resistance and extreme hardness giving it a very high abrasion resistance. Such stability makes InoCep membranes suitable for processes whereby membranes are require repeated steam sterilising and cleaning with aggressive chemicals. Furthermore the packing density is high so that the footprint of an installation is smaller and the investment and operational cost are lower compared to other ceramic membrane units.	
Current and potential domain of application	
Drinking water, Metal/Surface engineering, Chemical/Oil industry, Food & Beverage/Sugar industry, Waste/waste water treatment, Industrial chemicals recycling, biopharmaceutical/Life science, Milk & diary.	
Current state of development	
Other pore sizes and diameters of the fibres including high temperature gas separation.	
Contact details	
Organisation	Hyflux CEPAration
Website	www.ceparation.com
Contact person	Ing. Iris E. Kok
Address	Lage Dijk 29 B PO Box 2128 5705 BX Helmond 5700 DA Helmond
Phone	+31(0)492 565 330
Fax	+31(0)492 590 010
Email	info@ceparation.com

6. AQUAporin, nanobiotechnological membrane technology

Title and name of product or technology
AQUAporin membrane technology
Abstract
In all living cells, channels transporting water – aquaporins – exist. Aquaporins are proteins, which only transport water i.e. pure H ₂ O molecules. They have a unique selectivity and are extremely efficient being nature’s own water transporting systems. Overall Scientific and Technical objective The purpose of AQUAporin is to industrially exploit these unique features. This is done by incorporating recombinant aquaporin molecules in different types of industrial membranes for water filtration. By this, the nature will be used as a model for the development of a novel nanobiotechnological water membrane technology, with a unique and unseen selectivity towards water.
Description
AQUAporin is an industrial biotech company, founded January 2005, with seed financing from Teknologisk Innovation A/S. The company has until now met all targets and budgets and has an organization with a CEO, established scientific collaborations, a professional board and a scientific board. Our mission is to develop a new water membrane technology based on nature's own water filter, aquaporins, capable of purifying water to a unique level, Absolute Pure Water. Our initial market focus will be on the implementation of the technology in the ultra pure water market in the pharma/biotech industry. From this platform the technology will be introduced in other industries using ultra pure water. Our vision is to give today’s users of Ultra Pure Water a possibility of higher quality and lower costs in their production by moving the frontier of water purification from Ultra Pure to Absolute Pure Water. Purified water is the world's largest industrial product in terms of volume and the world's third largest industrial product in terms of turnover, behind only energy and oil. The current size of the global water treatment market is USD 287 billion today, and expected to be USD 413 billion by 2010, an annual compounded growth rate of 8% p.a. AQUAporin objectives are: Establish AQUAporin R&D lab, Q1 2007 <ul style="list-style-type: none"> • 20 x 20 cm demonstration membrane developed, ultimo 2008 • Conclude first licensing agreement in UPW production, primo 2009 • Conclude and evaluate field test in 3 water purification systems, Q2 2009 • First product on market, Q2 2010 • Break-even Q4 2009, profitable in 2010 • Broaden R&D activity of membrane technology to additional water markets (besides UPW), primo 2009 • Broaden marketing and licensing activity of membrane technology to additional water markets, primo 2010 • Conclude first licensing agreement in additional water markets in 2011 Patent applications covering the AQUAporin membrane technology™ has been filed in DK and in the US. The patent applications covers the principle of using aquaporins in a sandwich constructed membrane for water purification in any type of water purification process. Further embodiments of the membrane, as well as the product, AQUAporin water™, is also covered in the claims.
Innovations and advantages
Existing Reverse Osmosis membranes cannot purify beyond Ultra Pure Water

(UPW), but future AQUAporin Membranes can move the frontier to Absolute Pure Water (APW), and thereby give quality and cost benefits to industries using UPW today. – And creating Unique Selling Points, being:

- Reduced energy costs (estimated 5x energy reduction)
- Absolute Pure Water (99,999995%)
- Low production estimate

Current and potential domain of application

The potential for the AQUAporin membrane technology™ are enormous, and will in the future have great impact in many market segments.

The global market for raw materials, equipment and services going into water purification can be divided into a number of different segments, such as:

- Desalination of seawater
- Industrial process water
- Ultra-Pure Water (UPW)
- Municipal waste water treatment
- Agricultural water for irrigation

AQUAporin will focus on the UPW market as our entry market, to achieve Unique Selling Points, focused use of resources and rapid penetration.

The UPW market comprises a number of different segments, here listed in prioritised order:

- Pharmaceutical/biotech industry, where UPW is used in a number of different applications
- Power industry, where UPW is used to generate steam.
- Production of semiconductors, where UPW is used to rinse chips.
- Production of flat panels, where UPW also is used to rinse electronics.

All of these industries have increasing needs for UPW, and all are growing markets.

The standard component formfactors in which membranes are implemented, such as a spiral wound module, are generic cross-market products. Hence identical water membrane technologies and standard component formfactors are used in many different water purification markets.

Current state of development

The AQUAporin membrane technology is in the early stage of development.

However AQUAporin has recently closed a financing round of ~7 mill. USD, and will accelerate the membrane development through 2007-2008.

First product is expected in the market 2010.

Contact details

Organisation	AQUAporin
Website	www.aquaporin.dk (EU project; www.membraq.eu)
Contact person	Peter Holme Jensen
Address	Diplomvej 377 2800 kgs. Lyngby Denmark
Phone	+ 45 2810 5272
Fax	+ 45 88708090
Email	phj@aquaporin.dk

7. Zenon, UF membrane technology for backwash water treatment

Title and name of product or technology	
Submerged UF technology for backwash water treatment	
Abstract	
With submerged, PVDF based UF technology, back wash water can now be treated in a cost effective way, reducing the burden on groundwater consumption.	
Description	
Groundwater should be protected, and used effectively, especially in area's that are near the sea, to avoid intrusion of saltwater. As drinking water is being produced with sand filtration, and these filters have a normal recovery of 90 - 95 %. The remaining 5 or 10% can now effectively be treated with UF, that will concentrate this flow by a factor of 10. this water is free of particles and bacteria, and can be directly be used as drinking water.	
Innovations and advantages	
Various UF technology are on the market. However, most of them are either only suitable for MBR reactors, others are only suitable for water with a very low TSS level. Others use a Poly Ether Sulphone (PES) basis, which is sensitive for organic fouling, hence frequent cleaning would be necessary. With GE ZENON technology, there is a submerged PVDF based UF technology available that can cost effectively treat back wash water to drinking water and a concentrated waste flow.	
Current and potential domain of application	
As ground water totally depends on the local quality of the soil, the well deepness, local surface water etc. there will be variations in all the projects. In Holland the first back wash water treatment projects treating the full, not pre-settled flow are in operation. In Belgium there are no projects in operation on this application.	
Current state of development	
The technology is there, however, we need to find customers that are willing to support us in adjusting this technology for the local circumstances in Belgium.	
Contact details	
Organisation	ZENON B.V.
Website	www.zenon.com
Contact person	Frans Durieux
Address	Postbus 235 6920 AE Duiven Holland
Phone	0031 26 3120522
Fax	0031 26 3114610
Email	frans.durieux@ge.com

8. Memstill, desalination by membrane distillation

Title and name of product or technology	
Memstill	
Abstract	
A new desalination technique which makes use of waste heat and is very competitive. Also possible in combination with solar heat.	
Description	
<p>Memstill is a hybrid combination of membranes (contactor type and distillation). The Memstill technology uses hydrophobic membranes to separate warm sea water from pure distillate, and combines both a high transport of water vapour and a high transfer of evaporation heat into one membrane module. Because a Memstill module houses a continuum of evaporation stages in an almost ideal countercurrent flow process, a very high recovery of evaporation heat is possible: Gained Output Ratios (GOR) of 15-30.</p> <p>The process promises to decrease desalination costs to well below 0.50 €/m³, using low grade waste steam or heat as driving force.</p> <p>Memstill can economically operate at recoveries of less than 10%, without any additives like acids and antiscalants, producing high quality fresh water and a brine which is only 10% concentrated and with only 2 to 5 °C increased temperature, thus without any proven environmental damage.</p> <p>Memstill is energy/CO₂-neutral: it is driven by small quantities (80 – 200 MJ/m³) of waste heat or solar heat, temperatures between 60 and 90 °C are sufficient. For example, using the 2000 MW of waste heat which in principle is available in the industrial area of the Port of Rotterdam would produce 2 to 3 times the <i>total</i> water consumption of industries and households in the Netherlands.</p> <p>Due to its compactness (at least 10 times compared to MSF, comparable to RO) and containerized configuration, Memstill can be placed at the site where the heat is available, avoiding costly and low-yield transport of heat.</p>	
Innovations and advantages	
<p>Innovation is that a scaled up, leak-free module and process with high fluxes and low energy consumption.</p> <p><i>Advantages summary</i></p> <ul style="list-style-type: none"> - Low consumption of heat and electricity - Simple, fast modular construction - Small footprint - Minimal site work - Low investment and total costs - Very high product water quality - Double barrier to microorganisms - Limited corrosion and fouling - No additives - Ecologically justified brine disposal 	
Current and potential domain of application	
Near future: Small/medium scale seawater desalination for industrial water / of shore (< 500 m ³ /day); after 2010 large scale production of drinking water	
Current state of development	
2 Pilot installations of ca. 1 m ³ /h	
Contact details	
Organisation	TNO Industry and Science
Website	http://www.tno.nl/groep.cfm?context=markten&content=producten&laag1=190&item_id=229
Contact person	Albert Jansen
Address	PO box 342 , 7300 AH Apeldoorn, The Netherlands

Phone	+31 (0)55 5493943
Fax	+31 (0)55 549 3410
Email	albert.jansen@tno.nl

9. Ecodis, disinfection, electrochemical oxidation process

Title
Prevention and resistance to biological contaminants, including <i>Legionella</i> , using electrolysis
Abstract
<p>Nowadays, disinfection of tap water systems is mainly carried out using superheat-and-flush, copper/silver ionisation, ultraviolet light, instantaneous heating and hyperchlorination. Electrochemical disinfection is a relatively new concept. A low voltage current is directed across the electrodes causing the formation of oxygen radicals out of OH⁻ ions, resulting in <u>immediate disinfection</u>. Since tap water also contains chloride at low concentration, also chloride radicals are generated. Furthermore, out of both radical species, reactive ions are generated that are classified as 'free chlorine' or 'free oxidants', resulting in a disinfecting effect that can last from hours up to several days (<u>depot effect</u>). Bacteria such as <i>Staphylococcus aureus</i>, <i>Escherichia coli</i>, <i>Pseudomonas putida</i>, <i>Legionella pneumophila</i>, etc. are easily eradicated during passage through the <i>ecodis</i>[®] as well as in depot effect. The proposed disinfection mechanism of free chlorine or oxidants consists in the destruction of the bacterial outer cell membrane, the entrance in the cytoplasm and finally the degeneration of cytoplasmic proteins.</p> <p>The free oxidants generated by the <i>ecodis</i>[®] also clearly impacts biofilms, i.e. old biofilms are degraded, while the formation of new biofilms is prevented. Recent research showed the possibilities of the system for disinfection of purified vegetable process waters and decontamination of vegetables.</p>
Description
<p>The <i>ecodis</i>[®] is an in-line permanent adjusted disinfection system for disinfection of a diversity of water streams. The disinfection unit of the <i>ecodis</i>[®] contains specially coated, permanent electrodes. A low voltage direct current (VDC) induces from within the water itself, thus without chemicals, the formation of mainly oxygen based oxidants which create immediate disinfection. Bacteria-, viruses-, algae-, and other micro organisms are thus immediately destroyed.</p> <p>Not only oxygen, but also from in the water naturally present chlorides, chlorine radicals are also produced. This guarantees a permanent disinfection capability. A minimal concentration of chlorides is sufficient and is naturally present in all sorts of water. The two different disinfectants that are created by the <i>ecodis</i>[®] strengthen each other profoundly. Test cases have shown that free oxidants generated by the <i>ecodis</i>[®] have higher efficacy than free chlorine of NaOCl (bleach).</p> <p>The intensity and duration of the disinfection can easily be regulated via power input. Higher power will accelerate disinfection. In the event that the flow, for one reason or another, should decrease, the <i>ecodis</i>[®] will automatically shut down. Depending on the flow-rate and the water quality the microprocessor and control unit will adjust, as necessary, so that the disinfection level of the <i>ecodis</i>[®] are always optimal.</p> <p>Disinfection of drinking water using the <i>ecodis</i>[®] is carried out with respect for the existing drinking water standards in Belgium and Europe.</p> <p>Finally, the system can easily be monitored and adjusted by remote control and data communication via GSM modem.</p>
Innovations and advantages
<ul style="list-style-type: none"> • A great advantage of using the <i>ecodis</i>[®] is the fact that different active disinfecting components are created from within the water itself, without the addition of any chemicals. The distribution is thus homogenous in

<p>comparison to injection of NaOCl. Local over-doses and the related extra formation of (dangerous) by-products are not possible.</p> <ul style="list-style-type: none"> • Test cases have shown that free oxidants generated by the <i>ecodis</i>[®] have higher efficacy than free chlorine of NaOCl (bleach). • The <i>ecodis</i>[®] prevents not only the formation of, but also physically destroys and removes existing biofilms. A finished research project showed that biofilm-ATP as well as biofilm-AOC are removed efficiently using the <i>ecodis</i>[®]. • The use of permanent, long-life electrodes are responsible for low cost maintenance. The excellent immediate disinfection, the depot disinfection, and the adjustability of disinfection level make the <i>ecodis</i>[®] an optimal, efficient and, in comparison to other systems, cost effective system. • The use of power per cubic meter water is limited; typically less than 50 watt per cubic meter. • The system does not induce any corrosion. • Disinfection with the <i>ecodis</i>[®] is environmentally friendly and safe towards public health. 	
Current and potential domain of application	
<ul style="list-style-type: none"> • Disinfection of drinking water (both industrial and domestic) • Legionnaires prevention in sanitary installations • Water treatment in greenhouse and agriculture • Cooling tower and process water treatment • Medical sector (example: dental operation chair, ...) • Humidifiers and air conditioning • Swimming pool treatment • Waste water treatment (example: back-up for membrane filtration) • Aquatic treatment • Rain water treatment 	
Current state of development	
The <i>ecodis</i> [®] is currently commercially available, although further innovations are still ongoing	
Contact details	
Organisation	Ecodis nv.
Website	www.ecodis.be
Contact person	Dr. ir. Jaak Ryckeboer
Address	Brechtsebaan 30, 2900 Schoten, Belgium
Phone	+32(0)36416100
Fax	+32(0)36416109
E-mail	jaak.ryckeboer@ecodis.be ; info@ecodis.be

10. TA-Aqua+, oxidation process with UV/TiO₂

Title and name of product or technology	
TA-Aqua+	
Abstract	
<p>The technology is based on the Advanced Oxidation Technology (AOT) principle. The advanced oxidation will be achieved through a mass production of hydroxyl radicals directly in the water (photolysis) and indirectly through a catalytic reaction with Titanium dioxide which is present in the Titanium housing (photo catalysis). These processes are caused by the beam of two wavelengths produced by a special light source. The hydroxyl radicals will oxidize the cell membrane of the micro-organism and the cell will be irreversible damaged. The chemical composition of the water will not be changed.</p>	
Description	
<p>TA-Aqua+ 15: capable of treatment of 0 - 5 m³/hour, depending on demand and pollution TA-Aqua+ 30: capable of treatment of 0 - 5 m³/hour, depending on demand and pollution TA-Aqua+ 160: capable of treatment of 0 - 25 m³/hour, depending on demand and pollution</p>	
Innovations and advantages	
<p>The technology is based on a physical process that takes place in the Titanium reactor. The chemical composition of water will not be changed which means that the water will be potable without any addition of chemical toxic components. The redox potential of hydroxyl radicals is very high. This will cause, together with a hugh amount of hydroxyl radicals, a very high oxidation capability in the reactor. The energy consumption is very low. Yearly maintenance is easy to handle and of low cost</p>	
Current and potential domain of application	
<p>Drinking water Hot water circulating systems Cooling towers Humidifying systems</p>	
Current state of development	
Ready to market	
Contact details	
Organisation	Tour & Andersson AB
Website	www.tourandersson.com
Contact person	J. Wolters, Sector Head
Address	PO Box 188 2400 AD Alphen aan den Rijn The Netherlands
Phone	+31 172 446084
Fax	+31 172 491844
Email	jo.wolters@tourandersson.nl

11. WaterPyramid, evaporation with solar energy and condensation

Title and name of product or technology	
WaterPyramid	
Abstract	
The WaterPyramid combines large scale desalination and rainwater harvesting. The technology used is simple and durable and has been applied with good results in Africa for about 2 years now.	
Description	
Please see our website for a broad description, www.waterpyramid.nl .	
Innovations and advantages	
The WaterPyramid was rewarded with the World Bank Marketplace Development Award 2006. The innovation is that we developed a simple durable system that can be applied to purify salty and brackish water. Apart from that we professionalised rainwater harvesting techniques to such an extent that the water can now be applied for drinking water purposes. And last but not least, the system is incorporated within a proven business concept so that the system can be applied in rural villages in a financial sustainable way.	
Current and potential domain of application	
Water purification, rainwater harvesting	
Current state of development	
Ready to market	
Contact details	
Organisation	Aqua-Aero WaterSystems BV
Website	www.waterpyramid.nl
Contact person	Martijn Nitzsche
Address	Oude Delft 128, 2611 CG, Delft
Phone	0031-15-2129613
Fax	0031-15-2142926
Email	nitzsche@aaws.nl

12. Rainmaker, windmill producing water from air

Title and name of product or technology	
Water from air	
Abstract	
A Rainmaker is a windmill producing water in stead of electricity by condensating the available vapour from the air. The concept does NOT first make electricity and then utilises this a device for water production but DIRECTLY convert the wind energy in condensation energy.	
Description	
<p>The Rainmaker concept is a system whereby a stand-alone wind turbine is placed in rain lacking regions. This system is especially suited for such environments if also devoid of briny, brackish or polluted water bodies</p> <p style="text-align: center;"><i>A Dutch rainmaker system, literally, makes freshwater from air!</i></p> <p>The system's wind turbine does not drive a generator to produce electricity, as is commonly the case. Instead it drives a heat pump which is directly powered by the wind turbine's blades. With the heat pump the water vapour in the air is condensed and collected for domestic or irrigation purposes.</p>	
Innovations and advantages	
<ul style="list-style-type: none"> • Minimal local infrastructure is needed. • Sustainable and affordable technology. • Minimal environmental impact, no external energy sources needed (only wind). • 1 small sized windmill (18 meter rotor) can provide drinking water for an entire small village (500 - 1000 people). • Stand-alone, simple and robust, low maintenance, long lifespan (up to 20 years). • Minimal operating cost. • Applicable in numerous climatologically different geographical areas. <p>Local (geographical) production possible in a world-wide license structure</p>	
Current and potential domain of application	
Worldwide application in areas lacking sufficient local water resources OR first aid relief by means of a mobile unit.	
Current state of development	
A product prototype is being testes ad a test location during 2007. First series of Rainmakers will be available early 2008.	
Contact details	
Organisation	Dutch Rainmaker BV
Website	www.dutchrainmaker.nl
Contact person	Ms. M. Fikkert
Address	Agora 1, 8934 CJ Leeuwarden, The Netherlands
Phone	+31-58-2800730

Fax	
Email	info@dutchrainmaker.nl

13. Perfector-E, mobile purification unit, membrane filtration followed by UV disinfection

Title and name of product or technology	
Perfector-E Mobile water purification unit	
Abstract	
Recent humanitarian disasters like the tsunami in South East Asia and the war in Darfur boosted the need for the instant and reliable supply of safe drinking water in mostly rural and remote areas. In close collaboration with Dutch drinking water companies, Norit Membrane Technology (NMT) has developed a mobile water purification unit, denominated "Perfector-E" which filtrates and disinfects surface water, to provide consumable water. Its robust design and plug-and-play operation makes the unit suitable for a wide range of applications.	
Description	
The Perfector-E is an excellent system for the treatment of any polluted surface water. This compact built purification system is designed to provide high quality potable water out of heavily polluted surface water. Although not designed for desalination it is the perfect pre-treatment for RO.	
Innovations and advantages	
The "Perfector-E" is fed by a mobile generator and has a capacity of 2000 liter per hour net. The unit is based on membrane filtration; impurities like bacteria are retained by an automatically backwashed filter, followed by disinfection through ultraviolet light.	
Advantages: <ul style="list-style-type: none"> • Easy to use/operate • Produces high quality potable water • Easy to maintain • Low initial costs • Very robust • Useful in any situation requiring potable water 	
Current and potential domain of application	
The Perfector-E has been applied successfully and is still full operation in Atjeh, Indonesia (Tsunami emergency aid), Uganda refugee camp (MSF) and Paksitan (Kashmir region).	
In general: emergency and remote drinking water production at small scale	
Current state of development	
Commercially available and technologically proved in practice	
Contact details	
Organisation	Norit Membrane Technology B.V.
Website	www.noritmt.nl
Contact person	J. (Joost) Jacobs
Address	P.O. Box 731 NL-7500 AS ENSCHEDE
Phone	+31.(0)53.428 7010

Fax	+31.(0)53.428 7011
Email	info@noritmt.nl

14. MIMURA, magnetic treatment changing the molecular structure

Title and name of product or technology	
The MIMURA™	
Abstract	
Its an environmental recovery matrix designed to restore environmental black holes that have been caused by man.	
Description	
A resin crystal in a polymer sarcophagus that exhibits a focused force field that changes the molecular nature and structure of any liquid passing between its focusing radialix.	
Innovations and advantages	
The innovations and advantages occur at molecular levels i.e. surface tensions, nano-scaled sized reduction in the molecular structure e.g. water (minus ions H2O is 10-9) the expiration of harmful and odour filled gases from various samples e.g. pool water, alcoholic beverages, managing and reducing high concentrations of acids in large volumes of water i.e. HCl	
Current and potential domain of application	
To take samples of various liquids that are harmful and render them safe for consumption e.g. bore water to drinking water, hard water to neutral i.e. pools.	
Current state of development	
Ongoing development but already placed into niche markets. We are shipping large volume to our global distributor Lords of the Land Pty. Ltd. In Queensland, Australia	
Contact details	
Organisation	GICE MIMURA SPACE MATERIALS and TECHNOLOGY LIMITED
Website	Private intranet
Contact person	Leonard Melvin Fernando
Address	11 Putnam Street, Wishart, Queensland 4122
Phone	+61 7 3343 7150 (Australia) - +66 8 46 9999 57 (Thailand)
Fax	
Email	melvin@gicesecurity.net

15. Scalewatcher Enigma, electronic treatment preventing lime scale

Title and name of product or technology	
Scalewatcher Enigma Electronic Water Conditioning system	
Abstract	
A technology that removes and prevents build up of damaging lime scale in water systems, reducing maintenance, downtime, energy & water consumption without the use of chemicals	
Description	
An electronic unit generates a signal that is applied to the water by wrapping a signal coil around the outside of the pipe feeding vulnerable equipment and appliances. This changes the physical properties of the calcium and magnesium in the water thus preventing it from forming hard scale. Water is given back the ability of dissolving calcium and therefore it removes it and passes it harmlessly out to the drain	
Innovations and advantages	
Extends the life of water-fed appliances and equipment, eg boilers, washing machines, water heaters, refrigeration and cooling systems. Reduces cost of water treatment and reduces impact of chemicals on the environment	
Current and potential domain of application	
Anywhere there is hard water (65% of UK) all equipment that is used to heat or cool water will suffer a problem. Applicable to homes, businesses, local and central government organisations, etc	
Current state of development	
Although the systems are fully developed for potable water there is ongoing development for using it on waste water, sea water and other high TDS waters that may be used for water recovery, using for example Reverse Osmosis – the biggest challenge to the take-up of RO is the problem of membrane fouling and the massive increase in energy requirements that result – this can be reduced/eliminated using this non chemical method	
Contact details	
Organisation	Environmental Treatment Concepts Ltd
Website	www.electronicdescaler.com
Contact person	John Thompson
Address	4-5 North Park Business Centre Knowle, Fareham Hampshire, PO17 5LJ
Phone	01329 836960
Fax	01329 835406
Email	johnt@electronicdescaler.com

16. Calc -Tech, electronic treatment preventing lime scale

Title and name of product or technology	
Calc-Tech®, electro-magnetic treatment of water	
Abstract	
<p>The technology is the enhancement of the magnetic treatment with permanent magnets used since many years. The enhancement is resolving the known limitations of permanent magnets. These limitations are : flow speed dependent and low power. Calc-Tech is flow independent and can be applied around pipes of any diameter, using high power induction.</p>	
Description	
<p>Inductive coils create an electro-magnetic (inductive) field for the prevention of all kinds of deposits like lime scale. The crystals in the water do no longer form hard stone that is typical for lime scale. When depositions are avoided or removed, there is no bio film formed. This results in the reduction of chemicals that is added to the water.</p>	
Innovations and advantages	
<p>The system is innovative because it is using a magnetic field in combination with an electrical field, rather than permanent magnets. The technology is creating inductive pulses in the coils generating high electro magnetic energy. The coils are easy to apply, without opening the pipes and is unlimited in pipe diameter. The usage of Calc-Tech is avoiding or reducing the usage of chemicals, preserving the environment and reducing the risks for the health.</p>	
Current and potential domain of application	
<p>Used in protecting en cleaning pipes in water supply for cities, buildings, waste water treatment plants, cooling circuits in electrical plants and bio film removal/reduction. The system is extremely well accepted in the industry.</p>	
<p>Calc-Tech® is ready to use and has many industrial applications as reference.</p>	
Contact details	
Organisation	A-engineering nv
Website	www.a-engineering.be
Contact person	Dirk Esselens
Address	Galileilaan, 18 2845 Niel (Belgium)
Phone	+32 3 451 95 80
Fax	+32 3 451 95 89
Email	d.esselens@a-engineering.be

17. FACT, combination of crystallization and cake filtration followed by UV disinfection

Title and name of product or technology
Filtration Assisted Crystallization Technology (FACT)
Abstract
FACT, which stands for Filtration Assisted Crystallization Technology, is a hybrid process based on heterogeneous crystallization and filtration. During the process development heterogeneous seeds are selected, which enable a combination of fast crystallization and easy filtration. In the FACT-concept a small amount of an ion/molecule to be removed on the surface of a small amount of heterogeneous (i.e. of another chemical composition than the material to be removed) seeds in a crystallizer. Next, a filter separates the seeds with the layer of crystallized material from the solvent (often but not exclusively water). The grown seeds are then recycled to the crystallizer as a concentrated suspension. Consequently, the heterogeneous seeds grow during the FACT process until the moment that they are bled off when they reached the required size. FACT is compact due to the fast crystallization and easy filtration and it has been shown for water softening – one of the many possible applications of FACT – that it can compete technically and economically with alternative softening technologies like the pellet reactor and ion exchange.
Description
FACT, a new generic process developed by TNO, can amongst others be applied for the removal of hardness by means of the precipitation of calcium carbonate (CaCO ₃) on heterogeneous seeds. During the development heterogeneous seeds are selected by Medium Throughput Screening techniques, which accelerate the crystallization and which can easily be separated from the treated liquid. The acceleration of the crystallization is caused by stimulation of the heterogeneous nucleation. Examples of interactions between the seed and the material to be crystallized that can stimulate heterogeneous nucleation are preferential adsorption of the reacting ions and/or a good lattice matching between the seed and the crystal. The size of the seeds, which determines the surface area available for crystallization, is not only important for the crystallization kinetics, but also for the solid-liquid separation. In FACT the heterogeneous seeds are typically in the range between 5 and 50 µm. This seed size is large enough to enable an easy and cheap S-L separation by standard filters and small enough to small enough to accelerate crystallization by providing a sufficiently large active surface area for crystallization.
Innovations and advantages
The innovation in FACT-concept is the use of a relatively small amount (about 1 g/l) of heterogeneous seeds which create process advantages like a significant increase of the crystallization kinetics, while at the other hand a compact and cheap filter can be utilized for the S-L separation. The heterogeneous seeds are recycled to the crystallizer after filtration. TNO has applied for a patent on the FACT process. An important advantage of FACT is that it is a generic applicable hybrid process. For the application of FACT in the softening of water the following advantages were demonstrated: <ul style="list-style-type: none"> • Ca²⁺-ions could be removed very efficiently with FACT. The removal could be tuned at levels between 50 and 98%, thus also creating the possibility of split stream treatment. • FACT has the potential to be cheaper than competing – state of the art – softening techniques like the Pellet Reactor • FACT is much more flexible in the choice of the process conditions/-concepts and the type of seed material than the Pellet Reactor • The combination of a fast crystallization kinetics (5-10 times faster) and the low height of the unit operations ensure that FACT-installations can be much more

<p>compact than the Pellet Reactor.</p> <ul style="list-style-type: none"> Both the softened water and the removed CaCO₃ can be (re)used easily, so it is a potential water free process. 	
Current and potential domain of application	
<p>Until now the development of FACT has been focused on the softening of ground-/drinking-/process-water. The FACT-concept is generic and can for instance also be applied for the removal of F⁻, heavy metals or PO₄³⁻ from process- or wastewater. A further promising application of FACT is to use the concept for a controlled change of the shape and/or size and/or polymorph of solid products like fine chemicals and/or pharmaceuticals.</p>	
Current state of development	
<p>On site pilot plant experiments have been carried out for the FACT concept for two industrial ground- and process water streams at a scale of up to 5-10 m³/hour using calcium silicate as heterogeneous seed and a Pulse Tube Filter for the solid-liquid separation. In these tests the water streams were softened successfully with FACT: the Ca²⁺-concentrations could be decreased by 80-85%, the solids content in the filtrate was below specification and high filtration fluxes between 2.5 and 4 m³/m².hr could be realized with the Pulse Tube Filter at relatively low pressures between 0.2 and 2.5 bar.</p> <p>The experimentally measured crystallization and filtration data were used in a rough economic evaluation of the costs for the softening of groundwater with FACT. This evaluation showed that FACT could be about 30% cheaper than the costs for softening with the pellet reactor, the state-of-the-art technique for the production of Dutch drinking water.</p> <p>FACT has reached the status of proof of concept and is close to implementation. Main points of attention during the further development are solving unwanted scaling on some components in the installation – potential technical solutions have been identified but not yet tested – and to demonstrate long term stability and robustness of the FACT process.</p>	
Contact details	
Organisation	TNO Science & Industry; Department of Separation Technology
Website	www.tno.nl
Contact person	Dr. Dirk Verdoes
Address	P.O. Box 342 7300 AH Apeldoorn The Netherlands
Phone	+ 31 55 549 3053 (office); +31 651 347 967 (cell phone)
Fax	+ 31 55 549 3410
Email	dirk.verdoes@tno.nl

18. Uranex, Uranium removal by adsorption

Title and name of product or technology	
Uranex	
Abstract	
Uranium removal in drinking water	
Description	
Uranium removal with high selective adsorption material	
Innovations and advantages	
compact and selective system	
Current and potential domain of application	
ground or surface water for drinking water treatment	
Current state of development	
first reference plant, some pilot tests	
Contact details	
Organisation	Krüger WABAG
Website	www.Krueger-wabag.de
Contact person	Dr. Klaus Hagen
Address	Weierstr. 19 95448 Bayreuth
Phone	+49(0) 921/15 08 79-326
Fax	+49(0) 921/15 08 79-444
Email	klaus.hagen@veoliawater.com

19. Aqualite, filtration technology based on the natural mineral Aqualite

Title and name of product or technology	
Josab Aqualite™ System, Filter media Aqualite™	
Abstract	
Compact Water purification Systems without addition of chemicals, Natural filter media for different applications.	
Description	
Filtration technology based on the natural mineral Aqualite™	
Innovations and advantages	
Purifies the water without addition of Chemicals, is simple and versatile. Produces fresh water meeting WHO standards, high efficiency and capacity/equipment volume ratio	
Current and potential domain of application	
Drinking water, waste water treatment, oily bilge water treatment	
Current state of development	
Drinking water systems are in use, waste water treatment systems being tested, oily bilge water separators are in use.	
Contact details	
Organisation	Josab International AB
Website	www.josab.com
Contact person	Anders Vidhav
Address	Tågagatan 13 252 22 helsingborg, Sweden
Phone	+46 42 21 99 54
Fax	+46 42 21 99 64
Email	anders@josab.com

20. Advanced Amberpack, a nitrate removal process by ion exchange

Title and name of product or technology
Advanced Amberpack Nitrate Removal Process
Abstract
<p>Christ Kennicott Water Technology have for many years marketed their <u>Standard Amberpack™ Technology</u> successfully throughout the UK. Rohm & Haas (UK) Ltd, the world leader in ion exchange resin manufacture and Christ Kennicott Water Technology Limited, recognising their joint experience and expertise, have agreed to market to the water industry, a proven process that offers minimal waste stream problems yet is economic to build and operate. This process is known as the Advanced Amberpack™ Technology.</p>
Description
<p><u>Advanced Amberpack™ Technology</u></p> <p>Our Advanced Amberpack™ Technology is a process that offers a number of advantages over Standard Amberpack™ with the ability to regenerate the resin using only a bed volume of regenerant. This is possible due to the highly efficient Fractal distribution system used. The Fractal system is made from a flat plate thus eliminating the internal volume associated with the dished ends that were previously used. Similarly, less than one bed volume of rinse water is required to remove sufficient of the contaminated regenerant from the vessel. The 'plug' flow, created by the Fractal distribution system, passes through the vessel and offers a much more defined cut off point than when using a Standard Amberpack™ vessel. This allows greater water recovery. All the remaining rinse water can then be recovered as initially brine dilution water and then rinse water for the next regeneration.</p> <p>Use of Advanced Amberpack™ vessels and water recycling during regeneration gives a water conversion efficiency of around 99.8%.</p> <p>Each proposed nitrate removal plant consists of two or more (2 x 100%) streams; each stream consisting of a strong base anion (SBA) vessel complete with nitrate selective resin. During operation, one or more vessels will be on line and the other vessel will be out of service for regeneration or in standby mode. Dependent on the quantity of water to be treated, the duty vessels will be put into, or taken out of, service.</p> <p>Regeneration is completed using a 7-13% brine solution prepared using a salt saturator and softened water. In the event of a vessel being taken off line for an extended period the vessel can be selected to hold at the end of the brine injection leaving the vessel full of brine. Prior to going on line again, the vessel will then complete a rinse to waste before entering a full regeneration cycle.</p> <p>Each stream treats a maximum flow rate of 60 m³/h. Whilst on-line, the flow through each of the ion exchange units includes the required water to produce softened water for the next regeneration.</p> <p>As the feed water is generally variable, we usually include for a feed water nitrate monitor that is used to calculate the run length based on nitrate load. This results in a far more efficient plant. In the event that the product quality from one ion exchange unit rises above a specified value, the programmable logic controller will automatically initiate the regeneration sequence.</p> <p>Product water from the ion exchange vessels is blended with the raw water according</p>

to the results from the blended water nitrate monitor using a feedback control loop. As the nitrate level rises more water will be pushed through the ion exchange plant subject to the maximum permissible flow.

As the nitrate level drops, the flow through the ion exchange vessels will be reduced subject to a minimum of 20m³/h per vessel. Should the feed water nitrate concentration fall below the blended water set point the ion exchange plant will go into standby and wait until the level rises again and treatment is required.

The ion exchange plant normally receives a demand for water signal from a downstream tank or storage reservoir. The ion exchange plant will then operate to maintain this tank in a full condition.

A resin trap is included downstream of the ion exchange vessels to prevent resin loss via the water outlet. As a precaution, we would recommend strainers are included upstream of the Advanced **Amberpack**TM units to prevent any suspended solids reaching the ion exchange resins. These strainers are only required to catch occasional spikes of suspended solids, it is anticipated the feed water will normally have a suspended solids content < 1 mg/l.

Innovations and advantages

Compact process reducing civil footprint.

Use of Advanced **Amberpack**TM vessels and water recycling during regeneration gives a water conversion efficiency of around 99.8%.

Current and potential domain of application

Currently six operational plants in the UK and two more under construction. Potential, anywhere in the world that has nitrate problems.

Current state of development

Fully proven process.

Contact details

Organisation	Christ Kennicott Water Technology Ltd.
Website	WWW.Christwt.co.uk
Contact person	John Geary
Address	Kennicott House Well Lane Wednesfield Wolverhampton West Midlands WV11 1XR
Phone	01902 721212
Fax	01902 721333
Email	john.geary@christwt.co.uk

21. NITREAT, a nitrate removal process by ion exchange

Title and name of product or technology	
Nitreat –nitrate removal process	
Abstract	
This is a high rate ion exchange process for removal of nitrate from drinking water	
Description	
The process uses a multiport valve for supplying source water, brine for regenerating and rinse water.	
Innovations and advantages	
The process achieves high removal efficiency (to less than 5 mg/l of nitrate), uses little power, minimises the amount of brine needed for regeneration and most importantly, generates less than 0.5% of throughput water for disposal.	
Current and potential domain of application	
Fully developed and used by Thames Water and Anglian Water	
Current state of development	
Anglian--5 plants in operation, 2 under construction and 3 in design/ manufacture Thames – first plant to be built in 2005.	
Contact details	
Organisation	ACWA Services Ltd
Website	www.acwa.co.uk
Contact person	David Spurr
Address	ACWA House, Keighley Road, Skipton, North Yorkshire, BD23 2QG
Phone	01756 794794
Fax	01756 790898
Email	djspurr@acwa.co.uk

22. Aquaerator, mixing and aeration technology for reservoirs

Title and name of product or technology
Innovative Mixing and Aeration Technology for Reservoirs - The AQUAERATOR
Abstract
<p>The Invention of the AQUAERATOR was born from a crescendo of 35 years of working within the Water Industry, particularly dealing with the existing aeration and mixing devices on the market at that time. The AQUAERATOR was invented by AMG Ltd and received a substantial EU Grant of nearly 1 Million Euros. The Research and Development was split between HR Wallingford (UK) and the University of Barcelona. The 2 year EU Project (with full scale field trials) was completed in 2003. Since then AMG Ltd has installed 3 complete AQUAERATION Systems in drinking water reservoirs with a UK Water Company and 1 in a recreation lake with a Metropolitan Borough Council. In addition AMG LTD have expanded the Environmental Consultancy Division which enables us to scientifically evaluate the pre and post AQUAERATOR Installation. AMG Ltd are the only Company who have the sole rights to Supply and Install the AQUAERATOR. The AQUAERATOR is proven to be significantly better than our nearest competitor - the existing Helixor technology. During the R&D it was concluded that the AQUAERATOR would be suitable for the Fish farming and Wastewater Treatment Industries, for which we are considering further EU funding.</p>
Description
<p>The AQUAERATOR is based upon the amalgamation of the two aeration and mixing technologies for reservoirs on the market - the helixor and the air curtain - using the main advantages of both. The AQUAERATOR consists of a spherical stainless steel manifold with 40 air jets, a 2m high draught tube sits on top of the innovative technology, with an external diameter of 600mm. The compressed air source feeds each AQUAERATOR using MDPE pipe, which is laid on the bed of the reservoir. The air is forced through the central manifold at 12.5 l/s NTP, and the rising air and denser near bed water are well mixed in an extremely turbulent bubble plume. For example, at the top of the 2m draught tube the mixed air and water is around 175 l/s, and at about 20m head of water above the AQUAERATOR this entrained volume increases to 13.4 tonnes/sec. It has been calculated that even by reducing the length of the draught tube by 75% the reduction of entrained mixed air and water is only 30%.</p>
Innovations and advantages
<p>The major advantage between our competitors and AMG Ltd is that there is no scientific information about the air curtain or the Helixor, which could make the specification of the aeration solution pretty hit and miss with our competitors. During the design of the AQUAERATOR new software was developed to enable AMG Ltd to scientifically calculate the exact number of AQUAERATORS that is needed, thus saving the client both Capital and Running Costs. It is well known that the air curtain, although basic technology, uses an enormous amount of compressed air, which increases the running and energy costs for the customer. The helixor is relatively inefficient and therefore needs significantly more units to be able to provide the same water quality improvement as the AQUAERATOR.</p> <p>AMG LTD has recently undertaken a financial and scientific review of all of the aeration and mixing technologies on the market and we cannot be beaten on both Capital and Running Expenditure.</p> <p>It is well known that many reservoirs have problems with high levels of heavy metals during the summer months and AMG Ltd are currently researching methods to significantly lower these metals in the water column to further reduce costs during</p>

the drinking water treatment process. In addition we are also scientifically researching a method to significantly reduce the concentrations of phosphates and nutrients from entering the feeder streams, with the ultimate goal of preventing the formation or significantly reducing algal blooms. The AQUAERATOR is able to significantly reduce the stability of the *oscillatoria* in the water column, which should also help to prevent the bloom from flourishing. The reduction of the quantity of the algal bloom should also reduce the associated drinking water problems such as taste and odour.

Current and potential domain of application

AMG Ltd are currently focussing on the UK Water Industry and we are working closely with 4 Water Companies. AMG Ltd is in the process of undertaking the first field trial for fish farming for halibut in a fiord in Norway. Upon completion of this trial towards the end of 2007, it is likely that further scientific trials will be undertaken to evolve the AQUAERATOR within the Fish Farming Industry. The AQUAERATOR is patented around the world and it is our vision to begin exporting our product Worldwide during 2007/2008.

Current state of development

The EU funded Research and Development for the AQUAERATOR for improvement of drinking water quality has already been completed in 2003. AMG Ltd are now waiting for results from previously installed AQUAERATION Systems during the predicted hot summer of 2007, which should scientifically prove the innovation and production model of the AQUAERATOR to the Water Industry.

Contact details

Organisation	AMG Ltd
Website	www.aquariusmg.com
Contact person	Tony Wynes - Managing Director
Address	Mill Lane The Beckery Glastonbury Somerset BA6 9NT
Phone	00 44 1458 834734
Fax	00 44 1458 834734
Email	twynes@aquariusmg.com

23. Messner plate aerator for nitrification

Title and name of product or technology	
Plate aerator	
Abstract	
Energy efficient solution for aeration in the field of waste water and drinking water	
Description	
See leaflet	
Innovations and advantages	
Innovative for drinking water production	
Current and potential domain of application	
Waste water treatment	
Current state of development	
Application for the use in drinking water solutions is applied for with KIWA, the Netherlands	
Contact details	
Organisation	Bosman Watermanagement
Website	www.bosman-water.nl
Contact person	Bart Jan Brandt
Address	PO Box 3701 3265 ZG Piershil The Netherlands
Phone	+ 31 186 606031
Fax	+ 31 186 699009
Email	bjbrandt@bosman-water.nl

24. Micromac-ToxScreen, online monitor using luminescent bacteria

Title and name of product or technology	
Micromac-ToxScreen	
Abstract	
Micromac-ToxScreen is an innovative automated online water quality monitoring system that uses luminescent bacteria biosensors to detect µg/L concentrations of toxic organic and inorganic chemical pollutants in surface or ground water, as well as raw and treated drinking water.	
Description	
<p>The ToxScreen bioassay uses a renewable suspension of luminescent bacteria developed and produced by the Israeli company partner Checklight Ltd. When the bacteria are automatically mixed with a water sample, their light production, which is directly tied to cell respiration and other critical metabolic pathways, is decreased in proportion to the toxicity in the sample.</p> <p>The analytical part of the instrument is an automatic analyzer that uses a Systea's patented technology called Loop Flow Analysis (LFA) widely used in a variety of online chemical analyzers for water quality. At 14 day intervals, the instrument is re-supplied with a fresh inventory of liquid assay buffers and a freshly hydrated suspension of the freeze dried luminescent bacteria. Automatic safeguards have been engineered into the system to assure reagent and data quality and appropriate instrument functioning.</p> <p>The instrument is also equipped with auto calibration features to assure reliable instrument performance; microprocessor based system controls provide for data storage, data downloading, real time communication with a remote PC, and user adjustable alarm levels.</p>	
Innovations and advantages	
<p>The analyzer provides alarms in the presence of sub-ppm concentrations of a wide spectrum of toxic pollutants including pesticides, herbicides, PCB's, PAH's, heavy metals, biotoxins, petroleum based contaminants, protein synthesis inhibitors and respiratory inhibitors; the bioassay was found to be up to hundred folds more sensitive than commonly used bioluminescence-based tests. Main features are the following</p> <ul style="list-style-type: none"> - Alarms generation on two different type of chemical substances: organics and metals - Fully automatic operation - Long autonomy; low maintenance, good quality/ price operating costs - Low reagents consumption; short preparation time; low disposable costs - Easy operation; fully documented plug in analyzer, no special training is required 	
Current and potential domain of application	
<p>This analyzer is particularly suited to be used for raw drinking water monitoring, early warning of dangerous spills, accidents, sabotage and bioterrorism.</p> <p>Others fields of application:</p> <ul style="list-style-type: none"> - Natural resources real time water quality monitoring. - Waste water plants outlet control. 	
Current state of development	
<p>A series of field tests are going to be organized in Europe and Israel.</p> <p>A new joint venture company between Systea and Checlight is going to be established, in order to commercialize the product worldwide.</p>	
Contact details	
Organisation	SYSTEA SpA
Website	www.systea.it

Contact person	Luca Sanfilippo
Address	Via Paduni, 2A 03012 Anagni (FR) ITALY
Phone	+39-0775-776058
Fax	+39-0775-772204
Email	luca.sanfilippo@systea.it

25. TOXcontrol, online biomonitor using luminescent bacteria

Title and name of product or technology	
TOXcontrol; on-line biomonitor using luminescent bacteria	
Abstract	
The TOXcontrol uses luminescent bacteria as an indication of toxicity. This test uses a decrease in luminescence as an effect endpoint to measure the toxicity of water samples.	
Description	
The luminescent bacteria monitor is an automated version of the ISO 11348 allowing continuous monitoring of water samples. The acute test with this bacteria species is one of the most and best known ecotoxicity tests and has been used in ecotoxicological research since the 1980's. Because of the sensitivity to different substance groups and the short time needed to perform the test, the toxicity assessment with <i>Vibrio fischeri</i> is internationally standardized and accredited (ISO 11348 Determination of the inhibition effect of water samples on the light emission of <i>Vibrio fischeri</i>).	
Innovations and advantages	
It is the only system on the market, using luminescent bacteria, for continuous, on-line monitoring of toxicity in drinking water and surface water. It has the capability of protecting drinking water companies for the introduction of toxic chemicals into their water and ending up into their drinking water product.	
Current and potential domain of application	
The current application is mainly drinking water intake protection. Potential, future application is the use of this system for waste water toxicity monitoring. It would be particularly useful for effluent and influent monitoring helping to better regulate the waste water treatment process and minimising the effect of the effluent on the environment.	
Current state of development	
After the prototype production last year the 1st production series of 5 instrument have been built. Currently the experiences from customers and testing institutes are being evaluated to be integrated into the next series. Further developments are being discussed for new applications of the instrument. Possibilities are discussed for using ATP monitoring (drinking water and biofilm fouling applications) or nitrifying bacteria (waste water applications) on the platform (which is basically a pipetting robot) of the TOXcontrol.	
Contact details	
Organisation	microLAN BV On-line Biomonitoring Systems
Website	www.toxcontrol.com / www.microlan.nl
Contact person	Joep Appels
Address	Biesbosweg 2, 5145 PZ Waalwijk, Netherlands
Phone	0031 416 348090
Fax	0031 416 347504
Email	joep.appels@microlan.nl

26. Optisense, optical biosensor for real time monitoring

Title and name of product or technology
Optisense Optical Biosensor Technology for real time monitoring of drinking water
Abstract
Patented biosensor platform technology for instant and ultra-sensitive detection of (bio-)chemical substances. Technology based on unique combination of integrated optical chip technology, bio-chemistry and micro fluidics. Measurement of refractive index changes of agent specific absorbents.
Description
The Optisense Optical Biosensor technology is based on integrated Mach-Zehnder interferometry and SiON-technology. Principally, the sensors consist of a chemo-optical transduction layer (the refractive index of which is sensitive to the chemical concentration of a specific analyte), an integrated optical system (which converts the change of refractive index into an electrical signal) and processing and control electronics. The generic part of the sensor (integrated electronics, software and sensor chip) can be customized for specific use by applying application-specific, selective bio-chemical layers. The bio-chemical layers can be regenerated (on site) and reused (up to 500-1000x).
Innovations and advantages
<ul style="list-style-type: none"> • On-site detection of contaminants (portable options) • Instant on line read-out of measuring results • Platform technology • High sensitivity (laboratory quality, ppb) • Flexibility (choice of bio-chemical layers) • Reliability • Cost efficiency (on-site applications, no highly skilled staff required)
Current and potential domain of application
<p>Current domain of application</p> <ul style="list-style-type: none"> • <u>On line monitoring of drinking water quality</u> <p><i>Example: The SafeWat-project (Σ! 3181)</i></p> <p>This project encompasses:</p> <p>(1) the development of an integrated monitoring system for drinking water supplies which enables immediate response to water quality changes and</p> <p>(2) the construction of a sensing system integrated in the drinking water supply infrastructure for the 'source to tap' monitoring of drinking water quality.</p> <p>The SafeWat-project is a cross-border cooperation representing all links of the drinking water chain:</p> <ul style="list-style-type: none"> - Vitens - Kiwa Water Research - Mekorot National Water Co - OptiSense - Sandia National Laboratories <ul style="list-style-type: none"> • <u>On site detection of specific contaminants</u> <p><i>Example: Mobile detection of pesticides in drinking water</i></p> <p>Optisense develops, in close collaboration with Dutch drinking water company Vitens, a highly sensitive (0,1µg/L), portable, field-use measuring system for the</p>

concentration of pesticides in water-collection areas.

Potential domain of application

- Food industry, health care, security

The Optisense sensor technology is available to a wide range of markets that require accurate, quick and sensitive testing methods at low cost per test. Thanks to the platform-based core technology, the Optisense sensors have an almost infinite range of application possibilities.

Currently, Optisense is finalizing a sensor for the detection of mycotoxins.

Current state of development

Fine tuning of proto type.

Contact details

Organisation	Optisense B.V.
Website	www.optisense.nl
Contact person	Marcel Klein Koerkamp
Address	Hengelosestraat 706 7521 PA Enschede - the Netherlands
Phone	+31 (0)53 48 36 377
Fax	
Email	marcel.kleinkoerkamp@optisense.nl

27. Microarray immunichemical sensors using fluorescence

Title and name of product or technology	
Inexpensive handheld instrument and biochip for in-situ biochemical analysis	
Abstract	
To secure safe drinking water it is critical to access water quality at the waterworks quickly and react accordingly without lengthy delay. Our company vision is to develop and market an instrument and consumables intended for early detection and warning for microbiological contamination. Cyanobacteria and its toxins are our first target. State-of-the-art analyses for cyanotoxins such as HPLC or ELISA require skilled operators and sophisticated instruments. Therefore analysis is carried out in central laboratories. The total time of analysis can be up to one week, which imposes an unacceptable health risk to the consumers. This can be completely avoided if the analysis is carried out at the waterworks. Detailed market research and analysis based on e.g. interviews with water companies in the EU shows that there is an urgent need for such an instrument. The users are requesting an instrument that is portable, robust, inexpensive, reliable and user-friendly.	
Description	
The handheld instrument is based on microarray immunochemical sensors using fluorescence detection. The technological platform is generic and most immunoassay can be adapted.	
Innovations and advantages	
We have selected a technology platform that makes the end-user happy. The only task for the end-user is to unpack a disposable, apply sample and insert the disposable into the instrument. Minimal involvement of the end-user greatly reduces human errors. Using novel protein microarray technology combined with fluorescence imaging we combined multi-analyte analysis with ultra low detection limits. In close collaboration with world-class specialists, our innovative elegant design and architecture result in an extremely compact, robust and inexpensive instrument and biochip.	
Current and potential domain of application	
Our current focus is cyanotoxins. We envision great potential in all domains of water analysis based on immunoassays.	
Current state of development	
Establishing second round of financing for the next 3 years. We expect to launch our first product in one year and the instrument and consumables in 2010.	
Contact details	
Organisation	Toxispot - a spin-off of DHI Water, Environment & Health and NOVI
Website	http://www.toxispot.com/
Contact person	Hanne Kaas
Address	Agern Allé 5, 2970 Hørsholm, Denmark
Phone	+45 45 16 9538
Fax	+45 45 16 9292
Email	toxispot@toxispot.com

28. GeneDisc Cyclers, real time PCR

Title and name of product or technology	
GeneSystems technology: GeneExtract, GeneDisc Cyclers and the GeneDiscs	
Abstract	
Rapid, automated and standardised method for bacterial analysis of water networks. The GeneSystems Method is based Real Time PCR technology. For example, the GeneSystems technology is giving back a result of Legionella analysis in 3 hours from sample to result compare to 10 days using classic culture method.	
Description	
From sample to DNA, the GeneExtract is a sample preparation device. From DNA to result, the GeneDisc Cyclers is an automated thermocycler. Ease of use, the GeneDisc is a dedicated consumable for Real Time PCR	
Innovations and advantages	
Ease of use, automation and standardisation, GeneSystems technology brought the Real Time PCR to routine analysis level. The advantage of such a method is its turn around time: 3 hours from sample to result where the culture method takes 10 days! This criterion is very important for the health risk assessment such as the Legionella monitoring in water networks.	
Current and potential domain of application	
Environmental monitoring (water, bathing water, process water, air and sludge analysis) : All bacterial testing application such as Legionella, Pseudomonas, E. coli, Enterococcus, Total Flora, Cyanobacteria, etc. Process water and ultra pure water for Pharmaceutical plant : specific application to ultra pure water testing (Pseudomonas, Mycoplasma, etc.) Food Testing: Listeria, Salmonella, Campylobacter, etc.	
Current state of development	
World wide commercialisation. N°1 for Legionella Water analysis rapid method in France, UK, USA.	
Contact details	
Organisation	GeneSystems
Website	www.genesystems.fr
Contact person	Bertrand Coissac, Product Manager
Address	1, rue du Courtil - Centre CICEA 35170 BRUZ France
Phone	+33 299 059 124
Fax	+33 299 053 551
Email	bcoissac@genesystems.fr

29. CAD ZetaCAD, streaming potential technique to measure properties of membranes

Title and name of product or technology	
CAD ZetaCAD	
Abstract	
Scientific instrument to measure electrostatic and electrokinetic properties of various solid surfaces, such as membranes, precipitates, ceramics, powders, etc. Technique is used to study adhesion (fouling), charge permeability, filtration properties, etc. Measurement of <i>zeta potential</i> , <i>tangential streaming potential</i> and <i>surface conductivity</i> on <i>solid surfaces</i> by means of <i>streaming potential technique</i> .	
Description	
Measurement of : <ul style="list-style-type: none"> • Streaming Potential • Electrical Conductivity • Temperature <ul style="list-style-type: none"> • Applicable to particles above 50 µm diameter and flat surfaces. • Reliable and simple to setup. Measurement and rinsing of the system are fully automated. • Menu driven software Windows based. • Data acquisition creates ASCII files directly compatible with usual spreadsheet. 	
Innovations and advantages	
Modular system with uniform cell holder and flexible cell design for each application: Porous plug cells for various powders, custom made cells for non-woven, solid surfaces, (multiple layer) membranes, ceramics,... Streaming current measurement on request.	
Current and potential domain of application	
Water purification, (nano)filtration membranes, reverse osmosis membranes, filtration, biofouling, coatings	
Current state of development	
Product commercially available. Cell design on request.	
Contact details	
Organisation	Wilten Instruments
Website	www.wilten.nl
Contact person	Ir. Maykel Roelen
Address	Mon Plaisir 23 4879 AK Etten-Leur The Netherlands
Phone	+31 76-5016920
Fax	+31 76-5014499
Email	info@wilten.nl

30. AquaScope, inline FISH biomonitor

Title and name of product or technology	
AquaScope	
Abstract	
The Aquascope is a biomonitor to continuously monitor the microbiological composition of a fluid on line.	
Description	
For the on line monitoring of bacteria with the Aquascope, a combination of existing and innovative techniques is used, based on Fluorescent In Situ Hybridisation (FISH), using bacteria-specific DNA-probes. When the probes are labeled on the r-RNA of bacteria they are visualized with an optical instrument. The images are automatically analysed by means of high tech software.	
Innovations and advantages	
The Aquascope is the 1st autonomous in-line biosensor for both quantitative and qualitative bacterial detection in liquids.	
Current and potential domain of application	
The Aquascope can be applied anywhere where bacteria need to be detected in fluids, with the following practical examples: <ul style="list-style-type: none"> • Detection of Legionella in cooling water systems • Detection of Bacillus Cereus in potato processing industry • Detection of E. Coli in drinking water • Detection of viruses in feed water in greenhouses • Detection of beer spoilers in the brewing industry • Detection Colony forming Units (CFU) • Live and dead detection • Etc. 	
Current state of development	
The Aquascope is being demonstrated now (2007) at various (industrial) locations. The first series will be available to the market by the end of 2007.	
Contact details	
Organisation	Aqua Explorer B.V.
Website	www.aquaexplorer.nl
Contact person	Mr. A. Engelaar
Address	Agora 1, 8934 CJ Leeuwarden, The Netherlands
Phone	+31-58-2882544
Fax	+31-58-2801329
Email	info@aquaexplorer.nl

31. Microchip capillary electrophoresis as separation technology

Title and name of product or technology	
Automated sampling and analysis of drinking water on the Capella microchip capillary electrophoresis platform for quantitative determination of cations and inorganic anions.	
Abstract	
Microchip CE separation of drinking water samples can be used for quantitative determination of cationic species such as potassium, sodium, calcium and magnesium ions but also for measurement of anionic species such as chloride, bicarbonate and sulphate ions. The described Capella system can be used for automated sampling of drinking water for the assessment of water quality.	
Description	
The Capella platform consists of a CE microchip in a chip cartridge, connected via a chip cartridge holder to a high power supply unit and a conductivity detection unit. Optionally, the system can be extended with an automated sampler and washing station thereby enabling semi-continuous monitoring. MCE separation can be very fast and the estimated time for completing a full sampling/separation/washing cycle is about 2 min.	
Innovations and advantages	
Automation of sampling and MCE separation of drinking water enables monitoring of water quality and may thus help to improve water management in, for example, contamination and scaling issues.	
Current and potential domain of application	
Current: water quality → measurement of abundant ionic species such as K^+ , Na^+ , Ca^{2+} , Mg^{2+} , Cl^- , SO_4^{2-} , HCO_3^- . Potential: water quality + safety concerns → fingerprinting the content of higher as well as lower abundant ions in drinking water; a synergistic combination with other technologies (e.g., UV/VIS spectrometry) may deliver a good tool for signaling possible contamination events and also for identifying contaminants.	
Current state of development	
System is largely developed but microchip and separation need further optimization in aspects such as resolution and sensitivity. Furthermore, reproducibility of the automated sampling and separation is still an area of interest.	
Contact details	
Organisation	CapiliX B.V.
Website	www.capilix.com
Contact person	G.A.J. Besselink
Address	PO Box 455, 7500 AL Enschede, The Netherlands
Phone	+31 53 489 2471
Fax	+31 53 489 3601
Email	service@capilix.com

32. Electronic Nose (FOX) and Tongue (ASTREE)

Title and name of product or technology	
Electronic Nose (FOX) & Tongue (ASTREE)	
Abstract	
<p>The fox is well known to solve applications linked to the packaging. It analyses variation of samples being in contact with packaging (polymer tubes, pellets, glass or plastic containers,)</p> <p>The Astree has been under tested with water samples in order to check its performance. This will be done within TECHNEAU project.</p>	
Description	
<p>Systems based on metal oxide sensors or GC to analyse gas phase</p> <p>Systems based on polymer sensors to analyse liquid phase</p>	
Innovations and advantages	
<p>Allow to correlate with organoleptic perceptions (gustative & olfactive)</p> <p>Allow to check influence of packaging or polymer tubings</p>	
Current and potential domain of application	
Current applications : environment, packaging, pharmacy, food & beverages	
Current state of development	
These instruments are currently sold. They can however be tuned according to needs and applications.	
Contact details	
Organisation	Alpha MOS
Website	www.alpha-mos.com
Contact person	Sandrine Isz
Address	20 avenue didier Daurat 31400 Toulouse (france)
Phone	33.5.62.47.53.80
Fax	33.5.61.54.56.15
Email	isz@alpha-mos.com