

## *In this issue...*

- BioNexGen ID
- First Training Workshop in Tunisia
- Report on Euro Membrane Conference
- BioNexGen 24 months Partner meeting
- Report on the visit of Prof. Sami Sayadi
- BioNexGen Membrane Testers

## **BioNexGen ID**

### Title

Development of the Next **Generation** membrane **Bioreactor** system

### Programme

Seventh Framework Programme, Collaborative Project

### Duration

01/09/2010-28/02/2014

### Main objective

**BioNexGen** is developing a new class of functional low fouling membranes for membrane bioreactor technology with high water flux and high rejection of organic matter with low molecular weight

### Partner countries

Egypt, Germany, Greece, Italy, Syria, Tunisia, Turkey, UK

## **Editorial**

Dear Readers,

Welcome to the third issue of our **BioNexGen** newsletter! In this issue we will inform you about a few activities where our consortium was involved in during the past months. First of all, we will present you an article of the **BioNexGen** workshop in Tunisia that was combined with a partner meeting. You will also be informed about the Euro Membrane Conference which some of our partners have attended.

Last but not least you can find out more about our latest scientific exchange where Prof. Sayadi came from Tunisia to Karlsruhe University and learn also more about our MBR Membrane testers.

Moreover we warmly invite you to also regularly consult our project website under [www.bionexgen.eu](http://www.bionexgen.eu) in order to be updated on the latest developments.

Yours sincerely,

**BioNexGen** consortium

## **BioNexGen Partners**

The project is carried out by **7 European, 1 Turkish and 3 MENA partners**, namely two partners from North Africa and one from the Middle East.

The consortium has been carefully selected to ensure a multidisciplinary approach which is necessary to realise this innovative concept. It consists of academic and industrial partners and of technology transfer institutions.

- **Technology transfer:** Coordinator, Karlsruhe University of Applied Sciences (Germany), Steinbeis-Europa-Zentrum (Germany)
- **Membrane's development:** Institute on Membrane Technology at Italian National Research council (Italy), Foundation for Research and Technology, Hellas (Greece), Izmir Institute of Technology (Turkey), Swansea University (UK), as well as Microdyn Nadir (Germany) and Nanothinx (Greece), as European leaders in innovative MBR membrane technology and carbon nanotubes' manufacturing
- **Demonstration and field test activities:** Centre de Biotechnologie de Sfax (Tunisia), Central Metallurgical Research and Development Institute (Egypt) and Al Baath University (Syria)

## 1st training workshop on novel MBR technology (MENA, Tunisia)

This workshop is a part of the *Task 9.4 "Organisation and implementation of training workshop on novel MBR technology"* which aims at:

- ◇ Fostering personal contacts between European and MENA water engineering experts researchers, stakeholders, municipalities and companies
- ◇ Raising mutual understanding and awareness for water related problems and for wastewater treatment technologies

**BioNexGen** is a highly multidisciplinary project, encompassing a diverse range of expertise, many of them highly specialised and leading-edge. Therefore, not only internal training and technology transfer is important but also dissemination of the new scientific project results to the external interested parties like technicians, students, young researchers and young professionals. In order to train these interested parties in the novel developed MBR technology, two training workshops are planned to be organised during the project, one in Europe, the other in a consortium's MENA country.

It was hosted by CBS on March 8th & 9th 2012 in Sfax, Tunisia and approximately 80 external participants were registered to the workshop among them many companies were also present.



In total, around 100 persons attended to the workshop. Besides theoretical seminars, this workshop was combined with visits at MBR plants (e.g. MBR plant at Henkel company) and wastewater treatment plants (e.g. textile wastewater treatment plant in Ksaar Helal region) on site for allowing to become more acquainted with relevant industrial membrane technologies for wastewater treatment.



This first workshop has focused on *basic principles and state-of-the-art of "Membrane based wastewater treatment and reuse"*.

The aim of this event was to ameliorate significantly the recognition of MBR as a major tool for industrial wastewater treatment.

## Euromembrane 2012 conference held at Queen Elizabeth II conference hall, Westminster, London

The **BioNexGen** partners attended the 'Euromembrane 2012' conference held from 23 – 27<sup>th</sup> September, 2012 at London, UK which had its focus on Membrane Science and Technology in order to exchange the ideas on the ongoing research activity. The conference covered different types of membrane and related work including membrane materials, membrane fabrication and characterization, modeling and simulation, membranes for process intensification, and application.



Dr. Giorgio De Luca (ITM-CNR partner) presented his study on the rejection of lower molecular weight solutes using Carbon Nanotubes (CNTs) by combining three different computational methods namely, Quantum Mechanics (QM), Monte Carlo (MC) and Molecular Dynamics (MD). After the optimization of the CNT diameters as a function of their rejection capability, the analysis of the water flow in the identified nanotubes was carried out. The combination of the different approaches provides an overview on the CNTs selectivity. Thirteen charged and neutral solutes of large, medium and small molecular weight were considered, such as tyrosol, vanillic acid, EDTA, octylphenol ethoxylate and etc. Their geometries were optimized at quantum mechanics level in the frame of Density Functional Theory. Eventually it was found out that carbon nanotubes with outer and internal diameter smaller than 35 nm and 1.66 nm, respectively, would be recommended to attain at the same time high rejections and water flux.

Mr. Shamim Ahmed Deowan presented a poster on 'Treatment of model textile dye wastewater (MTDW) towards developing novel submerged membrane bioreactor process' representing the partners from HSKA and ITM-CNR. This paper dealt with the treatment of model textile dye wastewater (MTDW) using a submerged membrane bioreactor (MBR) with commercial available membranes. Since the quality of textile wastewater changes due to employed dyestuffs, accompanying

chemicals and processes from season to season and time to time, the model textile dye wastewater (MTDW) was developed based on literature studies to have constant wastewater quality. Remazol brilliant Blue R and Acid Red 4 colors each with 50 mg/L concentration have been selected as model dyestuff. The system took around two months to acclimate while the experiments were run for three months. Around 90% of COD removal efficiency and a color reduction efficiency of 40-60% for Red and 50-70% for Blue were noticed over entire period of operation. These data will serve as benchmarking in order to compare later with the novel **BioNexGen** membranes.

The partners also participated in the lectures and presentations from the other attendees which included academic and industrial scientists from both national and international institutes which helped them gained insight on the research and also opened a way to develop contacts. More information about the topics can be found at [www.euromembrane2012.com](http://www.euromembrane2012.com).

## Project events

### **24 months partner meeting at Sheraton Heathrow Seminar Hall, London, United Kingdom**

Following the Euromembrane conference, **BioNexGen** project partners gathered for the 24<sup>th</sup> month partner meeting at Sheraton Heathrow Seminar Hall at London. All ongoing R&D work has been summarized and presented by the respective partners.

The meeting not only helped the partners discuss and present the technical progress of the work from the earlier meeting but also gave a scope to discuss the challenges involved in the scaling up with the industrial project partners. Novel ideas emerged from the fruitful and enthusiastic discussions led to new objectives.

In addition the organization of the second **BioNexGen** workshop to be held in May 2013 in Italy and the Final **BioNexGen** Conference scheduled for October 2013 in Izmir, Turkey have been discussed too.



### **Visiting Professor: Fostering cooperation between research institutions**

*In each issue of our newsletter, we will try to present you an example of a successful exchange among **BioNexGen** partners. This time, we would like to introduce you Prof. Sami Sayadi. He is the director of Center of Biotechnology in Sfax, Tunisia who visited Prof. Jan Hoinkis at the Karlsruhe Institute of Applied Sciences.*

Prof. Sami Sayadi's (CBS partner) paid a scientific visit to Karlsruhe University of Applied Sciences, Germany from 11- 17<sup>th</sup> July 2012. His visit to the lab gave him scope to comprehend the ongoing research in HSKA related to the **BioNexGen** project both on laboratory scale as well as on the MBR pilot plant installed in the institute. The partners exchanged fruitful information about the model textile waste water running in the pilot scale. Prof. Sayadi's experience in dealing with real waste water from the industries gave an occasion for the partners in HSKA to discuss the challenges faced in the industries and to improvise the synthetic composition to test on the novel membranes.

Prof. Sayadi's visit also provided an occasion for the partners in HSKA to perceive the research at the CBS laboratory of Environmental Bioprocesses, Sfax (Tunisia). Project coordinator, Prof. Hoinkis took an opportunity to take Prof. Sayadi on a visit to a membrane based water treatment plant in Leonberg, Germany to envision the practical challenges in an industrial environment.

Prof. Sayadi during his talk at HSKA presented their experience in dealing with the real waste water from textile industry using MBR pilot plant at CBS laboratory. Different samples from Sitex textile industry located at the industrial zone of Ksar Helal (20 Km from the south of Monastir city) were collected. The industry is specialized in the dyeing of denim fabric (jeans) using indigo and/or sulfur dyes. It produces about 600.000 m<sup>3</sup> of wastewater/year (which represents the half of the region consumption). The wastewaters were treated with biological oxidation by aerobic stages with activated sludge to make them comply to the Tunisian rejection standard.

Prof. Sayadi's lab also performs trials with Olive Mill Wastewaters (OMW). This station is located in the region of Agereb at the edge of the olive grove of Sfax. The plant is specialized in treating huge quantities of OMW. OMW samples were taken from an anaerobic fixed bed digester treating raw OMW. The effluent produced by the anaerobic digester was collected which in turn served as an influent for the coupled MBR system.

## **BioNexGen Membrane Testers**

Basically, **BioNexGen** team is divided in two groups, i.e. membrane developers and membrane testers. We have chosen to present you both groups more closely so that you can better know who is behind our project, i.e. what professionals and expertise will enable the successful development of **BioNexGen** membrane. In this issue, we are presenting you our membrane testers.

### **Karlsruhe University of Applied Sciences (HSKA), Germany**

#### **Professor Dr.-Ing. Jan Hoinkis**



**Role in the project:** Coordinator  
**Background:** Chemistry, Thermodynamics  
**Current position:** Scientific Director of IAF  
**Major research interests:** process development, membrane technology, chemical on-line analysis

Prof. Dr.-Ing. Jan Hoinkis holds a degree in chemistry from Karlsruhe Technical University and did his doctorate in the field of thermodynamics. He worked 7 years in chemical industry being head of a group for process development. He is a key expert in the field of process engineering in combination with sensor / control systems. He also specialised in the areas of water treatment and water recycling by use of membrane technologies. He is a professional managing different R&D national and international project in co-operation with research institutes and companies, among them EU funded projects, such as the INNOWA project within the Asia Pro Eco programme, focusing on membrane bioreactors for textile effluent treatment and recycling. Many years in the department of process development in a large international chemical company have enabled him to gain experience particularly in the areas of membrane technology and chemical on-line analysis.

### **Centre de Biotechnologie de Sfax (CBS),**

#### **Professor Dr. Sami Sayadi**



**Role in the project:** MBR Tester  
**Background:** Biotechnology  
**Current position:** Director of CBS  
**Major research interests:** Membrane technology

Prof. Sayadi made his PhD in Compiègne (France) in 1988. He is the Director of CBS and head of the research Laboratory of Environmental Bioprocesses at CBS. He is author of more than 160 publications, 8 national patents and 1 PCT patent. In 2006, he was awarded the French Magazine "La Recherche" and the presidential prize for scientific research and technology in Tunisia. He got the "SCOPUS Award" for Science contribution to: Biotechnology, Microbiology and Environmental Sciences, in 2007. Prof. Sayadi was the national scientific coordinator of a federative project dealing with "wastewater treatment and reuse in Tunisia". He participated actively in the FP5 and FP6 EU projects. His was the scientific coordinator of the 2 following EU projects related Membrane Technology (Promembrane and Puratreat). He is local coordinator of FP7 projects CLARA, WATERBIOTECH and BioNeGen. He is the head of the «Pôle d'Excellence Régional AUF»: Environmental and Industrial Bioprocesses from 2007 to 2012.

**BioNexGen Membrane Testers**

**Central Metallurgical Research and Development Institute (CMRDI), Egypt**

**Professor El-Sayed Abdel-Aal**



**Role in the project:** MBR testing with textile wastewater, preparation and characterisation of silver nanoparticles

**Background:** PhD Inorganic Chemistry, Faculty of Science, Cairo University, Egypt, 1989

**Current position:** Head of Minerals Technology Department, Central Metallurgical R&D Institute (CMRDI)

**Major research interests:**

Preparation, characterization of advanced nanomaterials including but not limited to: metals (Ag, Ni), oxides (ZnO, SiO<sub>2</sub>), and hydroxyapatite, preparation and coating of hydroxyapatite on titanium alloy for biomedical implant applications, continuous processing of phosphate for phosphoric acid production, crystal habit modification of phosphogypsum, gibbsite, calcium oxalate, etc., chemical processing on laboratory and pilot plant scales of ores, e.g. ilmenite, bauxite, clay, magnesite, bentonite, etc., studies for purification of phosphoric acid by different techniques, solvent extraction, ion exchange and precipitation, studies in the field of lignin separation for environmental protection, purification of industrial waste water and desalination of seawater.

**Centre for Water Advanced Technologies and Environmental Research (CWATER), UK**

**Professor Nidal Hilal, PhD, D.Sc.**



**Role in the project:** Membrane tests with model waters and characterisation

**Background:** Water Process Engineering

**Current position:** Director of CWATER, College of Engineering, Swansea University

**Major research interests:** membrane nanotechnology, water treatment and the application of AFM to process engineering.

Professor Hilal is recognised for developing and applying the force measurement capability of AFM to the study membrane processes of separation. He published over 300 publications. He also serves on the panel of referees for 45 international journals. His research has produced several important breakthrough innovations. These include: the development of novel membranes; *the smallest* AFM colloid probe reported in the literature; *the first* AFM study of nanofiltration membranes, including *the first* demonstration that such membranes have pores; *the first* AFM coated colloid probe technique; *the first* AFM cell probe technique; *the first* AFM Calcium Carbonate probe technique to study desalination; *the first* direct measurements of the interaction of single live cells with surfaces; *the first* use of the atomic force microscope as a nanoviscometer and meso-scale cavitations studies. In a pioneering study he utilised the techniques to rapidly and accurately predict the fouling potential of membrane surfaces and demonstrated the effect of membrane surface treatments on the strength of adhesion.

Professor Hilal is a Fellow of FICHEM, a member of the European Desalination Society, and a member of the European Membrane Society. He was awarded the degree D.Sc. by the University of Wales in 2005 due to his outstanding research contribution to the field of membrane science and technology.