



Space2Tex

Waste water recycling in textile finishing through the application and further development of membrane bio-reactors used in space life-support systems

The logo for Space2Tex, featuring the text "Space2Tex" in white on a green rectangular background. The background of the logo area includes a grid and images of a globe and a satellite.

Space2Tex

Fifth Framework Programme Collective Research

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The Challenge

The textiles and clothing industry is one of Europe's leading industrial sectors with an annual turnover of 215 billion Euro and a work force of 2.6 million employees distributed in more than 110,000 companies in EU25 mainly represented by SMEs!! Environmental issues constitute a major challenge for SMEs, mostly when wastewater in textile finishing is concerned. The textile finishing industry uses water as the principal medium for removing contaminants and applying dyes and finishes. Apart from a minor amount of water that evaporates during drying, the bulk is discharged as aqueous effluent. The main concern is therefore about the huge amount of water discharged and the chemical load it carries.

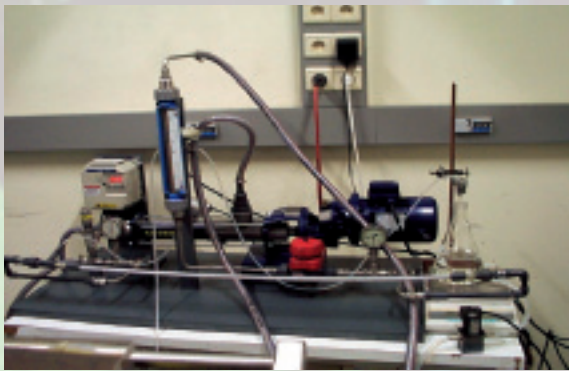
The release of chemicals and process auxiliaries in the water is a huge problem for the quality of life and health of European citizens. The EC has recognized the seriousness of the problem in the Water Framework Directive (2000/60/EC), in the Directive 96/61/CE IPPC/BAT, and in the 19th amendment to Council Directive 76/769/EC, stating that the Member States are obliged to "take the appropriate steps to eliminate pollution of waters by dangerous substances".

The Space2Tex Project

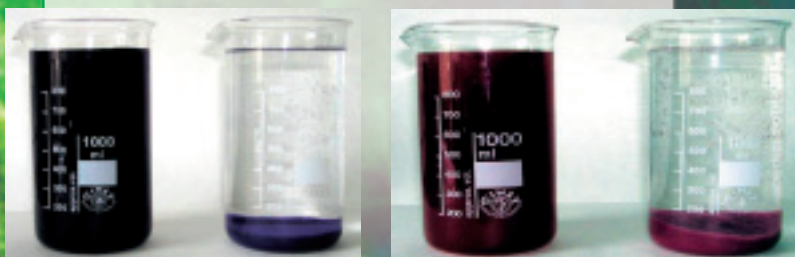
The Space2Tex project aims at developing a novel concept of compact wastewater treatment plant for water recycling in textile finishing. The project final objective is the application of Membrane BioReactors (MBRs) for the biodegradation of textile finishing pollutants, often hardly biodegradable, in small wastewater system plants to be inserted end-of-pipe of textile processing plants, with the final aim of recycling wastewater. The Space2tex project has been originally conceived within the framework of the European Space Agency's Technology Transfer Programme, inspired by the Melissa research activities on Membrane BioReactors.

The Lab-scale Process

Developed by Vito, the laboratory scale MBR prototype has been set-up to be used for laboratory testing on textile wastewater. The lab-scale prototype allowed to identify the MBR performance with respect to biodegradation efficiency of real wastewater provided from textile finishing industries. Parallel trials on a Conventional Activated Sludge lab-prototype have been carried out allowing to compare the results achieved using the MBR prototype with respect to traditional systems.



Laboratory testing of post-treatment options has complemented testing activities to allow the identification of the most appropriate post-treatment to enable water re-use, allowing the removal of persistent contaminants.



The Advantages of Applying MBR Technology

Membrane BioReactors used in wastewater treatment plants have proved their competitiveness if compared with traditional activated sludge systems, and demonstrated the following advantages:

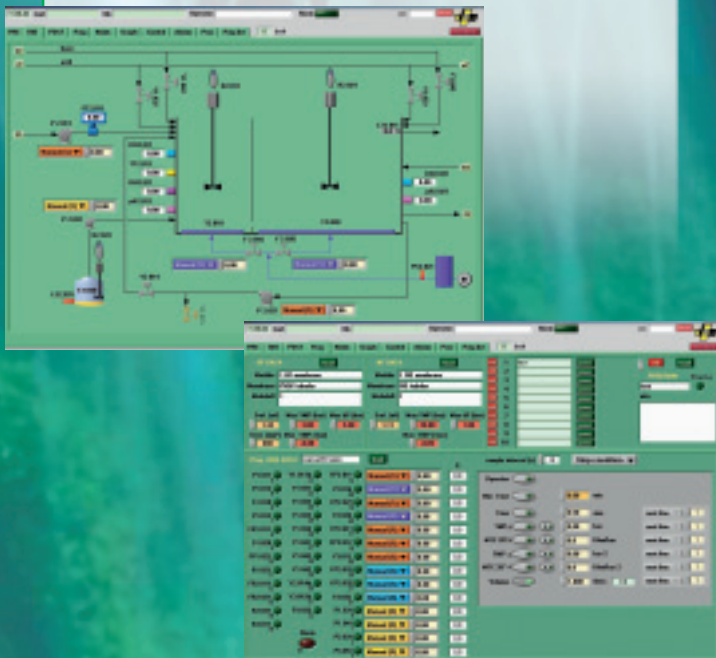
- complete retention of suspended solids due to the high-efficiency membrane filtration system (Ultra- or Micro-Filtration according to pore size), resulting in a high quality effluent, which is basically free of Total Suspended Solids (TSS) and of pathogenic germs;
- high internal biomass concentration due to the effective retention of sludge by the membrane, resulting in reduced bioreactor volumes;
- higher retention times of hardly biodegradable compounds, due to the membrane retention ability of long-chain molecules, resulting in increased biodegradation of COD and BOD₅;
- smaller footprint of the overall treatment plant due to higher biomass concentrations and higher conversion rates and to the replacement of the secondary clarifier by a (submerged) membrane filtration unit;
- lower costs for sludge disposal due to the lower biomass generation;
- process automation due to the application of modern process control equipment, resulting in system modularity and easy processing.

The Space2Tex Pilot Plant Prototype

A pilot scale plant has been prototyped and installed in textile finishing companies in order to carry out on-site testing campaigns. The pilot plant prototype has been designed and constructed by Vito. On site trials have been carried out under the responsibility of D'Appolonia and with continuous remote control follow-up by Vito at the premises of an Italian printing company belonging to the Core Group SMEs. Reuse tests are foreseen at Inotex in the Czech Republic.



The plant is fully automatized and controlled through Vito's MEFiAS™ software, which was initially developed for pressure driven membrane filtration processes, appositely extended to control and monitor the complete treatment system.

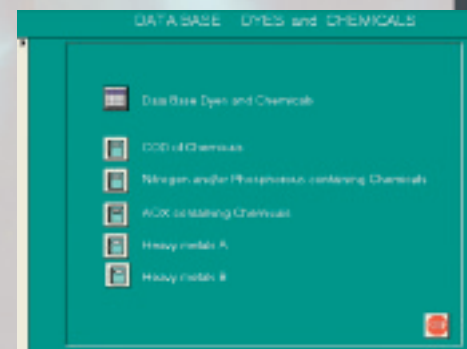
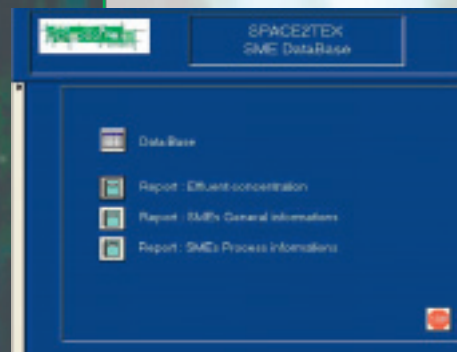


The Space2Tex Database and the Chemical Database

The Space2Tex Database and the Chemical Database have been developed to rationalize information collected directly from SMEs. The Space2Tex Database aims at structuring information that allows characterizing the textile finishing sector mainly composed of SMEs, while the Chemical Database aims at constituting a reference knowledge base on dyes, chemicals and auxiliaries, which are applied within the textile finishing industry. The Chemical Database contains to date 275 references of chemicals used in the textile finishing production and gives the possibility to

make a rapid search of those chemicals that contain specific substances (e.g. all the chemicals that contain a heavy metal). For this reason, this tool could be very useful for textile finishing SMEs to

find out dyes or auxiliaries containing substances that are responsible of excessive load within the discharged wastewater, thus giving the SME the possibility to evaluate whether to replace the responsible substance with direct consequence both on the economy of the SME as far as the saving of wastewater treatment costs are concerned, as well as on the social aspect which is obviously related to a better compliance with environmental issues.

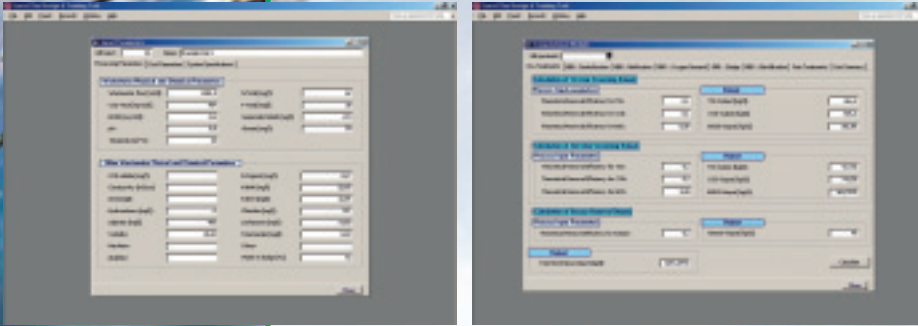


The Space2Tex Design & Training Tool

The Space2Tex Design & Training Tool developed by D'Appolonia contains the design methodology that allows sizing the basic unit operations and related equipment that compose the Space2Tex system and estimating the costs associated to installation and running.

The Space2Tex Design & Training Tool consists of two functionalities: a Plant Design & Prototyping Tool and a Training Tool. The former is meant for those users which are skilled in the design or in running of WWTPs, guiding the user along the whole procedure of sizing the Space2Tex wastewater treatment plant

given wastewater specifications, and allowing for the selection of specific process conditions. The Training Tool is a reduced performance version of the Design & Prototyping Tool. In this case, the tool only requires for input parameters, such as a company's wastewater parameters (pollutants concentrations and wastewater quantities), allowing users, often textile companies' practitioners, to skip the insertion of process parameters, but to exploit the Tool to self-audit whether the system would be suitable for their own industrial situation.



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FET - Fédération de l'Ennoblement Textile,
ATOK - Association of Textile Clothing and Leather Industry



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