Third Stage Summary

Water, the key factor of social, economic and life quality development, becomes a problem which can generate social conflicts at national or international level. This issue it's very important especially for Black Sea region, where the current situation requires great attention regarding the quality of sea water and consequently for providing its decontamination. Although until now, most of the attention has been paid to technical devices and to the enormous capital investments for the construction of treatment plants, this is not sufficient to fulfill the practical and political objectives.The current imbalance in solving the main problems regarding wastewater treatment is determined by the insufficient amount of devices and equipment adequate for effluent purification

The research work of IMAWATCO consortium is based on the fact the the most efficient materials for water decontamination are: absorbant charcoal, polymer membranes and natural zeolites.

As tourism and small industry units are spread along the entire Black Sea coast, one of the solutions to solve the problem of pollution is the construction of local treatment plants, attached to those objectives which are the source of pollution. Such systems should include a settling tank for sludge storage, followed by a filtration-treatment unit for water purification prior to sending it into the sea.The role of these sewage treatment facilities is to retain inorganic and organic contaminants from wastewater

Basically, such a facility will consist of a first layer of natural zeolites as the first stage depth filtration and purification, a second layer composed of polymer membranes for ultrafiltration and selective absorption and a last layer of active charcoal for complete purification of wastewater.

This way, an enhanced absorption capacity for various water pollutants as: pesticides, surfactants, metal cations, ammonium ions, hormones, etc, will be provided.

The research works carried out within BS-Eranet project are performed in collaboration with partners from Turkey and Bulgaria.Therefore, Istanbul Technical University is responsible for obtaining the zeolite layer, Institute of Organic Chemistry toghether with the Solar-Terrestrial and Spatial Institute (both belonging to the Bulgarian Academy of Sciences) are dealing with the

active charcoal layer and finally, the project coordinator, INCDCP-ICECHIM, is responsible for achieving both the multifunctional polymeric membrane and the whole assembly.

Researches performed by INCDCP-ICECHIM in the third stage of the project BS-Eranet-7-045/2011 IMAWATCO were carried out in order to obtain multifunctional polymeric membranes using binary mixtures based on acrylic copolymers (acrylonitrile-vinyl acetate coded AN-AV) and water-soluble polymer, polyvinyl alcohol (coded PVA).

In order to demonstrate the technology reproducibility and optimization, three AN-AV copolymers containing different AV concentrations were prepared, under the same conditions as described in the laboratory technology developed in the previous project stage.

Initially, for obtaining polymeric membranes, some DMSO solution were prepared, by dissolving appropriate amounts of acrylic copolymer and APV.The use of APV is required, on the one hand, by the possibility of adjusting the membrane porosity, due to the different phase inversion rates of the two polymers and, on the other hand, by the necessity to introduce-OH groups on the surface of the membrane, which would be available in the reaction of enzymes covalent immobilization. The obtaining of polymer membranes was performed by coagulation of polymer solutions in DMSO, achieved in a coagulation bath consisiting of various solvent-nonsolvent mixtures. Researches confirmed that the the best rate of coagulation can be reached when using solvent-nonsolvent mixtures. Prior to the immobilization of enzymes, membranes were activated by the reaction with glutardialdehyde. The activation reaction occurs at OH groups of PVA. We studied both the effect of polymer membranes activation and of the enzymes covalent immobilization on the membranes chemical composition, respectively on their thermal behavior and hydrophilicity.

Research to demonstrate the membranes functionality and utility in the retention of organic substances in water have been carried out, finding that, a significant reduction of pollutants from wastewater occurs by ultrafiltration.