

First stage summary

Water is essential to socio-economic development and for the improvement in quality of life. It is a problem that can generate social national and international conflicts. This is a fact especially important for the Black Sea region, where the current situation demands a higher focus on the water quality and water decontamination. Until now, most of the focus has been given on the issue of technical devices and over the enormous capital investments required for the construction of treatment plants. However, it is not enough to meet the political and practical objectives. The current unbalance in dealing with the main issues regarding wastewater treatment failure is related to the scarcity of devices and materials adequate for highly efficient purification of effluents.

The IMAWATCO project consortium has based its research on the idea that some of the most efficient water purification materials are absorbent charcoal, polymer membranes and natural zeolites.

Tourism and small industry units are scattered along the length of the Black Sea coast. This is why one of the possibilities to solve the pollution issue is the construction of local treatment plants, attached to the objectives that are the source of pollution. These systems should include a settling tank for sludge storage and then a filter-treatment unit to purify water before sending them into the sea.

The role of the treatment plants is to retain inorganic and organic contaminants from wastewater. In principle, such a plant will include a first layer of natural zeolites as the first stage of depth filtration and purification, a second layer consisting of polymer membranes for ultra filtration and selective adsorption and a final layer of activated charcoal, for the complete purification of wastewaters. In this manner it is provided an enhanced absorption capacity for the various pollutants in water: insecticides, surface-active agents, metal cations, ammonium ions, hormones, etc.

Research within the BS-Eranet project are clearly defined between partners: Technical University of Istanbul is handling the zeolite layer, Institute of Organic Chemistry, and the Institute Solar-Terrestrial and Space (both included in the

Bulgarian Academy of Sciences) are working on the activated carbon layer and project coordinator INCDCP – ICECHIM deals with multifunctional polymeric membrane and the realization of the final kit.

Research carried out by INCDCP-ICECHIM in the first phase of the project BS-Eranet-7-045/2011 IMAWATCO was designed to obtain adequate acrylic copolymer for membrane developing and membrane formation in mixtures of such copolymers with polyvinyl alcohol.

Research has shown that by increasing the content of vinyl acetate monomers within the copolymerization mixture in an aqueous medium, the composition deviation increases from the azeotropic one.

The copolymer molecular weights were distributed on a nonlinear range, as the copolymer obtained from 80AN: 20AV had the higher relative viscosity.

We determined the rheological behavior of the solutions of the three copolymers, at different concentrations in two solvents: dimethylformamide (DMF) and dimethyl sulfoxide (DMSO). In almost all cases it was found that at low shear gradients the flow is dilatant, while with larger gradients the flow is slightly pseudo plastic with a tendency to shift towards quasi - Newtonian. Flow behavior was determined at two temperatures: 25 and 70 °C.

In some cases, the flow has an unstable behavior, suggesting that these copolymers can be used for molecular imprinting by phase inversion.

Solutions in 8% DMSO of copolymer blends 90% AN: 10% AV and PVA, with up to 25% PVA, exhibited a flow behavior very close to the copolymer without any additions.

We have obtained membranes from solutions of the copolymer C1 - PVA blend.