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TRACK MEMBRANES AS A SUCCESSFUL EXAMPLE OF ION-TRACK TECHNOLOGIES APPLICATION: HISTORY AND STATE OF ART

The overwhelming majority of modern productions (from micro- electronics and so-called "high technologies" to biotechnology and medicine) cannot function without the use of membrane technologies which are necessary for obtaining pure liquid and gaseous materials and also for purification and concentration of different solutions and suspensions. The first track etched membranes or so called nuclear filters were created in the USA and the Soviet Union in the early 1970's using ion-track technology. Track etched membranes in contrast to traditional membranes with a network structure have pores in the form of capillaries with a regular usually cylindrical shape. The pore sizes of nuclear filters lie in the range of 0.01-10 micrometers; the pore number reaches values of 105 - 1010 per square centimeter (1-20% of through porosity). The narrow distribution of pores by size is the principle advantage of nuclear filters (no more than 10% from the average diameter). Track etched membranes are manufactured using methods of nuclear physics. At the first stage the thin (8-40 μm) polymer films are either treated with beams of multicharged non-radioactive ions (C, O, N, Ar, Ne, Kr, Xe, Co, etc) accelerated up to energies more than 1 MeV/nucleon at the cyclic or linear accelerators, or by irradiation using U235 fission fragments which are formed by the actions of neutrons in a nuclear reactor. In the second stage the polymer film treated by ion beams or by fission fragments is irradiated by ultraviolet light for formation of polymer defects which appear after film treatment in the first stage. During the final stage the film with numerous tracks is treated by chemical etching and, as a result, the dissolving of track zones, and the appearance of through pores, takes place. Afterwards, the ready product is washed, dried and packed.
During last 30 years these filters have been used in large scale processes of water purification, for the needs of microelectronics for manufacturing of modern antiviral vaccines (anti-rabies, anti-influenza, vaccine against encephalitis), for E-coli bacterial analysis of drinking water at water purification plants, for encephalitis immune diagnostics by ELISA method, etc. In the last years these filters were used for manufacturing of apparatus for blood plasmaspheres, for purification of drinking water from microbiological and colloid impurities and for production of infusion filters for safe drug delivery.

The following topics will be discussed during the course of the lecture:
1. Main Principle of Track-etched Membrane Technologies
2. Physico-chemical Properties of Track-etched Membranes and Characterization Technologies
3. Track-etched Membrane Filtration Applications and New Concepts to Produce Innovative Polymeric Track-etched Membrane
4. Applications of Track-etched Membrane in Modern Nano-Technologies

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