Nanofibrous membranes with antifouling properties

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Decreasing supply of drinking and service water is a big worldwide problem that has an increasing tendency in these days and the need for new water supplies, or reuse of waste water, is crucial nowadays. In addition to the natural factors affecting the world water cycle system, people through their technological development, institutional and financial conditions are contributing to ever increasing demands to fresh water. This requires a new efficient low-cost form of sewage treatment with lower energy and chemicals consumption. This approach can guarantee that the environment will be less negatively affected and there should be sustainable development for all humanity.

Our research team tries to solve this problem through enhancing the current membrane filtration processes by modifying the fibrous polymeric substrate, which would allow the preparation and subsequent production of nanofibrous filter membranes with new properties. Basic fiber-forming matrix will be modified by incorporation ammonium quaternary salts into a polyurethane polymeric chain. The generalized polyurethane base unit is shown in Figure 1.

Selection of suitable primary monomers has an impact on the possibilities of preparation of a polyurethane matrix with properties compatible with an electrostatic forming device for preparation of nanofibrous membranes. This is a technological issue that has been solved within our research project. SEM images of nanofibrous structures are captured in Figure 2.

The main idea of our project is to prepare structures with increased resistance to the development of microbial biofilms through incorporation of suitable functional groups directly into the polymeric backbone of the basic copolymer and preparation of nanofibrous structures by electrospinning of the prepared matrix. The presentation will be divided to explanation of our approach to modification of polyurethane fibers by quaternary ammonium salts, to formation of nanofibrous membranes by electrospinning and finally to results from monitoring of dynamics of Escherichia coli (CCM 3954) and Pseudomonas aeruginosa (CCM 3955) biofilm development.

Figures:

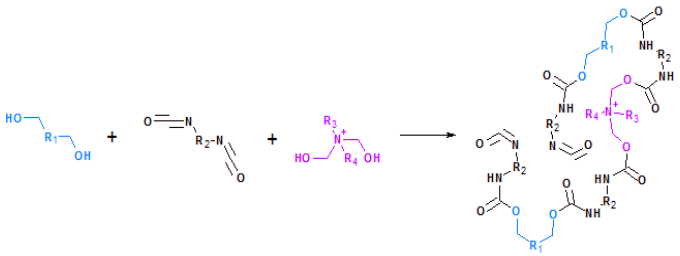

Figure 1. Generalized base unit of prepared polyurethane

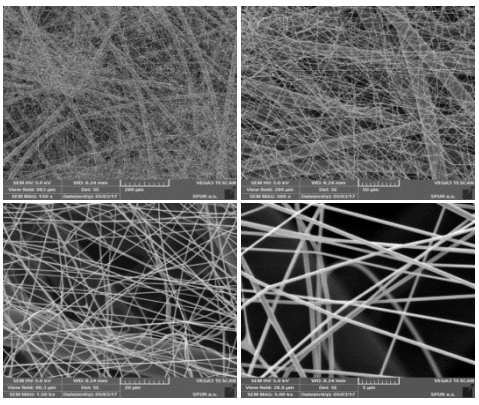

Figure 2. SEM images of prepared nanofibrous membranes