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Fouling behavior of silver nanoparticels during membrane filtration

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In the last decade many new nanotechnology based products have been developed. This causes a worldwide exponential growth of the production volume of nanoparticles (NPs). The impact of manufactured NPs on living organisms is still under discussion. However, most researchers postulate that NPs are toxic. It is obvious that after usage manufactured NPs will accumulate in the aqueous environment. Therefore, sustainable growth of nanotechnology requires an environmentally-friendly technology to remove the NPs from potential drinking water sources. A promising technique to remove nano-sized contaminants from water is based on membranes. Not much is known on the filtration and fouling behavior of NPs. To design a suitable filtration process fundamental knowledge about interactions between NPs, and their interactions with the membrane and other potential foulants present therefore is essential.

Silver NPs are most widely used in consumer applications, and for that reason chosen as model NPs in our work. Silver NPs with uniform size were prepared in the liquid phase from silver nitrate reduced by sodium borohydride in presence of stabilization agent (see Figure 1). They were stabilized by negative charge, positive charge or steric stabilization. When the reaction was finished, the NP solution was dialyzed with deionized water to remove ions and excess of stabilization agent. The resulting dialyzed solution contains just silver NPs with absorbed surfactant. Size distribution of the silver NPs was measured by Dynamic Light Scattering (DLS), Asymmetric-Flow Field Flow Fractionation (AF4) and UV-vis. Concentration before and after filtration was measured by Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES). Semi dead-end filtration and cross-flow filtration tests were carried out using PES/PVP hollow fiber membranes varying in pore size. The membranes were characterized on Molecular Weight Cut Off, pore size distribution, water permeability and surface charge. After this, filtration tests were carried out using the prepared silver NPs. The first results on retention and fouling behavior for the different NPs, as well as the influence of the presence of other ions and natural organic matter in the feed solution for the different membranes will be presented.

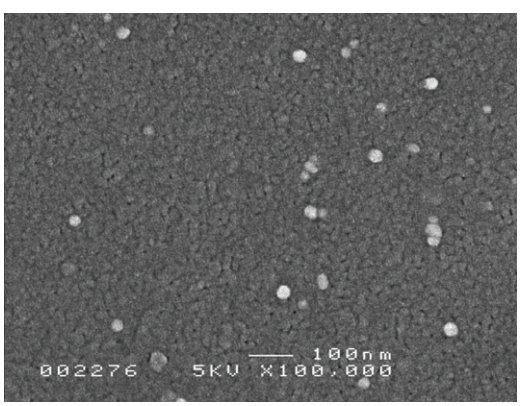

Figure1. SEM picture of prepared Silver Nanoparticles

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