

Entwicklung von neuartigen Hochleistungsmembranen für die Filtration - HEIMEM

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The use of membranes in small-scale and micro membrane sewage treatment plants is particularly interesting in sensitive areas or areas with water shortages. So far, however, there are no suitable polymer membranes exhibiting high permeation rates at very low pressures and being as robust to blocking and backwashing as to make pre-cleaning completely unnecessary. In this project, two well-known approaches to modifying the matrix (mixed-matrix membrane) and the surface (plasma thin film modification) were combined to develop new robust high-performance membranes. The mixed-matrix concept relies on obtaining composite materials by addition of additives to a polymer matrix. Such addition increases the mechanical stability required to enhance the material's porosity and wall thickness. Cross-links for additional stabilization are obtained by adding nanoparticles and fibers. The plasma thin film concept, on the other hand, modifies membranes by treating them with plasma to obtain surfaces with different properties as well as very thin films that meet the relevant requirements and have potential to be optimized. In a gas atmosphere under low pressure, a radio frequency plasma is ignited thus ionizing, activating and fragmenting the gas molecules. The membranes obtained by combining the above two approaches are much more energy-efficient. Their clearly improved backwash properties contribute to avoiding peak performance drops and can increase minimum flows through reduced fouling. Analyses of the performance of different types of membranes with unfiltered apple juice as "synthetic sewage" allowed studying the blocking behavior of real sewage at constant framework conditions. In addition, pilot plant-scale tests were carried out with real sewage and a test run was performed in a micro sewage treatment plant. To sum up, the approach presented has proved to be applicable. Considerable progress thus can be achieved in profitably using decentralized, efficient sewage treatment concepts, preferably in rural areas.