DWA-
Topics

Treatment of Industrial Wastewater and Process Water with Membrane Processes and Membrane Bioreactor Technology

November 2007

German Association for Water, Wastewater and Waste

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In Europe the DWA is the association in this field with the greatest number of members and, due to its specialist competence it holds a special position with regard to standardisation, professional training and information of the public. The ca. 14,000 members represent the experts and executive personnel from municipalities, universities, engineer offices, authorities and businesses.

The emphasis of its activities is on the elaboration and updating of a common set of technical rules and standards and with collaboration with the creation of technical standard specifications at the national and international levels. To this belong not only the technical-scientific subjects but also economical and legal demands of environmental protection and protection of bodies of waters.

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Foreword

These topics have been prepared by the DWA Working Group IG-5.5 "Membrane Technology" in the DWA Technical Committee IG-5 "Treatment of Industrial Wastewater". The topics consist of several parts.

Part 1 deals with **membrane processes** per se, i.e. the application of this process step in the separation of undissolved, colloidal or dissolved matter.

Part 2 describes the **membrane bioreactor processes**. Thereby, the emphasis is on the process unit, consisting of the biological degradation in the aeration tank and the separation of the biomass by means of membranes. Details are given, in particular, on the requirements and specifics of membrane bioreactors in contrast to conventional activated sludge processes.

Part 3 (Membrane Processes) and Part 4 (Membrane Bioreactor Processes) present **practical examples**, **operating experience** and **details on design** (not part of the English version)**.**

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Part 1: Membrane Processes

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1 Introduction

The principle of membrane processes is the physical separation of substances, i. e. wastewater or process water to be treated is separated into treated water (filtrate/permeate) and the concentrated phase (concentrate). The driving force for the separation is the difference in trans-membrane pressure. The factor distinguishing these pressure-driven processes is the amount of the pressure difference. Membrane processes which use other driving forces, e. g. electric fields or a difference in concentration, are not discussed here.

In contrast to conventional filtration technology, pressure-driven membrane processes allow the separation down to the molecular structure.

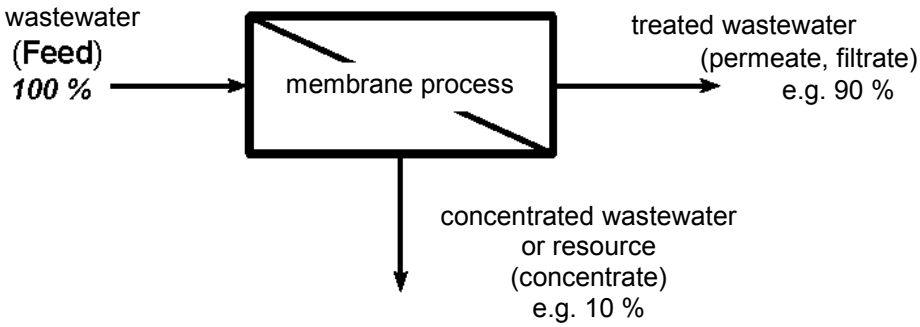

Fig. 1: Scheme showing the principle of membrane processes

- In order to ensure the success of membrane processes, there are two properties of key importance: The **selectivity** of the membranes, i. e. their ability to differentiate between the components of a mixture (e. g. between oil and water or between ions and water). Thereby, the resistance of the membrane against transport processes differs according to the characteristics of the components.
- The **performance** of the membranes (often called membrane flux), i. e. the permeate or filtrate flux, respectively (usually expressed as L/(m²·h)), to be achieved under defined operating conditions.

In Fig. 2 membrane processes are classified as a function of particle or molecule size, respectively, and pressure difference.

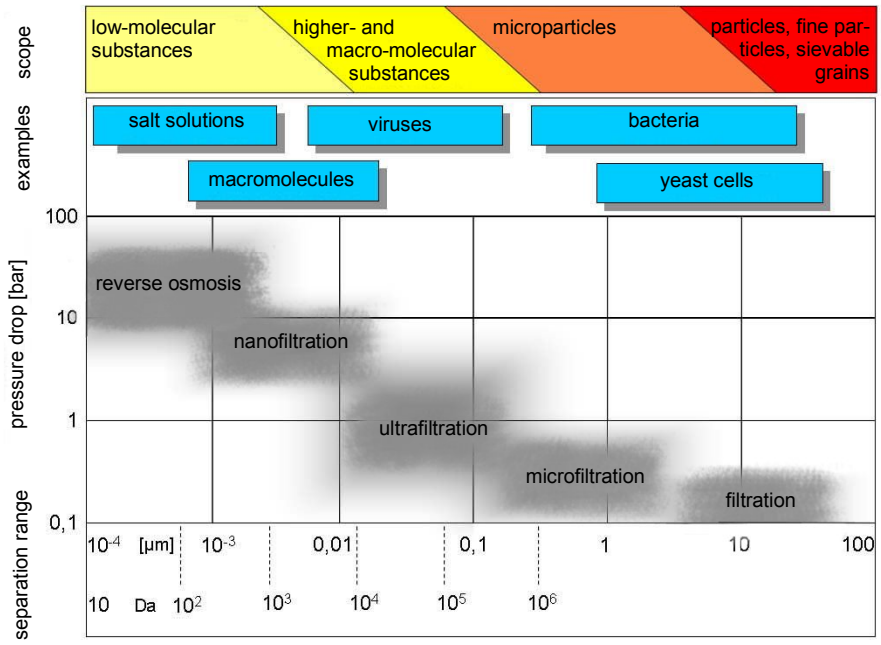

Fig. 2: Classification of membrane and filtration processes