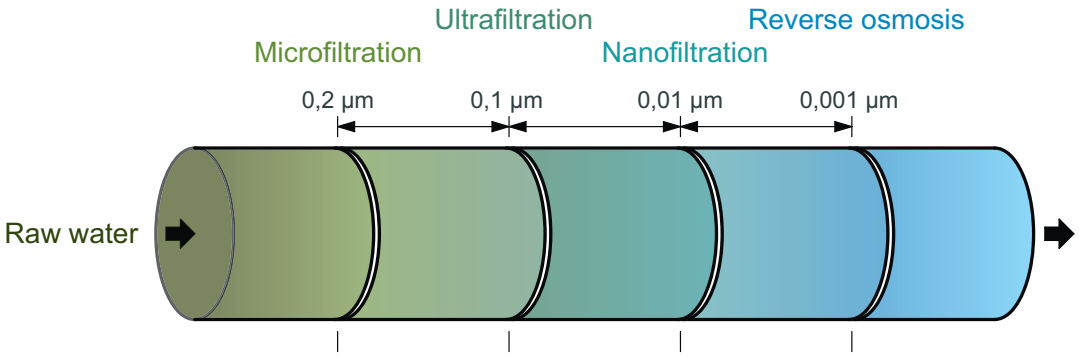
Fundamentals and processes

The term "membrane filtration" covers various processes:
- **Microfiltration (MF)**
- **Ultrafiltration (UF)**
- **Nanofiltration (NF)**
- **Reverse osmosis (RO)**

Membrane filters are purely mechanical "fine sieves".
These fine sieves consist of artificially created films, so-called membranes, with precisely defined pore diameters or closed surface.

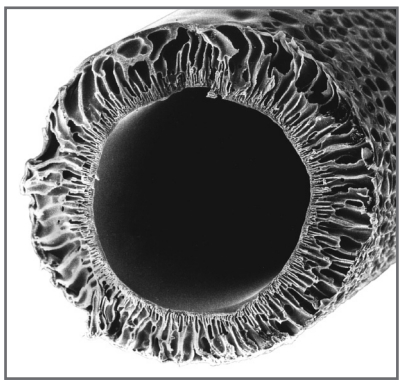


The following substances can be held back :	• **Plankton** • **Algies** • **Turbidity** • **Bacteria** • **suspended substances/ solids**	• **Macro-molecules** • **Viruses** • **Colloids**	• **DOC** • **large Ions**	• **Ions**
Required trans-membrane pressures:	**0,2-5 bar**	**1-10 bar**	**5-10 bar**	**10-150 bar**

Membrane function

The pore diameters define the membrane type and relate directly to the separation rates:

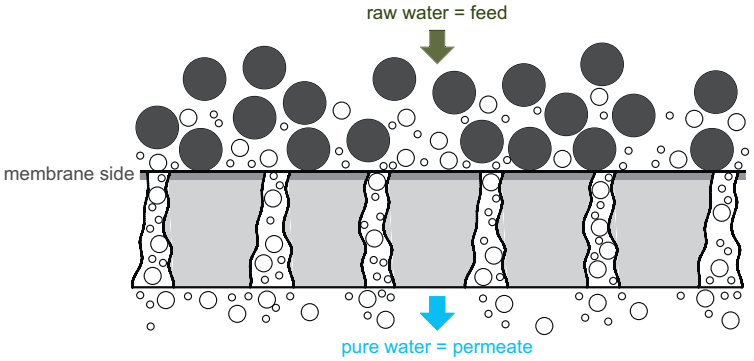
All substances smaller than the pores can pass through the membrane, and larger substances are held back. In the context of drinking water treatment, this unselective process is disadvantageous, as both undesired and desired minerals are partially or totally removed.



Membrane structure

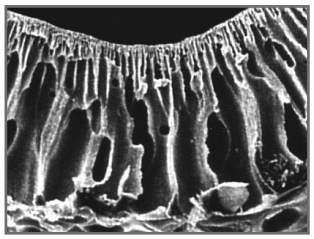
The actual effective membrane layer is extremely thin and is located on the side facing the raw water. The absolutely largest part of a visible membrane is the carrier material required for the physical structure and strength.

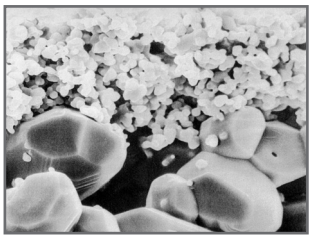
It is important that the pores of a membrane increase in size toward the pure water in order for the membrane to function properly. Otherwise, there is a risk of permanent blocking.



Materials

Today's common membranes consist of plastics (e.g. polysulphone) or ceramic.


Polysulphone


Ceramic

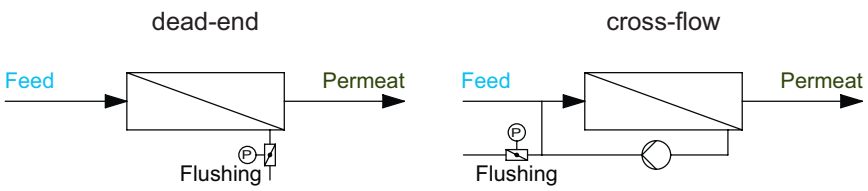
Types

A differentiation is made between the following, depending on the use and structure:

- Hollow-fibre membrane modules
- Spiral modules
- Pipe modules
- Plate modules

Method of operation

Membranes can be operated in so-called "dead-end" operation or in "cross-flow" operation.



A disadvantage of dead-end operation is the danger of blocking. With cross-flow operation, a flushing effect is achieved via forced water circulation.
Finally, the method of operation depends heavily on the raw water condition and the module structure.

Back-flushing/ chemical cleaning

Accumulated material on the membrane surface is detached and removed from the system via back-flushing. Depending on the substance content of the raw water, very frequent flushings (up to every 5 min.) may be necessary.

Chemical cleaning is also heavily dependent on the raw water quality.

Chemical cleaning normally occurs in cross-flow operation.

Frequent chemical cleaning is required especially with high concentrations of DOC. This cleaning causes partial regeneration of the membranes with a corresponding increase in flux.

Micro-biological condition of the pure water

Insofar as membrane filtration can supply microbiologically pure water, thus not requiring subsequent disinfection, depends on a variety of factors.

With all membrane processes, the raw water is separated from pure water by only an extremely thin membrane layer approx. 1 µm thick. Membranes can hold back bacteria and viruses to a great extent (5 to 6 log levels) as long as there are no tears in the membrane.

With thousands of individual membranes normally interconnected in several individua modules, it is highly improbable that each individual membrane remains intact over the entire term of operation. Finally, the raw water condition, the type and number of observed germs and the temperature are determinant here.

With only occasional appearances of germs in small numbers, it is safe to dispense with additional disinfection.

In general, it must checked whether additional disinfection measures must be carried out. The determining factor here is whether drinking water will be treated or whether industrial water not demanding a total lack of germs will be required.

Project name: _____

Customer:

_____
Name

_____
Street | Post code, City

_____
Phone | Fax

_____
E-mail | www

Project management:

_____
Name

_____
Street | Post code, City

_____
Phone | Fax

_____
E-Mail | www

Water analysis:

Chemical/physical analysis: ❑ yes, see appendix Biological analysis: ❑ yes, see appendix

Design data:

Pre-treatment available:
❑ no
❑ yes, which _____
❑ Raw water from _____

Nominal treatment output: _____ m³/h

Installation space existent:
❑ no
❑ yes Lenght _____ Depth _____ Height _____

Intended Use: _____

_____

_____

Remarks: _____

_____

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