

- 1 *Example of EMF: separation of small, positively charged molecules. All other components are retained both by the filtration membrane and the electric field.*

ELECTRO-MEMBRANE FILTRATION (EMF)

Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB

Nobelstrasse 12
70569 Stuttgart
Germany

Contact

Dr.-Ing. Berta Spasova
Phone +49 711 970-4092
berta.spasova@igb.fraunhofer.de

Dr. Ana Lucía Vásquez-Caicedo
Phone +49 711 970-3669
analucia.vazquez@igb.fraunhofer.de

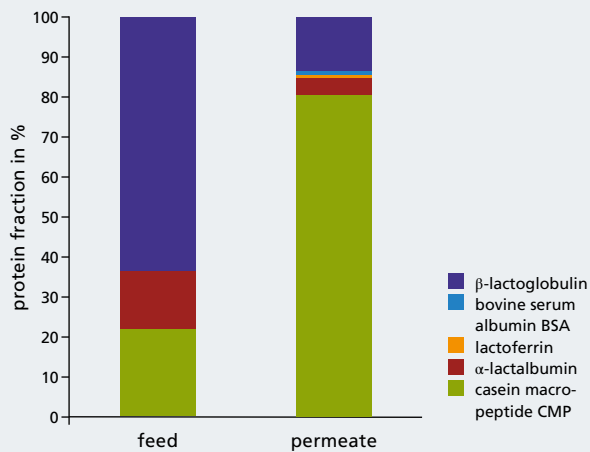
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Electro-membrane filtration (EMF) is a process for the electrophoretic separation or fractionation of charged molecules. The process combines a mechanical membrane filtration with the electrophoretic driven move in an electrical field. The EMF reactor is divided into two chambers – the retentate compartment and the permeate compartment – using a standard filtration (e.g. ultrafiltration) membrane. The driving gradient for the material transport across the membrane can be generated both by the transmembrane pressure and by the electric field applied. Depending on the design of the process and the charge of the molecules, the electric field can intensify or counteract the effect of the transmembrane flux. This permits separation both on the basis of the electric charge and the particle size. As a result, for example, a significantly higher degree of selectivity combined with low energy consumption can be achieved compared with the established

mechanical membrane filtration methods. Fraunhofer IGB develops EMF filtration devices and applications and offers feasibility studies with samples from food industry or downstream processing.

Performance characteristics

- Increased performance compared to ultra- or microfiltration:
 - Increased selectivity
 - Separation can be achieved both by molecule size and electric charge
 - Reduced membrane fouling
 - Higher transmembrane fluxes can be reached
- Fractionation of otherwise unseparable materials like valuable proteins



2



3

Application areas

- Downstream processing
- Food processing
- Recovery or winning of valuable products from liquid streams

Our service offers

- Process and plant design
- Process and system integration
- Analytics and characterization of materials
- Conceptual design for customized, application-specific solutions (process, technology, system)
- Simulation and modelling
- Process analysis and optimization
- Process, technology and prototype development
- Testing, benchmarking and validation
- Economic evaluation
- Equipment delivery in cooperation with our industrial partners

Our equipment

- EMF cells with 120 cm² and 750 cm² membrane area
- Flexible EMF test system
- Mobile EMF pilot system
- Technical and chemical laboratories
- Equipment for pre-treatment (e.g. centrifugation unit)
- In-house chemical analysis

Reference projects

- Whey2Food – Enhanced protein fractionation from protein sources for their use in special food applications, EU (grant agreement no 605807)
Further information:
www.igb.fraunhofer.de/en/whey2food
- EnReMilk – Integrated engineering approach validating reduced water and energy consumption in milk processing for wider food supply chain replication, EU (grant agreement no 613968)
Further information:
www.igb.fraunhofer.de/en/enremilk

Further information

For more detailed information on our research in the field of electro-membrane filtration please visit our website:
www.igb.fraunhofer.de/electro-membrane-filtration

- 2 Fractionation of casein macro-peptide (CMP) from whey by EMF.
- 3 EMF pilot unit at Fraunhofer IGB.