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Research area: General aims

Environmental technology // Water

Key words:

Ceramic membranes, wastewater

TITLE:**Nanoporous ceramic membranes for a sustainable recycling of water and solvent****Background/Problem area**

11 partner companies from 4 different sectors were involved in this cross-sector project. The production of paper, textiles and chemical products as well as the processing of metal are known to consume vast amounts of water and solvents. A more sustainable use of these resources through a further closure of the cycles was the overall objective of the project. The focus of this study was on membrane technology.

The technological problem involved in membrane use is the fact that common membranes are made of organic polymeric material and are not suitable for all treatment processes. Limitations include high temperature, extreme pH values, aggressive solvents or abrasive particles. Ceramic membranes can be used in a broader variety of applications, due to their more resistant materials. Owing to their high loading capacity and temperature stability, ceramic membranes offer special advantages for applications in the pulp & paper industry. Partial streams such as effluents from chemical pulp bleaching often have temperatures in excess of 70 °C. Organic membrane materials cannot be used at these temperature levels, whereas ceramic membranes can – and their still higher investment costs for a given membrane area are frequently compensated for by higher flux and longer service life. Existing ceramic membranes are much more stable under harsh conditions but up to now the lowest cut-off of this membrane type has been 1 nm.

Objectives/Research results

The objective of the project was the development of ceramic membranes with a pore size < 0.9 nm (cut-off < 200 g/mol). The process of material development was supplemented by laboratory and pilot trials using process waters of the partner companies involved.

For the pulp and paper industry four different waste waters were examined in lab trials. With the newly developed 200 Da membrane a significantly higher separation efficiency has been achieved. Noteworthy is the AOX retention of 85% in the experiments with waste waters from bleaching. The permeability of this waste water was observed in lab trials at 7 to 12 l/(m²hbar) with the new membrane. A trial at pilot scale was conducted to confirm the results of the extensive lab studies.

Application/Economic benefits

The project results can be used in all industries dealing with water and solvents, especially in pulp and paper mills. Objective was the technically mature development of a new membrane material in combination with an approved module design. By using ceramic nanofiltration membranes not only water is being recovered, but soluble substances can be concentrated and recycled into the papermaking process as well. This use of membrane plants as integrated instead of end-of-pipe solutions allows their economical application and cost-effective operation.

For SME of the environmental technology sector, economic benefits will emerge from the broader use of membrane technology in the European paper industry.

Period of time: 01.05.2010 – 30.04.2013

Remarks

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