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Biocatalytical ethanolysis of edible oils with CaLA immobilized on acrylic beads and membranes

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PURPOSE OF THE ABSTRACT

In the process industry, downstream processes are the most energy and resource consuming steps in industrial operations. To contribute to Europe's goal of a clean and liveable environment, new processes are required that have a very broadly applicable concept for an efficient integration of downstream operations in the overall process chain to reduce CAPEX and OPEX and therefore significantly enhance the competitiveness of the European process industry. The MACBETH consortium provides a breakthrough technology by combining catalytic synthesis with the corresponding separation units in a single, tailor-made, highly efficient catalytic membrane reactor (CMR). Within MACBETH for the first time 24 partners with manifold expertise and competencies in membrane technology are united to successfully transfer the technological concept to other sectors of the chemical industry.

Based on a large variety of already established building blocks (such as biocatalysts, membranes, support materials and reactor concepts) a demo plant for bio-catalytical oil cleavage (BOC) is being developed, showing the commercial applicability of CMR in biotechnology for the first time. The BOC case will develop a CMR-based reactor combining enzyme-catalysed selective ethanolysis of oil fatty acids in an organic media system followed by an integrated membrane separation to isolate selected fatty acids as ethyl esters or as mono-, di- or triglycerides.

In a 350 hour long run a column filled with lipase from Candida antarctica immobilized on acrylic bead (IMMCALA-COV-1) processed over 4 kg of oil per gram of immobilized enzyme in a continueous flow. The immobilized enzyme has been demonstrated to remain active for over 1000 hours under process conditions (40 ˚C). A demo plant is being set-up for further scale-up and even longer runs in combination with membrane separation of the reaction products. Enzymes have also been successfully immobilized directly onto the membrane to combine the enzymatic conversion with the separation step to form a catalytic membrane reactor for further efficiency improvement.

FIGURES

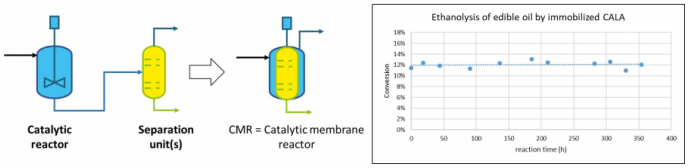

Fig. 1. CALA immobilized on acrylic beads IB-COV-1 used in a contineous flow for over 350 h. Edible oil was partly converted into ethyl esters by ethanolysis at 40 °C. The products were separated with a membrane.

FIGURE 1

Fig 1

FIGURE 2

KEYWORDS

immobilization | ethanolysis | CaLA

BIBLIOGRAPHY