PROCESS INTENSIFICATION OF LIQUID FRACTIONATION WITH SUPERCRITICAL FLUIDS BY USE OF MICRO-DEVICES

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This study is focused on the process intensification of extraction with supercritical fluids by using micro-devices. The main purpose is to investigate the efficiency and applicability of micro-mixers in Supercritical Fluid Extraction (SFE) Processes, in order to drastically reduce the size of the plant, therefore increase the security and decrease the process costs. Due to the extremely small size of the mixing channels inside the micro-mixer, higher mass transfer can be achieved compared to extraction columns. The extraction experiments are carried out in a high-pressure micro-device plant, in which the micro-mixer is the unit where the solvent and the liquid feed get into contact. In the downstream, first the raffinate is separated and subsequently the extract in the second separator by pressure and temperature changes.

Extraction of ethanol from aqueous solutions using supercritical CO_2 as solvent is studied and performed to test the feasibility of the micro-device plant proposed in this work. Experiments are carried out at 101bar, 60°C, different feed concentrations of ethanol and different solvent-to-feed ratio values. Samples are analysed by PAAR density meter. Phase equilibria calculations are performed in order to confirm that our micro-device plant reaches one theoretical stage.

The micro-mixer chosen for the experiments is HPIMM (from Fraunhofer ICT-IMM), a passive micro-mixer, which mixing principles rely on the pumping energy, with multi-laminating flow configurations (consisting on a generation of an alternating arrangement of a thin fluid compartments – *multilamellae* - which are then mixed by diffusion, shown in Fig. 1).

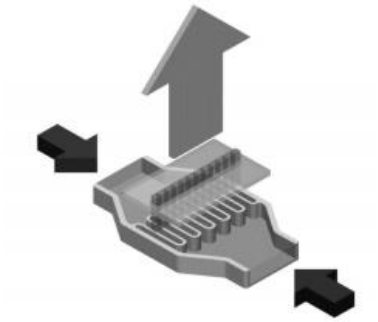

Fig 1. Representation of the multi-lamination principle. Interdigital flow passes slit to create multi-lamellae.

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