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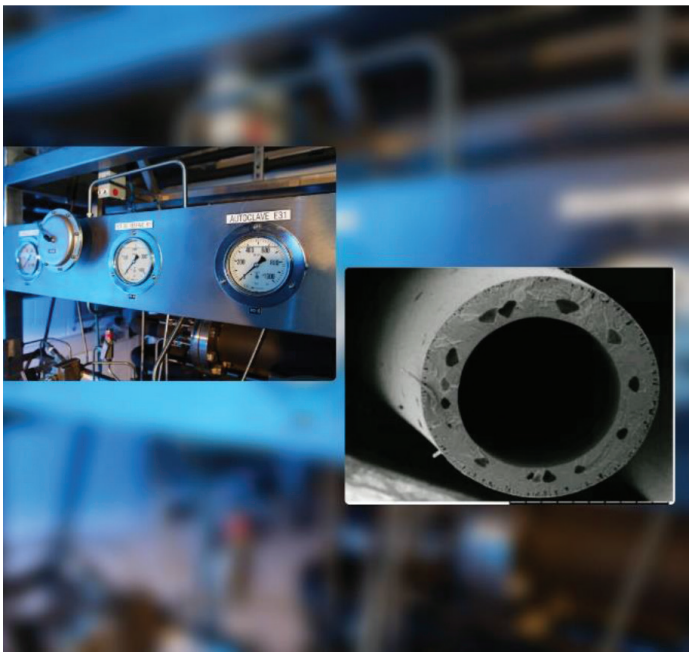
TOWARDS ENERGY EFFECTIVE SUPERCRITICAL PROCESSES THROUGH COUPLING WITH MEMBRANE PROCESSES

Procédés membranaires en milieu ScCO$_2$ pour des procédés supercritiques énergétiquement économes

Novel clean processes require the utilization of green solvents, among which CO_2 in supercritical state ($ScCO_2$) is considered as an excellent choice for its innocuity and its modular favorable properties (solvent power, viscosity, diffusivity...). Applications in the field of vegetal extraction, materials elaboration and processing, etc. are now being commercially exploited. Despite the advantages of $ScCO_2$ from an environmental and safety point of view, energy costs associated to the use of CO_2 under high pressure remain high and can discourage its use at industrial scale. Indeed, target product recovery and solvent recycling is usually done by CO_2 decompression to its gaseous state and the recompression step to the supercritical state is obviously energy consuming.

So, this thesis aims at reducing the energy cost related to the recompression of the CO_2. It is thus proposed here to design an hybrid process where implementation of a membrane filtration unit and/or a membrane liquid contactor, makes it possible to dramatically diminish the extent of the CO_2 decompression.

The ANR MemScCO$_2$ project will operate a modified existing 200 mL $ScCO_2$ pilot and possibly test this technological solution at a pre-industrial scale (25 L pilot). Modelling will be undertaken to optimize the different process options in respect to energy conception and a Life Cycle Assessment study will question the global validation of these new hybrid supercritical processes.



ScCO$_2$ process and hollow fiber membrane for a coupled separation system