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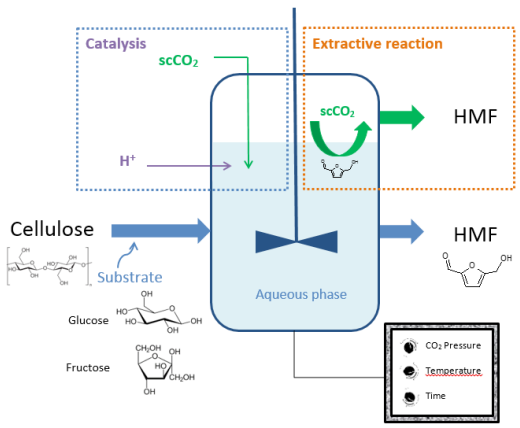
# SYNTHESIS OF FURANIC COMPOUNDS FROM LIGNOCELLULOSIC GLUCOSE IN SUPERCRITICAL $CO_2$-WATER TWO-PHASE SYSTEM

*Synthèse de structures furaniques à partir de glucose cellulosique en système diphasique eau-$CO_2$ supercritique*

This work aims at developing a new production process for 5-hydroxymethylfurfural (HMF), a promising bio-based platform chemical for the production of fuels and renewably sourced polymers. In the first part of this work, synthesis of HMF from lignocellulosic biomass-derived hexoses, and more particularly fructose, was carried out in a two-phase high-pressure $CO_2$-$H_2O$ system, regarded as an efficient and eco-friendly technology in biomass processing. From kinetic experiments and their modeling, the effect of $CO_2$ as a potential reversible acid catalyst was assessed.
Also, HMF yield was shown to be limited due to sequential degradation reactions. A relevant way to increase HMF yield by preventing its degradation has consisted in coupling its synthesis with simultaneous extraction by supercritical $CO_2$, leading to a one-pot extractive reaction process. In that context, partition coefficients of HMF between supercritical $CO_2$ and water have been experimentally evaluated, assuming that equilibrium is achieved at any time in the extraction device. Experimental data has enabled the application of thermodynamic models to describe the ternary $CO_2$-HMF-$H_2O$ system in order to find favourable operating conditions for the process. Coupling the kinetic modelling with the $CO_2$ extracting process modelling, based on the thermodynamic equilibrium of the mixture, has provided the theoretical tool allowing prediction of the best operating conditions for the one pot extractive process of HMF production from sugars issued from lignocellulosic biomass. This operating mode allowed exploiting all advantages of the use of $CO_2$ for such reactions of biomass conversion: reversible acid catalyst and extracting solvent.




*Dehydration of cellulose and cellulose-derived sugars into HMF in supercritical $CO_2$ ($scCO_2$)-water two-phase system*