**Simulation of sorption enhanced biomass gasification for green hydrogen production**

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This study presents a three-dimensional computational particle fluid dynamic (CPFD) simulation of sorption-enhanced gasification (SEG) using almond shells as feedstock. A detailed biomass characterization, including devolatilization behavior and gasification at two different steam-to-biomass ratios, was carried out. The devolatilization kinetics were obtained performing experimental tests at a temperature between 600 and 850 °C in a bench scale fluidized bed reactor in inert atmosphere. Then steam gasification tests were carried out using a similar lab-scale fluidized bed reactor. A mixture of olivine and calcined dolomite was used as the bed material in the gasification tests. Experimental data, including gas yield, tar concentration, and gas composition, were used to tune and validate the CPFD model. Results showed that an increase of the steam-to-biomass ratio from 0.5 to 1.0 increases the hydrogen volumetric fraction from 70.2 % to 78.8 %. Parallely, gas yield increased from 0.76 to 0.80 Nm3/kg confirming the positive impact of the in-situ CO2 capture on syngas quality with tar content ranging from 9.5 to 11.6 g/Nm3. Char yield decreased from 39.6 % to 36.0 %. The model predicted quite well the gasification behavior, only some discrepancies in tar formation were observed.