A CFD STUDY OF GAS-SOLID SEPARATION IN A DOWNER PYROLYSIS REACTOR: AN EULERIAN-EULERIAN APPROACH

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Biomass pyrolysis has emerged as a very promising renewable alternative for bio-oil production. Previous work has shown that the most effective biomass pyrolysis processes require careful control of temperature and residence times, and downer reactors appear to be one of the best technologies to achieve these requirements.

In this work, a novel gas-solid downer reactor for the pyrolysis of biomass feedstock (see Figure 1) (Huard et al., 2010)* has been investigated through CFD modeling. The reactor is equipped with a novel fast gas separation method to decrease the product vapour residence time and to reduce the severity of vapor over-cracking compared to other fast separation methods. We present here the gas-solid behaviour and separation efficiency in both dilute and dense operating conditions using Eulerian-Eulerian modelling approach. The model is validated against the published experimental data (Huard et al., 2010) and the impacts of the operating conditions on the separation efficiency are investigated (example of the results is shown in Figure 2).

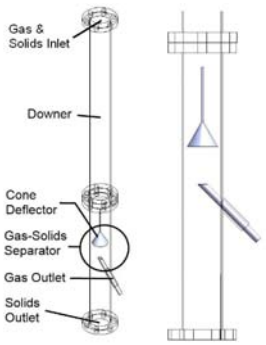

Figure 1 –Downer reactor Geometry (Huard et al, 2010)

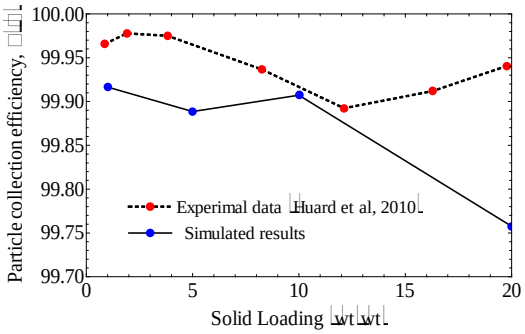

Figure 2 – Effect of solid loading on particle collection efficiency

* Martin Huard, Franco Berruti, and Cedric Briens, 2010. Experimental study of a novel fast gas-solid separator for pyrolysis reactors, Vol 8, Article A134 (DOI: 10.2202/1542-6580.1969)