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BIOMASS FAST PYROLYSIS PROCESS AT LABORATORY SCALE: RESIDENCE TIME AND HEATING UP EVALUATION IN A SHAFTLESS SCREW REACTOR BY MEANS OF A DISCRETE ELEMENT MODEL APPROACH

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ABSTRACT Screw reactors may be specifically and effectively designed for small scale fast pyrolysis processes but very few models are so far available to describe their behaviour as an aid for their design and optimization. In present work, an analysis of Solid Residence Time and heating up process is proposed for this type of reactor, studying the system through of a 3-D CFD model. The screw reactor where the pyrolysis process takes place, has been modelled by means of a Discrete Element Model DEM approach based on the multiphase code "MFIX". In this case, gas phase and related interactions occurring with particles, are taken into account while evaporating phenomena and chemical reactions are neglected. This approach, allows for investigating more in detail some characteristic effects related to the perturbation of operating parameters to compare numerical and experimental data. The simulated particle heat flux is in line with experimental results at an average value of about 100W corresponding to 1 kg/h biomass flow rate with a 7% moisture content w.b. For the solid phase, the residence rime in the pyrolysis zone (less than half of the whole reactor length) is in the order of 5.5 seconds that is in typical for such components.

Keywords: fast pyrolysis, DEM, RTD, screw reactor