

Mixing characteristics of bubble columns with internals for Biomass to liquid synthesis

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The use of renewable energy sources is becoming increasingly necessary, if we are to achieve the changes required to address the impacts of global warming. Biomass is the most common form of renewable energy, widely used in the third world but until recently, less so in the Western world. Latterly much attention has been focused on the conversion of biomass to liquid fuels; a process which would greatly increase the potential usefulness of biomass as a renewable resource.

Conversion of biomass to liquid is carried out by first gasification of biomass to yield synthetic gas. The synthetic gas can then be converted to liquid fuels using Fischer Tropsch process or transformed to methanol for subsequent use as a chemical, solvent or fuel. For large-scale FT / methanol synthesis the slurry bubble column reactor is the best choice. These reactors offer high conversion and high volumetric productivity when operated in the heterogeneous or churn turbulent regime. Notwithstanding the presence of large diameter bubbles and their short residence time in the liquid, gas-liquid mass transfer is quite fast in this regime due to the effective interaction between bubbles of various sizes. However, despite the simple construction and operation of bubble columns, their scale-up is very difficult due to complex interrelations among the many parameters that determine the behavior of bubble columns. In addition the complexity increases with the presence of cooling internals that affect the hydrodynamics and mixing behavior in bubble columns.

Gas phase backmixing is one of the important hydrodynamic parameters to be considered in the scale-up of bubble columns as it can adversely affect the reaction rates and product selectivity. The present investigation focuses on studying the effect of the cooling internals on gas phase mixing behavior. The percentage of internals used in this study is the same percentage used industrially for methanol synthesis (5 % internals) and FT synthesis (25% internals).