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Fluid dynamics and scale-up of pharmaceutical molecule

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Therapeutic molecules can be produced from plants growing in bubble column reactors. The basic mechanism involves injecting a gas (typically air or nitrogen) through a liquid medium surrounding the biomass. It has been found that the amount of drug produced strongly depends on the flow parameters such as tank dimensions, gas inlet flow rate, sparger design, contained solid mass and the volume, density, and viscosity of the surrounding liquid. Current production techniques rely largely on trial and error due to the lack of fundamental knowledge on the multiphase flow in question. We have recently implemented novel non-intrusive flow visualization and velocimetry techniques to understand the underlying mechanisms governing flow mixing. Our experimental methodology consists of laser imaging and particle tracking, revealing detailed information on mixing pattern and vortical structures forming within the flow. In the absence of biomass, bubbly and churn-turbulent flows are found to form at low and high gas injection rates, respectively. In the bubbly regime, two vortices are dominantly formed on the vessel sides which break down into smaller eddy transitioning into the churn-turbulent regime. The results are targeted to be analyzed in dimensionless maps setting eventually a suitable pathway to scale-up the set-up for commercialization and increased production.

Biography

Dr. Kamran Alba received his Ph D in 2013 from Mechanical Engineering Department of The University of British Columbia. His main research area lies in the field of experimental and analytical fluid dynamics with applications vastly found in energy, food-processing, mining and biology fields. The fluid flows studied range from multiphase, suspension and buoyant systems to coating and co-extrusion processes. He is currently an Assistant Professor in Department of Engineering Technology of The University of Houston and the manager of Complex Fluids Laboratory.

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