INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

Name of the Student	:	pillajettipremsagar
Roll Number	:	166107023
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Thesis Title : Experimental Investigations of Flow Behavior in Pulsed Plate Columns Using Radioactive Particle Tracking

Name of Thesis Supervisor(s)	:	Dr. Raghvendra Gupta, Dr. Rajesh Upadhyay
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SHORT ABSTRACT

This thesis investigates the hydrodynamic behavior in Pulsed Plate Columns, which play a crucial role in liquid-liquid extraction processes across diverse industries, including mineral processing, pharmaceuticals, and the nuclear fuel cycle. A pulsed sieve plate extraction column is a vertically oriented separation device that employs alternating fluid pulses to improve component extraction. This is achieved by generating uniform dispersion of droplets from a disperse phase, leading to increased interfacial area for efficient mass transfer. The column utilizes an internal sieve-like plate as a contact stage, facilitating effective separation of compounds through enhanced interaction. Despite their broad applications, there needs to be more experimental data for the local hydrodynamics in these columns. This research is motivated by the aforementioned gap, explicitly focusing on the quantification of mixing. This quantification is achieved by measuring velocity fluctuations within the pulsed plate column under various geometrical and operational parameters. The employment of the Radioactive Particle Tracking (RPT) technique is highlighted in the investigation of a pulsed sieve plate extraction column. The velocity measurements are executed using the RPT, which involves choosing a unit cell zone between two consecutive plates far away from the column's inlet and exit. In this technique, a radioactive particle functions as a tracer, tracking the fluid's movement. The particle's position is recorded over time through six scintillation detectors. Preceding this investigation, studies for optimizing the resolution and sensitivity of detectors are conducted. The application of the RPT technique is then carried out, and the Monte Carlo reconstruction algorithm is employed to measure the Lagrangian track. This track provides valuable insights into the local velocity field within the column.