

## Process Intensification: A Study of Micromixing and Residence Time Distribution Characteristics in the Spinning Disc Reactor

1. The extensive article under review is a doctoral thesis study conducted to systematically investigate the micro and macro mixing of thin films created by a spinning disc reactor (SDR).
2. The first part of this study compares the micromixing ability of SDR technology to its primary competing processes: the semi-batch reactor (SBR) and the continuous tubular flow reactor using narrow channels (NCR).
3. Multiple operating parameters were tested for the SDR including, quote - disc rotation rates, disc size, disc surface configurations, feed flowrates, feed distribution systems, liquid feed concentrations and viscosities – unquote.
4. The second focus of this study was to determine, quote – the residence time distribution (RTD) of the liquid flow in the 30 cm SDR – unquote, under a range of different operating conditions.
5. Process intensification was primarily a strategy to reduce capital investment while maintaining the same level of production. It was quickly realized that successful intensifications also result in reduced environmental impact and better overall process efficiencies.
6. Reducing equipment size while maintaining throughput also offers the benefit of better heat transfer and mass transfer rates which helps to reduce undesirable byproducts.
7. Process intensification can be achieved through multiple possible methods: quote – the use of centrifugal forces, flow field/fluid microstructure interactions, periodic flow, high/ultra-high pressure, electric field, and diffusion/conduction path reduction – unquote.
8. The Spinning Disc Reactor (SDR) is one possible process designs which can offer significant intensification. It involves a rotating disc mounted on a horizontal or vertical shaft. Liquid reactants are fed near the center of the disc and drawn outwards due to centrifugal force.
9. Use of an SDR was successfully used, quote – at Newcastle University for industrial application: ... polystyrene production and precipitation of barium sulphate from aqueous solutions – unquote. The results were significant when compared to a conventional batch reactor.
10. The author chose to focus the study on the implementation of SDR technology vs a competing method of intensification for a number of reasons: high heat transfer rates, high mass transfer rates, ability to mix at a molecular level, ability to include parallel reactions, minimal reactant volumes, short residence times, and easy operation.
11. The liquid film produced on an SDR is typically 50-200 um thick.
12. The typical residence time of an SDR is 1-5 seconds.

**Source:** Al-hengari S. Process Intensification: A Study of Micromixing and Residence Time Distribution Characteristics in the Spinning Disc Reactor. October 2011.  
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**Review by:** SP



