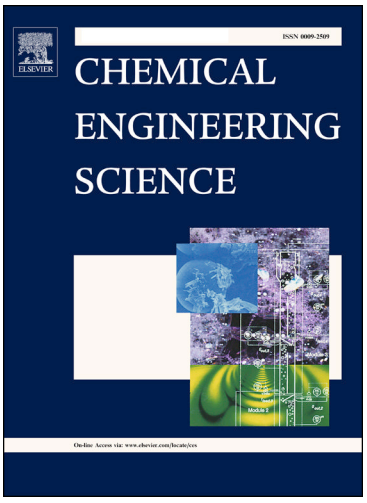

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Mixing of non-Newtonian fluids in a cylindrical stirred vessel equipped with a novel side-entry propeller

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HIGHLIGHTS

- Mixing of non-Newtonian fluids was studied using an ultrasonic Doppler anemometer.
- Experimental and theoretical results were consistent.
- Rotation speeds and rheological properties affected the flow patterns.
- The 2D and 3D velocity profiles were compared and evaluated.

Abstract: A side-entry propeller was designed and introduced in this study. The mixing performance of shear thinning fluids in a cylindrical stirred vessel equipped with this propeller was experimentally investigated via an ultrasonic Doppler anemometer (UDA, experimental results were consistent with theoretical findings. The power number and Reynolds number of this propeller were evaluated by using Chhabra, Metzner and Reed equations. Results showed that the power number versus the Reynolds number curves were highly comparable with Metzner and Reed equations. The velocity jet vectors flow field of 320, 380, and 440 rpm were described in detail. These findings demonstrated that the circulation loops, cavern size, and shape were highly influenced by shear thinning parameters and operating conditions. The average of the velocity profiles from five sample lines in front of the propeller was utilized to analyze the effect of rheological properties and operating conditions on the propeller. The axial, radial and tangential 2D velocity profiles located at one sample line (200 mm) in front of the propeller at the design rotation speed were evaluated.

Keywords: Mixing; Non-Newtonian fluids; Side-entry novel propeller; Power consumption; Velocity jet distribution

1. Introduction

The mixing of non-Newtonian fluids has been widely investigated because this procedure is utilized in various industries, such as biotechnology, chemicals, wastewater treatment, pharmaceuticals, cosmetics, and paint (Paul et al.

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