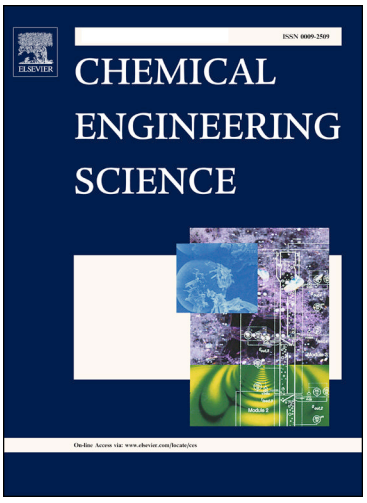


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# Computational fluid dynamic studies of mixers for highly viscous shear thinning fluids and PIV validation

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## Abstract

Agitation of highly viscous shear thinning fluids is normally conducted with complex impeller designs. Often, impellers almost as large as the tanks containing them and impeller blades equipped with holes are adopted in industry. In this work, we studied experimentally the main features of the flow generated by this type of impellers for a mixture of glycerol with a carbomeric gel by means of particle image velocimetry. The experiments were conducted at temperatures ranging from 40 to 60 ºC and impeller speeds ranging from 40 to 140 rpm. In all cases, the flow regime was laminar or in the transition region. We also used computational fluid dynamics simulations to describe the behaviour of the mixer, validating the results experimentally with good agreement. We used the numerical results to obtain information on the performance of the mixer, determining the locations and size of vigorous agitation zones and the local effect of the holes present on the impeller blades. The power curves of the mixer were obtained, and the mixer efficiency in terms of power consumption was found to be similar to other impellers used to mix highly viscous non-Newtonian fluids.

## Introduction

Mechanically stirred tanks are ubiquitous in a wide range of chemical process industries. Their applications vary from mixing and blending different materials to generating solid suspensions or enhancing heat and mass transfer. Guidelines are readily available on the design of mixing tanks; these depend on the application, materials and volume to be mixed, and the flow regime (Kresta et al., 2015). Often these guidelines are based on industrial experience rather than on fundamentals and, as a result, extensive analysis and lab/pilot scale experimental studies are recommended to decide the best