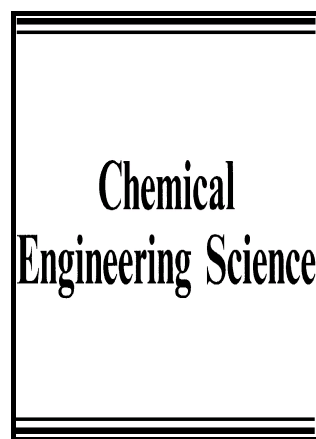


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# Real Time Monitoring of the Quiescent Suspension Polymerization of Vinyl Chloride in Microreactors - Part 2. A Kinetic Study by Raman Spectroscopy and Evolution of Droplet Size

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## Abstract

This paper regards the experimental study on the polymerization of vinyl chloride droplets in quiescent state using microreactors. As presented in a previous work performed with methyl methacrylate monomer, this work presents results on the reaction kinetics of vinyl chloride (VCM) polymerization monitored by Raman spectroscopy and on the evolution of VCM droplets as captured by charge-coupled device (CCD) camera in a microcapillary. Different experimental recipes were proposed using commercial initiators in order to compare the system performance when initiated with monofunctional and bifunctional peroxides. For the first time in the open literature the evolution of VCM droplets is shown up to high conversions (> 90 %) in quiescent state. It is also shown how the pressure drop can modify the PVC particle morphology at the end of polymerization. Finally, it is shown that the Raman technique is able to monitor the reaction kinetics at different conditions, being possible to identify four different characteristic stages during the vinyl chloride polymerization reactions.

*Keywords:* microreactors; suspension polymerization; Raman spectroscopy; vinyl chloride; kinetics; bifunctional initiator

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## 1. Introduction

The usage of microreactors has increased steadily in the chemical engineering field (Jensen, 2001; Pattekar and Kothare, 2004; Sun et al., 2008; Chang et al., 2004; Iwasaki and Yoshida, 2005; Richard et al., 2013) and also in other areas of study (Zhang et al., 2004; Salic et al., 2012; Massignani et al., 2010). The application of this technology has been proposed originally in order to allow for small-scale production and became a reality in the late 1980s and early 1990s (Benson and Ponton, 1993). In order to provide higher flexibility and

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