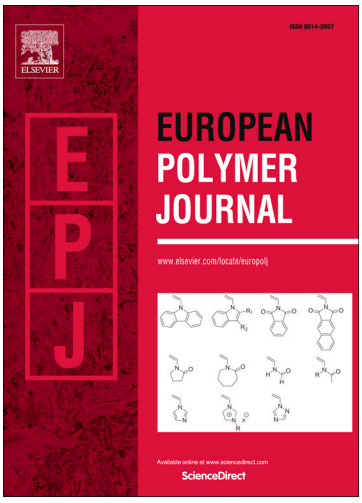

Preparation of highly interconnected hydrophilic polymers from emulsion templates with improved mechanical properties

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Preparation of highly interconnected hydrophilic polymers from emulsion templates with improved mechanical properties

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Abstract

Highly interconnected hydrophilic polymers were prepared through the polymerisation of (paraffin-oil)-in-water emulsion templates using internal phases below 74 vol%. These were stabilised by Tween 85 and contained acrylamide and *N*,*N*′-methylene bisacrylamide, as monomers, in the continuous water phase. The emulsification energy was increased, resulting in increased contact between emulsion droplets, allowing open cellular and highly interconnected structures to be achieved. This was coupled with a reduction in the internal phase volume allowing the obtainment of highly interconnected materials with excellent mechanical properties under compression, producing a Young's modulus of 490 ± 90 MPa for a material with 36 ± 3 % porosity. It was also found that the morphology of these materials could be altered through variations in the internal phase volume, the surfactant level and the emulsification energy. These porous polymers also possessed quite different behaviours in different solvent environments suggesting applications in controlled release or as rigid absorbents.

Keywords: High internal phase emulsions / medium internal phase emulsions / polyMIPEs / polyHIPEs / hydrophilic porous polymers

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1. Introduction

Emulsion templating has emerged as an attractive route towards the preparation of cellular, and thus porous, polymeric materials [1-4]. In particular, the use of high internal phase emulsions (HIPEs) as templates is popular. A HIPE has a dispersed internal phase which exceeds 74 vol% which is the characteristic packing density of face centred cubic (fcc) or hexagonally closed packed (hcp) arranged uniform hard spheres. When the continuous phase is solidified a cellular monolithic material is obtained with closed or open cellular structure. When the continuous phase of the HIPE contains one or more monomeric species polymerisation results in the formation of what is known as a poly(HIPE) material [5-8]. Poly(HIPE)s generally