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Kinetics of water absorbency in AA/AMPS copolymers: applications of a diffusion–relaxation model

Fátima Rosa, João Bordado, Miguel Casquilho*

Instituto Superior Técnico, Ave. Rovisco Pais, IST, 1049-001 Lisboa, Portugal

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Abstract

Superabsorbent copolymers, based on acrylamide, 2-acrylamido-2-methyl-propanosulfonic acid and a divinyl crosslinker, *N*,*N*′-methylenebisacrylamide, have been synthesized by free radical solution and inverse emulsion polymerization. The copolymerization has been carried at different pH values of the monomer mix reaction medium.

The copolymers were characterized by their dynamic swelling behavior in deionized water, i.e. the mass of water absorbed by a sample of copolymer was measured vs time. The results were analyzed in terms of the Berens–Hopfenberg non-Fickian equation, leading to a one-only-term relaxation. These kinetics were interpreted by the diffusion–relaxation model and offer quantitative information by diffusivity at 20°C of water in the copolymers. In this investigation, the results have been confirmed within experimental error as the sample of the copolymer is swollen. © 2001 Published by Elsevier Science Ltd.

Keywords: Swelling; Superabsorbent copolymers; Absorption kinetics

Table 4
Equilibrium swelling and calculated parameters for the copolymers

	C-1	C-2	C-3	C-4	C-5	C-6	C-7
r_∞	669	420	395	144	466	329	857
x	–	0.32	0.18	0.64	0.41	–	–
$1-x$	1	0.68	0.82	0.36	0.59	1	1
k_F (s^{-1})	1.93×10^{-3}	8.24×10^{-3}	6.75×10^{-3}	5.39×10^{-3}	8.83×10^{-3}	3.71×10^{-3}	3.07×10^{-3}
k_1 (s^{-1})	2.34×10^{-3}	4.04×10^{-3}	6.32×10^{-3}	5.45×10^{-3}	3.15×10^{-3}	8.36×10^{-3}	7.77×10^{-3}
D (m^2/s)	1.58×10^{-14}	6.77×10^{-14}	5.54×10^{-14}	4.40×10^{-14}	7.25×10^{-14}	3.04×10^{-14}	2.52×10^{-14}