Application of NMR Techniques for Detection of Structural Changes in Starch-Based Polymer Systems Due to Storage

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Abstract. Nuclear magnetic resonance (NMR) spectroscopy, frequently used in the study of polymer morphology and molecular motion, was applied for the study of structural changes related to starch retrogradation. Two samples of thermoplastic starch prepared with two different plasticizers (formamide and sorbitol) were studied using NMR techniques. The ^{13}C, ^{1}H spectra and ^{13}C spin-lattice relaxation times were measured on these samples within a month after their preparation and again after ten months of storage. For sorbitol-plasticized starch only small changes in ^{13}C NMR spectrum and ^{13}C spin-lattice relaxation times were observed after ten months, which may be related to physical ageing of the sample. On the other hand, distinct differences in ^{13}C NMR spectra and ^{13}C spin lattice relaxation times of formamide-plasticized starch indicate the onset of retrogradation in this sample. The narrowing of ^{1}H NMR spectra of both studied samples revealed water uptake from the atmosphere during sample storage.