

INFLUENCE OF CATALYST ON SYNTHESIS AND PROPERTIES OF STARCH ACETATE

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Starch acetate based on a sustainable native polymer can be used as a thermoplastic substance for replacement nondegradable plastic products. The acetylation of potato starch with acetic anhydride and sodium hydroxide/ calcium oxide as catalysts was investigated in this work. Low and high temperature starch acetylation reactions were carried out at 45°C and 123°C, respectively, by using Mark and Mehlretter method [1] with some modifications (see Fig. 1.).

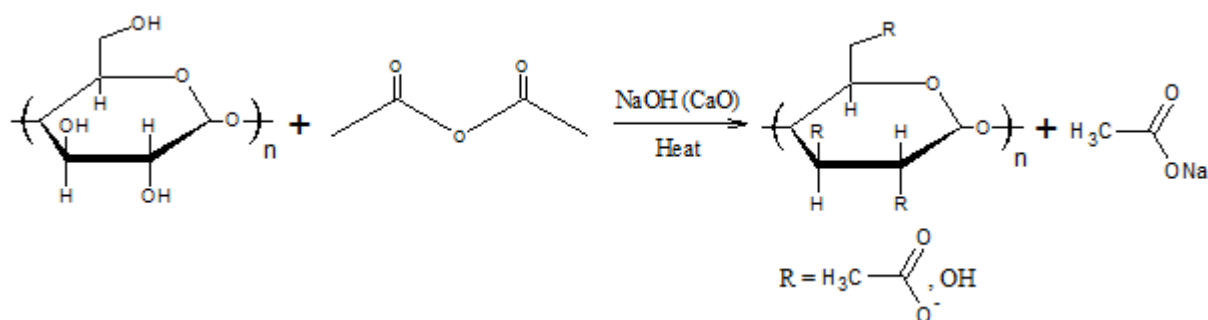


Fig. 1. Reaction scheme of starch acetylation

The effects of process variables such as temperature (45 and 123 °C), NaOH and CaO to starch ratio (0–2.75 mol/mol AGU) and reaction time (1–40 hours) on the degree of substitution (DS) of acetyl groups were investigated (Table 1). At these conditions, acetylated potato starches with DS values ranging from 0.22 to 1.10 were obtained.

Table 1. Influence of reaction parameters on DS of acetylated starch

Sample No.	Starch: NaOH: CaO:Acetic anhydride molar ratio	T, °C	Time, h	DS
1	1: 0.04: 0: 3	45	16	0.30
2	1: 0.04: 0: 3	45	40	0.26
3	1: 0.08: 0: 3	45	16	0.30
4	1: 0.08: 0: 3	45	40	0.31
5	1: 0.04: 0.04: 3	45	16	0.22
6	1: 0.04: 0.04: 3	45	40	0.35
7	1: 0.08: 0.04: 3	45	16	0.26
8	1: 0.08: 0.04: 3	45	40	0.30
9	1: 2.75: 0: 3	123	1	0.50
10	1: 2.75: 0: 3	123	2	0.70
11	1: 2.75: 0.04: 3	123	1	0.80
12	1: 2.75: 0.04: 3	123	2	1.10

It was determined that at low temperature reaction conditions the DS of the obtained products was affected to higher degree by NaOH content than CaO content. The DS of the samples prepared at 123 °C was higher than that of the samples obtained at 45 °C. CaO had significant influence on DS only at high temperature conditions. Moreover, the DS of acetylated starch obtained at high temperature conditions by using CaO was higher than that synthesized without CaO. Obtained acetylated starches were characterized by infrared spectroscopy, microscopy and thermal analysis.

[1] Y. Xu, V. Miladinov and A. Hanna, Synthesis and Characterization of Starch Acetates with High Substitution, Cereal Chemistry, 735-740 (2004).