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Research Article

Synthesis and Characterization of Novel Water Soluble Starch Tartarate Nanoparticles

Suk Fun Chin, Suh Cem Pang, and Lih Shan Lim

Department of Chemistry, Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Malaysia

Correspondence should be addressed to Suk Fun Chin, sukfunchin@gmail.com

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Starch tartarate nanoparticles were prepared by esterification reaction between native sago starch (*Metroxylon sagu*) and tartaric acid using dimethyl sulphoxide (DMSO) as a solvent and 2-dimethylamino pyridine (DMAP) as a catalyst at 100°C. The substitution of tartaric acid onto native sago starch was confirmed by the FTIR spectra which showed the presence of carbonyl group absorption band of tartarate ester. The solubility of the as-synthesized starch tartarate nanoparticles was observed to increase linearly with increase in the degrees of substitution. Under optimized synthesis conditions, starch tartarate nanoparticles of mean particle sizes which ranged from 200 nm to 300 nm were produced.

1. Introduction

Starch as a polysaccharide is one of the most abundant renewable agroresources. Starch mainly composed of amylose and amylopectin polysaccharides. The ratio of amylopectin and amylose depends on the plant origin such as maize, corn, sago, tapioca, wheat, and potato [1, 2]. Starch has been traditionally being widely used as a major low-cost food item in many countries. Due to its low-toxicity, abundant availability, biodegradable, and low cost, starch and its derivatives are widely used in various industry applications such as coating and sizing in paper industries, binder and adhesives, absorbent, drug delivery carriers, and implants [3–6]. However, the inherent poor mechanical properties, insolubility in water, and high viscosity have limited the utilization of native starch in various applications. This drawback has prompted many researchers to modify starch in order to improve its properties for various technological and biomedical applications. The properties of modified starch were affected by several factors, such as the degree of substitution (DS), sources of starch, and types of substituent [7].

The esterification reaction is one of the most commonly used approaches to modify starch. Among the commonly studied starch esters are starch acetate [8, 9] and starch maleate [10]. Starch esters are being used in applications such as substitutions for petroleum-based plastic materials, sealing adhesives, and biodegradable packing materials [11]. Various synthesis methods have been used to synthesize starch esters. The esterification of starch is normally carried out by reacting starch with fatty acid chlorides [12], acetic anhydrides [13], succinic anhydrides [14], sodium selenite [15], or dicarboxylic acid [16] in various types solvents and under basic conditions.

In this work, we have attempted to prepare a new type of water soluble starch esters by the esterification reaction between native sago starch and tartaric acid. Tartaric acid is a nontoxic, natural occurring compound found in fruits such as grapes, bananas, and tamarinds. Tartaric acid is being used as a popular food additive in soft drink, cream of tartar and baking powder. Being a dicarboxylic acid, the esterification of starch can occur through the substitution of carboxylic group of the tartaric acid onto the free hydroxyl groups of starch molecules.

2. Experimental

2.1. Materials. Native sago (*Metroxylon sagu*) starch was purchased from a local grocery store. Ultrapure water (~18.2 MΩ) was obtained from Water Purifying System