Deacetylation of Chitin and the Properties of Chitosan Films with Various Deacetylation Degrees

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ABSTRACT

The degree of deacetylation is the proportion of glucosamine monomer residues in chitin. It affects many properties of chitosan. The objectives of this research were to study the deacetylation of chitin by alkaline and to investigate chitosan film properties with different degrees of deacetylation. Chitin was deacetylated by boiling (95°C) in concentrated sodium hydroxide (50%) solution for 120-300 minutes. The degree of deacetylation of chitosan was determined by potentiometric titration method. Chitin possessed a degree of deacetylation of 7.74%. The alkaline deacetylation produced chitosan with a degree of deacetylation of 15.24-70.19%. We found a linear relationship between the degree of deacetylation and deacetylation time (degree of deacetylation = 2.476 + 0.230t, R^2 = 0.915). The deacetylation time had no effect on the yield and whiteness of the obtained chitosans. Film was formed from the obtained chitosan at each deacetylation time and their properties investigated. Increasing the deacetylation time increased the tensile strength, elongation and water vapor transmission rate of the films. In contrast, redness (a*) and yellowness (b*) of the films decreased.

Keywords: Chitosan, Degree of deacetylation, Deacetylation of chitin, Linear potentiometric titration, Chitosan film

INTRODUCTION

Chitin is a copolymer of N-acetyl-D-glucosamine and D-glucosamine units linked with a β-(1-4) glycosidic bond, where N-acetyl-D-glucosamine units are predominant in the polymeric chain (Kim, 2011). It is a highly insoluble material with low chemical reactivity. Chitosan is the N-deacetylated derivative of chitin, although this N-deacetylation is almost never complete (Kumar, 2000). Chitosan has a high density of amino groups and is soluble in weakly acidic solvents such as acetic or formic acid. It appears that the physicochemical properties of chitin and chitosan are widely different, which are governed by three principal factors: source of raw material, molecular weight and degree of deacetylation (Chandumpai et al., 2004). Chitosan can be obtained by alkaline deacetylation of chitin.