

Precipitation Behaviour of Debranched Waxy Rice Starch in the Presence of Fatty Acid

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ABSTRACT

Debranched waxy rice starch (DBS) and fatty acid (FA; i.e., lauric acid and stearic acid) were dissolved and co-precipitated in acetate buffer solutions pH 3-7. The X-ray powder diffraction (XRD) patterns of precipitants obtained displayed B-type at low pH (3-5) but V_h-type at pH 7, indicating that DBS precipitated as free form at pH 3-5 but as inclusion complexes with FA at pH 7. The precipitation behaviour of DBS in the presence of FA at pH 3-7 was evaluated, using rapid visco analyzer (RVA). RVA was able to detect the increased viscosity, resulting from both the precipitations of free DBS and DBS/FA inclusion complexes. DBS/FA complexes precipitated at a higher temperature than did free DBS. RVA profiles also revealed that DBS favorably precipitated as free form at pH 3 and as DBS/FA inclusion complexes at pH 7. It was thought that more FAs dissociated at pH 7 and resulted in the increased solubility which facilitated more FA to form inclusion complex with DBS. RVA profiles clearly demonstrated that lauric acid had less potential to form inclusion complex with DBS, particularly at a pH below the pK_a. In addition, it was likely that the formation and the precipitation of DBS/FA complexes occurred at a higher temperature when the pH of the mixture was increased.

Key words: Debranched waxy rice starch, Lauric acid, Stearic acid, Complex, RVA

INTRODUCTION

Starch is mainly consisted of two types of polysaccharides, amylose and amylopectin. Amylose is an essentially linear polymer with molecular weights ranging from 10⁵-10⁶ and with the number of glucose residues per molecule ranging up to 5000 (Galliard and Bowler, 1987). Many chemicals that consist of a non-polar moiety, such as fatty acids, iodine and surfactants are known to form inclusion complex with amylose and precipitate from the solution (Kuge and Takeo, 1968). A part or whole of their molecules are usually incorporated inside amylose helices in which the interior surface is built up by C-H groups and glycosidic oxygen atoms, forming a lipophilic core. Nuclear magnetic resonance (NMR) and molecular