New insight into the control of the degree of hydrolysis and the determination of the percentage conversion in the production of poly (vinyl alcohol) from commercial poly(vinyl acetate)

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Poly(vinyl alcohol) (PVA) is a water-soluble synthetic resin with excellent adhesive, film-forming and emulsifying properties. It is conventionally produced by the hydrolysis of poly(vinyl acetate) (PVAc). Alkaline hydrolysis of PVAc is preferred over the use of acid-catalyzed hydrolysis for the industrial production of PVA. Alkaline hydrolysis is carried out using sodium hydroxide (NaOH) and water or, more advantageously, by methanolysis employing sodium hydroxide and methanol.

Poly(vinyl alcohol) is suitable for a wide variety of applications, which are largely determined by its adhesive, film forming and emulsifying properties. Resin properties depend on the molecular weight of the parent PVAc and the degree of hydrolysis. By tuning the molecular weight of the parent PVAc and the degree of hydrolysis independently during the manufacturing process one can obtain the resin that provides the property balance needed for different applications.

In the study, partially hydrolyzed PVA was produced from commercial PVAc by alkaline hydrolysis in a water/methanol medium. Commercial poly (vinyl acetate) (48 %w/w) was treated with aqueous NaOH in methanol to afford PVA (74% yield) and the byproduct sodium acetate (CH_3COONa).

Percentage conversion was determined by a titrimetric analysis of the byproduct sodium acetate with a standard 0.1 M HCl solution, which revealed that the PVA produced was 83 mol% hydrolyzed. The amount of alkali (NaOH) used in the reaction is the key factor that controls the degree of hydrolysis. The PVA product was characterized by IR spectroscopy and the melting point in comparing with an authentic sample.

PVA product was soluble in warm water and remained soluble on cooling. An aqueous solution of PVA product showed excellent adhesive properties.

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