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Ferulic Acid-Grafted Chitosan: Thermal Stability and Feasibility as an Antioxidant for Active Biodegradable Packaging Film

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Abstract : Active packaging has been developed based on the incorporation of certain additives, in particular antimicrobial and antioxidant agents, into packaging systems to maintain or extend product quality and shelf-life. Ferulic acid is one of the most effective natural phenolic antioxidants, which has been used in food, pharmaceutical and active packaging film applications. However, most phenolic compounds are sensitive to oxygen, light and heat; its activities are thus lost during product formulation and processing. Grafting ferulic acid onto polymer is an alternative to reduce its loss under thermal processes. Therefore, the objectives of the present research were to study the thermal stability of ferulic acid after grafting onto chitosan, and to investigate the possibility of using ferulic acid-grafted chitosan (FA-g-CTS) as an antioxidant for active biodegradable packaging film. FA-g-CTS was incorporated into biodegradable film via a two-step process, i.e. compounding extrusion at temperature up to 150 °C followed by blown film extrusion at temperature up to 175 °C. Although incorporating FA-g-CTS with a content of 0.02–0.16% (w/w) caused decreased water vapor barrier property and reduced extensibility, the films showed improved oxygen barrier property and antioxidant activity. Radical scavenging activity and reducing power of the film containing FA-g-CTS with a content of 0.04% (w/w) were higher than that of the naked film about 254% and 94%, respectively. Tensile strength and rigidity of the films were not significantly affected by adding FA-g-CTS with a content of 0.02–0.08% (w/w). The results indicated that FA-g-CTS could be potentially used as an antioxidant for active packaging film.

Keywords : active packaging film, antioxidant activity, chitosan, ferulic acid
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