Stabilization of Oil-In-Water Emulsions by Enzyme Catalyzed Oxidative Gelation of Sugar Beet Pectin

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ABSTRACT

Enzyme catalyzed oxidative cross-linking of feruloyl groups can promote gelation of sugar beet pectin (SBP). It is uncertain how the enzyme kinetics of this cross-linking reaction are affected in emulsion systems and whether the gelation affects emulsion stability. In this study, SBP (2.5% w/v) was mixed into an oil-in-water emulsion system (4.4% w/w oil, 0.22% w/w whey protein, pH 4.5). Two separate, identically composed, emulsion systems were prepared by different methods of preparation. The emulsions prepared separately and subsequently mixed with SBP (referred as Mix A) produced significantly larger average particle sizes than the emulsions in which the SBP was homogenized into the emulsion system during emulsion preparation (referred as Mix B). Mix B type emulsions were stable. Enzyme catalyzed oxidative gelation of SBP helped stabilize the emulsions in Mix A. The kinetics of the enzyme catalyzed oxidative gelation of SBP was evaluated by small angle oscillatory measurements for horseradish peroxidase (HRP) (EC 1.11.1.7) and laccase (EC 1.10.3.2) catalysis, respectively. HRP catalyzed gelation rates, determined from the slopes of the increase of elastic modulus (*G'*) with time, were higher ($P < 0.05$) than the corresponding laccase catalyzed rates, but the final *G'* values were higher for laccase catalyzed gels, regardless of the presence of emulsions or type of emulsion preparation (Mix A or Mix B). For both enzymes, rates of gelation in Mix A were higher ($P < 0.05$) than in Mix B, and higher stress was needed to break the gels in Mix A than in Mix B at similar enzyme dosage levels. These differences may be related to a lower availability of the feruloyl-groups for cross-linking when the SBP was homogenized into the emulsion system during preparation.

9.