

Characterization of the surface-active components of sugar beet pectin and the hydrodynamic thickness of the adsorbed pectin layer

Abstract

The fraction of sugar beet pectin (SBP) adsorbed onto limonene oil droplets during emulsification has been isolated, and its chemical and physicochemical characteristics have been determined. While the SBP sample itself was found to contain 2.67 and 1.06% protein and ferulic acid, respectively, the adsorbed fraction contained 11.10% protein and 2.16% ferulic acid. The adsorbed fraction was also found to have a higher degree of acetylation, notably at the C2 position on the galacturonic acid residues, and was also found to contain a higher proportion of neutral sugars, which are present in the ramified side chains of the pectin molecules. The thickness of the layer of SBP adsorbed onto polystyrene latex particles was studied by dynamic light scattering and was found to increase with increasing surface coverage. It was found to have a value of ~140 nm at plateau coverage, which closely corresponded to the hydrodynamic diameter of the pectin chains. The adsorbed layer thickness was found to be sensitive to pH and the presence of electrolyte. The thickness at a surface coverage of ~20 mg/m² in the absence of electrolyte at pH ~4 was 107 nm and at pH 8.8 was 70 nm, while at pH ~4 in the presence of 10 mM NaCl the thickness was found to be 70 nm. It was concluded that the SBP molecules form multilayers at the surface due to electrostatic interaction between the positively charged protein moieties and the galacturonic acid residues. The removal of calcium from the SBP had no effect on the adsorbed layer thickness; hence, multilayer formation due to calcium ion cross-linking was considered unlikely.