**Decoding Gum Arabic: Unraveling the Connection Between Structure and Functionality.**

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Gum arabic (GA), the exudate from *Acacia senegal*, is commonly used to stabilize aroma oil and beverage emulsions due to its amphiphilic character, high emulsifying capacity, and very low viscosity in aqueous solution. GA emulsions are able to prevent coalescence over extended storage periods. Despite its wide use and overall excellent technofunctional properties, the molecular reasons for the functional differences among various GA batches remain relatively unclear. Long-term emulsion stability, which is crucial for the quality of a GA batch, is mostly determined through an acceleration test, in which the change in droplet size distribution of a GA emulsion, after heating the emulsion over the course of a week, is observed and evaluated.1 Previous studies on individual GA samples have postulated that certain GA glycoprotein fractions, especially those characterized by a high protein content and significant spatial expansion, are crucial for initial emulsion stability.2,3 However, quality markers for unfractionated GA and correlations with structural parameters have not been established. Therefore, our aim was to investigate the structural properties and techno-functional characteristics of 20 GA samples of varying quality in detail to clarify the interrelation. To obtain valid results, analytical methods such as the protocol for monosaccharide analysis were refined. Furthermore, new approaches were developed which provide rapid and detailed insights into the molecular properties of GA.

The gum samples were first analyzed for their monosaccharide composition, protein content, molecular weight, and molecular weight distribution. O/W emulsions with weighted orange oil were prepared from all samples, and their initial droplet size distribution and viscosity were determined. By using Pearson correlation tests, we demonstrated that rhamnose content and the rhamnose/galactose ratio positively correlate with molecular mass. The molecular mass itself correlated with the viscosity of the emulsion, while the protein content negatively correlated with the droplet size distribution. Especially the molecular mass/viscosity ratio appeared to have a subtle impact on batch quality. To gain a deeper understanding of the relation between quality (i.e. long-term emulsion stability) and molecular structure, selected GA samples were fractionated by using hydrophobic interaction chromatography according to their protein content in different glycoprotein fractions, known as arabinogalactan (AG), arabinogalactan-protein (AGP) and glycoprotein (GP). The fractions were analyzed similarly to the native samples and also further characterized after partial enzymatic and chemical hydrolysis. This enabled detailed insights into the structural differences and similarities between the samples to be obtained, as well as the identification of the decisive factors for batch quality.

*References:*

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