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Pendant-drop tensiometry for the evaluation of the foaming properties of camel and bovine milk-derived proteins

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Dynamic surface tension measurement is an important analytical tool to determine the foaming properties of surfactants such as milk proteins. A rapid decrease of surface tension indicates a fast adsorption of the surfactants to the surface and hence, a fast stabilisation of the dispersed phase against coalescence. The aim of this research was to examine the relationship between foaming properties and pendant-drop tensiometry parameters of camel and bovine milk-derived proteins (skimmed milk, sodium caseinates, sweet whey, β-casein, α-lactalbumin and β-lactoglobulin). Camel and bovine milk proteins were identified by the reversed-phase high-performance liquid chromatography (RP-HPLC) and foaming properties (Foam capacity (FC) and stability (FS)) were analyzed. Pendant-drop tensiometry parameters (surface tension (γ) and the viscoelastic modulus (ε)) were used to characterize the competitive adsorption of milk proteins to the air/water interface. Maximum FC and FS were found for skim milk, sodium caseinates and β-casein when compared to globular whey proteins for both milk, with higher values for β-casein. Good correlation was observed between foaming and interfacial rheological properties of camel and bovine proteins. Thus, milk proteins adsorbed layers are mainly affected by the presence of β-casein which is the most abundant and efficient protein in reducing the surface tension at the air/water. On the contrary, globular whey proteins (α-lactalbumin and β-lactoglobulin) involved in the composition of protein layers giving higher viscoelastic modulus values, but could not compact well at the interface because of their rigid molecular structure. Hence, the tensiometry findings confirmed the pendant-drop tensiometer as a valuable tool for the characterization and the prediction of the foaming properties of both camel and bovine milk proteins.

Keywords: Camel and bovine milk, milk proteins, foaming property, tension, viscoelastic modulus.

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