# Exploring the Influence of Interfacial Hydrogen Bonding on Surface Properties and Foam Stability in Saponin Mixtures

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Due to the constantly increasing pollution of the aquatic environment with detergents, it is crucial to develop modern, effective alternatives to commonly used synthetic surfactants. The ideal detergent must have a high surface activity to obtain a dispersed system with minimal biosurfactant content [1]. It should also be a biocompatible and hypoallergenic compound so that it can be used in industrial processes and in cosmetic and medical applications. A key feature of modern biosurfactants should also be the ease of removal of the compound from the aqueous environment and fast controlled biodegradation as soon as further activity of the compound is unnecessary.

Saponin is a plant-derived biosurfactant extracted from various plants, making it biodegradable and safe for humans and the environment. Saponin is used in cosmetics and medicine as a safe, bioactive and effective emulsifying agent. In vitro and in vivo studies exhibited their anti-inflammatory, antimutagenic, antiviral, antibacterial, antifungal and antitumor activities. Moreover, by reducing surface tension, saponins increase the solubility and absorption of medicinal substances sparingly soluble in water. The use of saponins makes it easier for drugs to penetrate cell barriers.

In recent years, various biotransformation methods of the original saponin extract, e.g. by fermentation, have become increasingly important [2]. The main way of transformation is through hydrolysis of saponin glycosyl groups to transform natural saponins into rare saponins containing low sugar chains. The generated conversion products have better bioavailability or more potent biological activity than the original saponins.

In our research, we want to develop safe methods for increasing the surface activity and foam-forming ability of saponins and their derivatives. Saponin is a compound capable of forming complexes and other advanced spatial structures with other biopolymers and chemical compounds through electrostatic interactions or via hydrogen bonds. Saponin can be both a hydrogen bond donor and an acceptor [3-5]. We aim to demonstrate that it is possible to use hydrogen bonds and/or electrostatic interactions to form complexes between saponin and other chemical compounds in order to 'modulate' surfactant surface and foaming properties.

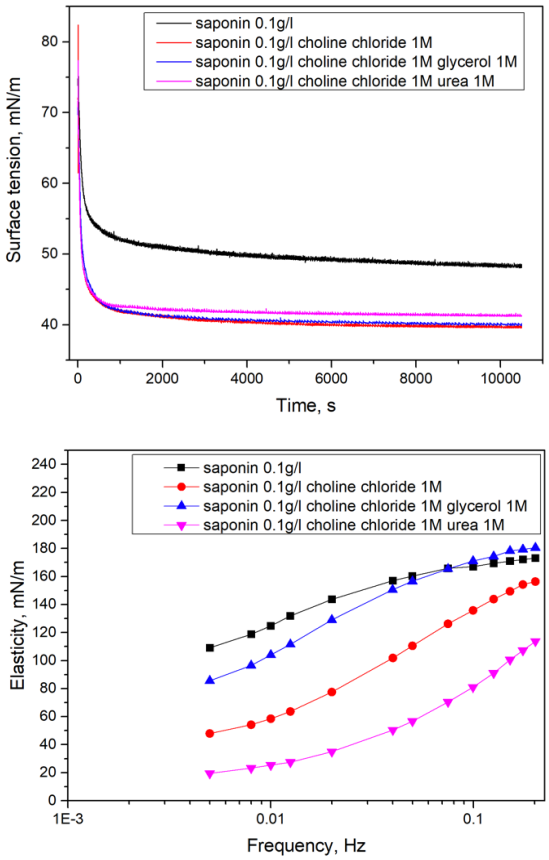


**Figure 1.** Surface activity and dilational elasticity in saponin - choline chloride - glycerol - urea mixtures.

The present study analyses the effect of adding glycerol, choline chloride and urea on saponin surface activity. As seen in Figure 1, adding these chemical compounds leads to significant changes in the adsorption layer. For example, choline chloride significantly increases the mixture's surface activity relative to the saponin solution's surface activity. Choline chloride also reduces the surface dilatational elasticity of the tested mixture.

We also compared changes in surface properties with changes in foam-forming properties and the stability of the foams obtained in the foam-forming column and in the Multiscan apparatus.

**References**

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