Dynamic and equilibrium surface layer properties of jujube (Ziziphus jujube) leaf extract

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Many fluid systems in our modern world are based on stabilized foams and emulsions, in particular in the field of food technology. The increased attention to sustainable stabilizers leads to a continuously increasing interest in biosurfactants, such as saponins extracted from various natural sources [1]. This work deals with jujube leave extract, one of the many possible sources for saponins. The optimum application of biosurfactants requires basic knowledge about their adsorption behavior at relevant interfaces, such as water/air or water/oil for applications in foams or emulsions, respectively. We studied the adsorption dynamics, the dilational visco-elasticity and the equilibrium surface layer behavior of saponins extracted from jujube leaves by drop profile analysis tensiometry (PAT1, SINTERFACE Technologies, Berlin). Due to the high surface activity, similar to other saponins [2], this biosurfactant adsorbs remarkably already at rather low concentrations so that the formation of the surface layers is rather slow. Hence, the determination of the dynamic and equilibrium adsorption layer behavior requires particular measuring procedures. In this study, we prepared 10 concentrations of jujube leaf extract powder (3 mg/l to 700 mg/l) and investigated their elastic modulus and surface tension. An adsorption-desorption protocol based on a square pulse perturbation of the solution drop surface area is applied to determine the equilibrium surface behavior in the most reliable way. The surface equation of state shows highest surface pressure values Π of more than 17 mN/m, while the values of the dilational surface elastic modulus $E = -d\Pi/d \ln A$ increase up to 120 mN/m, respectively. The protocol for the adsorption layer formation included a compression and expansion step of the solution drop surface area A to determine the equilibrium surface behavior in a most reliable way.

Keywords:
Saponin extract, adsorption kinetics, surface equation of state, dilational surface viscoelasticity, drop profile analysis tensiometry

References:

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