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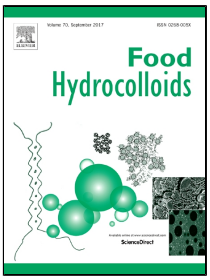

Multiscale evaluation from one bubble to the foam of surface active properties of cellulose derivatives used for a starchy model sponge cake

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Key words:

Cellulose, air/water interface, tensiometry, viscoelasticity, functional properties

Highlights:

- Static and dynamic tensiometry showed good interface stabilization by HPMC and MC
- HPMC and HPMC+MC solutions were the only ones able to form a stable foam
- MC had lower viscosity and shear-thinning properties while forming more rigid interfaces
- A synergistic effect was shown for HPMC and MC in stabilizing foams

Abstract

Interfacial properties of cellulose derivatives (HPMC and MC) were studied to understand their role in structuring a foam during the whipping process. Multiscale studies were performed to explain macroscopic observations with microscopic mechanisms. Results showed that HPMC was more flexible and had higher viscosity and shear-thinning properties than MC, which in turn diffused quicker to the interface due to a smaller molecular weight. Both hydrocolloids showed a good ability to stabilize interfaces through their surface tensions and dilatational moduli measured by static and dynamic tensiometry, respectively. However, only HPMC and HPMC+MC solutions were able to develop a stable foam. Methylcellullose formed more rigid interfaces and the interfacial elasticity was probably too high, leading to a difficult fractionation of bubbles. Moreover, its lower viscosity measured at low shear rate could explain its incapability to retain bubbles in the bulk just after their formation. HPMC and MC display complementarity and synergistic effects when used together, since