Disintegration of colloidal lignin in emulsion interfaces as monitored and triggered by atomic force microscopy

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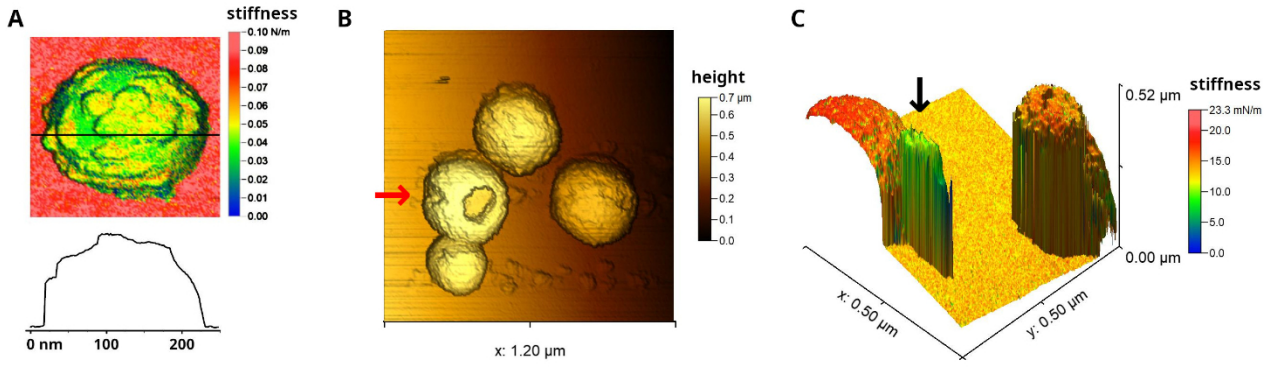
Recently, we analysed Pickering droplets and their stabilising lignin nanoparticles (LNP) for their topography, stiffness, and adhesion using Atomic Force Microscopy (AFM). The measurements were done for ultrasonicated emulsions in nanoresolution under water.[1] We also showed that the droplets were moved and merged, and soft nanoparticles flattened in the interface (Fig. 1A), when they were contacted with increased interaction forces. There were also indications of thin interfacial films adding to the stability of the droplets, which is now backed with neutron scattering data.[1,2] Building on this, we now study the behaviour of colloidal lignin on emulsions that have been prepared with a low-energy microfluidic method.[3] Soft bioparticles often are presumed to be intact, well-attached to the Pickering-Ramsden interface, and separate from each other. However, we observed lignin aggregates (Fig. 1B) and particles detaching from the aggregations during the imaging (Fig. 1C).[4] Furthermore, we gained even stronger evidence of a thin layer stabilising the emulsion interface despite the mechanically gentler emulsification method. These results challenge the common presumption of having Pickering-Ramsden as the only stabilisation mechanism for emulsions with colloidal lignin and biobased particles in general. Besides presenting results, I will discuss general opportunities and pitfalls in AFM analysis of Pickering emulsions

Keywords:
Atomic force microscopy, emulsion, Pickering emulsion, lignin, colloidal lignin, interfacial particles, liquid-liquid interface



AFM micrographs of oil droplets under water. A: Flattened LNPs on a nanodroplet.[1] B: A hollow lignin particle on a microdroplet was chipped (red arrow), and bumps formed on the interfacial film at high contact forces.[4] C: A lignin particle detached (black arrow) from an interfacial aggregate.[4]

References:

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