35

Ultrasound monitoring of magnetic separation in hybrid emulsion systems

Authors: Filip Ratajczak[1]; Rafał Bielas[1]; Matus Molcan[2]; Arkadiusz Józefczak[1]

[1] *Chair of Acoustics, Faculty of Physics and Astronomy, Adam Mickiewicz University in Poznań*

[2] *Institute of Experimental Physics, Slovak Academy of Sciences*

Magnetically responsive emulsions serve as multifunctional systems that can be manipulated by external fields for transport or separation processes. In particular, Pickering emulsion-based systems, stabilized by iron oxide nanoparticles (IONPs), enable magnetic control over their structure and mechanical properties. While many studies focus on systems with particles adsorbed solely at droplet interfaces, we analyze hybrid emulsion systems, where magnetic nanoparticles are present both at the droplet surface and within bulk phases. Those additional particles may influence the system's separation behavior.

In this work, magnetic separation of oil-in-water and oil-in-oil Pickering and hybrid emulsion systems is investigated. Magnetic fluids with nanoparticles of varying sizes are used to assess the influence of particle size and localization on systems'stabilization efficiency and magnetic responsiveness. Magnetic separation experiments are conducted under various magnetic field strengths and configurations, enabling the assessment of the influence of additional particles on the behavior of hybrid systems under different experimental conditions. To monitor system evolution, a non-invasive ultrasonic technique is applied, providing control over internal changes such as droplet fragmentation, coalescence, and spatial redistribution of the phases. The obtained results highlight the role of particle size and distribution during magnetic separation of the examined systems. This way, they support the design of functional emulsion-based materials for future applications in targeted substance delivery or filtration technologies.

Type:

Oral