**Graphene oxide at soft interfaces: foams, emulsions and capsules**

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It is now widely accepted that graphene oxide and related 2-dimensional nanomaterials can stabilise emulsions and foams at a fraction of the material cost when compared to the conventional 3D (usually spherical) particles employed for Pickering/Ramsden emulsification [1]. Emulsions stabilised by graphene oxide show remarkable long-term stability, and can be tuned by changes in solution conditions, making them interesting candidates for a range of applications.

Such emulsions are exquisitely sensitive to the parameters used during their formulation, which affect the interactions between graphene oxide and the oil–water interface: pH, salt, oil type, and the presence of other additives. Their stability to dilution is particularly appealing when compared to molecularly stabilised emulsions.

In most cases, emulsification of oil in water with graphene oxide gives simple oil-in-water emulsions [1]. However, for certain oils, carefully engineered solution conditions result in single-step production of multiple emulsions [2], leading readily to multi-compartment capsules through polymerisation of the outer droplet interface. Controlling the outer ‘skin’ of these capsules allows for controlled release of active agents contained within, with potential applications in agriculture and water treatment.

The same colloid chemistry, i.e. developing an understanding of stability and interactions, can be used to exert subtle control over graphene oxide using light-switchable surfactants, or non-covalently bound magnetic particles or magnetic molecules. This enhances opportunities for using this material to capture toxins or valuable materials from water at low concentrations, and provides new routes for remediation and refining.

More recently, graphene oxide-stabilised Pickering emulsions have been shown to provide a valuable route for templating inorganic (silica) capsules, offering a scalable and cheap route to encapsulate oily materials with a controlled porosity shell [3]. Such capsules may be valuable in delivery of various actives, from scents to agrochemicals.

**References**

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