

NEW MODES OF SOLUTE RELEASE FROM CAPSULES AND CAPSULE-LOADED GELS

Srinivasa R. Raghavan, Department of Chemical & Biomolecular Engineering, University of Maryland, USA
sraghava@umd.edu

Key Words: Directed Assembly, Biopolymers, Microcapsules, Microgels

Several challenges are known to arise in the context of formulations used in cosmetics, and these also extend to formulations in pharmaceutical or agrochemical applications. In all these cases, there is generally a need to deliver an active ingredient to the external environment in a pre-determined profile or mode.

One such mode is where the active remains contained within the formulation (not delivered) for a certain period of time; then a trigger is applied such as a specific temperature or solution pH, whereupon the active is rapidly delivered to the external medium. This mode is termed a step-release mode.

A second mode is a variation of the above. Here, a certain fraction of the active in the formulation is delivered rapidly over the initial time period. Then, when the trigger is applied, the remaining fraction is also delivered to the external medium. This mode is then a multistep-release mode.

A third mode is of a different character, where the delivery of the active occurs at a steady, but slow rate, over an extended period of time. This is termed an extended-release mode. If the release rate is nearly constant, the concentration of the active in the external medium will increase linearly with time, which is termed zero-order release. Ideally, the time period for such release should be tunable from minutes to hours to even months.

This talk will describe the design of formulations in our lab that enable release of actives in line with the above modes. The key to our design is the synthesis of new polymeric capsule structures. In particular, we have made multilayer capsules that have multiple concentric layers, much like an onion. We can control the composition and thickness of each polymeric layer in such capsules. For instance, a specific layer can be made responsive to a stimulus such as temperature or pH whereas the other layer(s) can be unresponsive to the same stimulus. These capsules can also be embedded in viscoelastic polymer gels (giving an overall consistency akin to a cream or lotion) for cosmetic applications.