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Novel surfactant-in-surfactant amphiphilogels

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The non-ionic surfactant sorbitan monostearate has previously been reported to gel organic solvents e.g hexadecane, isopropyl myristate, vegetable oils [Murdan *et al*, 1996]. We recently found that the hydrophobic surfactant (HLB 4.1) also gels liquid non-ionic surfactants such as sorbitan monolaurate, sorbitan monooleate and the polysorbates 20, 40, 60, 65, 80 and 85 at concentrations 10-20% w/w. The surfactant gels (organogels or amphiphilogels) are prepared by dissolving or dispersing sorbitan monostearate in the surfactant solvent at 60°C and cooling the sol at room temperature. Cooling the sol causes a decrease in the solubility of the gelator in the dispersing medium, with consequent reduction in solvent-gelator affinities. As a result, the sorbitan monostearate molecules self-assemble. Tubular aggregates are formed which immobilise the fluid dispersing medium. The resulting gels are opaque, thermoreversible semi-solids and their microstructure (examined by light microscopy) consists of clusters of tubules dispersed in the solvent (figure 1).

Surfactant gels (containing a hydrophilic surfactant e.g. polysorbate 20) can solubilise an aqueous solution. For example, 5,6-carboxyfluorescein (CF) solution is added dropwise to the organic sol (e.g., 10%w/w sorbitan monostearate + 10% polysorbate 20 in sorbitan monooleate) while vortexing, both phases being at 60°C. A clear oil solution (containing solubilised aqueous phase) is obtained which sets to the gel state on cooling. Once again, cooling occurs as the gelator molecules self-assemble into tubular clusters. In this case however, the aqueous CF solution is trapped within the surfactant tubular clusters (figure 2). The tubular clusters seem to be the most favourable location for the aqueous phase in the organic gel, where the aqueous solution is probably bound by polar surfactant headgroups.

The amphiphilogels are stable for months at room temperature, showing no syneresis. These surfactant-rich systems may find applications as delivery vehicles for drugs and antigens. Hydrophobic and hydrophilic molecules have been solubilised in these gels and they will be investigated for potential as oral, transdermal and injectable systems.

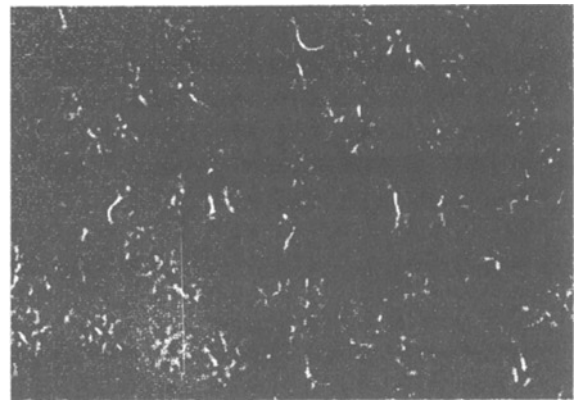

Figure 1: Microstructure of a sorbitan monostearate/sorbitan monooleate gel consists of clusters of tubules dispersed in the liquid medium.

10μm

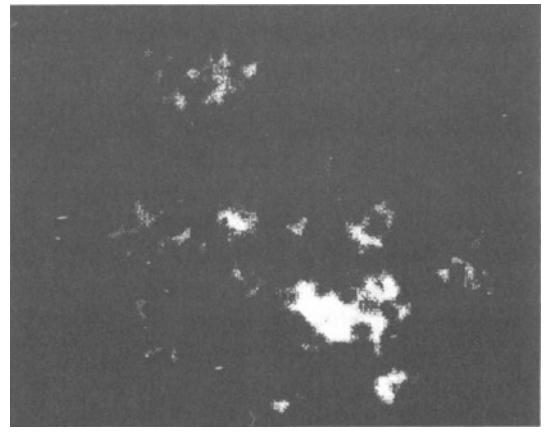

Figure 2: The microstructure of a surfactant gel with incorporated CF solution. The aqueous phase is present in the surfactant aggregate structures.

10μm

1. Murdan S, Gregoriadis G and Florence A T, (1996), STP Pharma Sciences, 6, 44-48.