

THE STRUCTURE AND STABILITY OF O/W EMULSIONS STABILISED BY POLYETHYLENE GLYCOL 1000 MONOSTEARATE/FATTY ALCOHOLS

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Previous studies (Eccleston, 1976) showed that the homologue composition of fatty alcohols can markedly affect the consistencies and stabilities of (O/W) creams prepared with ionic surfactants. Similar results were obtained when the non-ionic surfactant cetomacrogol 1000 was used, although the effect was not as marked (Eccleston, 1977). The present work extends these studies to other non-ionic surfactants including polyethylene glycol 1000 monostearate (PEG 1000 monostearate, Cithrol 10 MS, Croda). This surfactant is combined with fatty alcohol to form a commercial non-ionic emulsifying wax.

Liquid paraffin-in-water emulsions stabilised by PEG 1000 monostearate and alcohols A - cetostearyl, B - myristyl (C₁₄); C - cetyl (C₁₆) and D - stearyl (C₁₈) and ternary systems prepared by dispersing appropriate quantities of each fatty alcohol and surfactant in water without the addition of an oil phase, were examined at 25°C over a time period of 30 days. The techniques used included microscopical and rheological experiments (Ferranti-Shirley cone-and-plate viscometer).

Preliminary diffusion experiments were performed microscopically at low (25°C) and high (Kofler micro hot stage) temperatures to investigate any interaction between each alcohol and aqueous PEG 1000 monostearate solution. Each pure alcohol interacted slowly with the aqueous surfactant solution. The extent of interaction decreased and the time scale over which it occurred increased with increase in fatty alcohol chain length. For example, interaction between the C₁₄ alcohol and surfactant was rapid and appeared to be complete after 8 hours. In contrast, interaction between the C₁₈ stearyl alcohol was both limited and slow; little interaction product was visible even after 4 days. It is significant that although cetostearyl alcohol interacted slowly, the interaction product was considerably more extensive than that formed with the pure alcohols. At high temperature liquid crystals formed in all systems, including those prepared with stearyl alcohol.

Ternary systems and emulsions A, B and C were white, soft semisolids immediately after preparation; the stearyl alcohol preparations, D, were mobile liquids. The rheological properties of each ternary system and corresponding emulsions were similar. Flow curves for all systems were hysteresis loops and (except stearyl alcohol systems) showed spur points. The initial consistencies of the pure alcohol ternary systems and emulsions decreased with increase of fatty alcohol chain length so that apparent viscosities reduced for systems B, C and D respectively. It is significant that systems containing cetostearyl alcohol were more resistant to shear breakdown than the pure alcohol systems, and thus had higher apparent viscosities. Microscopically, structure was apparent in the continuous phases of emulsions A, B and C, but not readily visible in D.

On storage, the pure alcohol systems were not as stable as those prepared with cetostearyl alcohol; some pure alcohol systems creamed within the 30 day testing period.

Rheological and microscopical data for the ternary systems and emulsions correlated well with diffusion experiments. Emulsion consistencies and stabilities were related to gel networks formed in the continuous phases when the non-ionic surfactant and fatty alcohols interacted with water.

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