Evaluation of emulsion stability prepared by the required HLB method under quasi micro gravity created by Clinostat

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Since Griffin proposed the HLB theory in 1949, the HLB number has been widely used in industry as an indicator of the surfactant properties. When a surfactant emulsifies an oil and water, its HLB number not only determine the type of emulsions but also influence on the stability of the emulsion. The appropriate HLB number of the surfactant should be tuned considering the properties of the emulsified oil which are commonly expressed as “required HLB number (rHLB)”. Fine emulsions are formed when the surfactant passes through a phase state of higher interfacial activity in the emulsification process. In other words, the phase behaviour in the surfactant system can be roughly predicted from the HLB and rHLB numbers.
In this study, we have investigated the stability of O/W emulsions in surfactants/oil/water systems with different HLB and rHLB numbers, particularly utilizing the microgravity condition. Our previous results demonstrated that quasi-microgravity remarkably suppressed creaming as well as Ostwald ripening, so it can be expected that the microgravity experiments would reveal the significance of the surfactant HLB number.

The O/W emulsions were prepared in the POE sorbitan stearate (HLB14.9)/glyceryl stearate (HLB4.0)/liquid paraffine/water system. The weight fractions of the mixed surfactants and oil in the system were fixed at 0.04 and 0.40, respectively. The appearances and droplet sizes between these emulsions were apparently same just after emulsification, but phase separation and droplet growth depended on the surfactant HLB number. The droplet growth with time was observed even for the emulsion with the HLB number matched to rHLB (~10) in terrestrial gravity (1G), while the droplet size remained constant in micro-gravity (0.03G, Figure), suggesting that the surfactants inhibited coalescence and/or coagulation. In our presentation, the emulsion stability under different HLB conditions will be shown and discussed based on interfacial properties.
In this study, we include additional factors of PIT by changing the temperature at which we can expect phase changes. Our objective is to explore the effect of microgravity with temperature changes to predict emulsion stability.

Keywords:
Emulsion stability, HLB number, Quasi-microgravity