A new model to predict efficiency of cleaning systems: HLD parameter

Martina Guidotti¹*, Massimo Bonini¹, Piero Baglioni¹

¹Department of Chemistry and CSGI, University of Florence, Sesto Fiorentino-Florence, Italy
*guidotti@csgi.unifi.it

Cleaning is crucial to many applications, ranging from detergency processes in laundry and hand-washing applications to the removal of detrimental films from solid substrates. Water-based systems for cleaning typically consist of dispersions in water of surface-active agents and additives such as perfumes and rheo-modifiers. This project aims at identifying a model able to predict the detergency performances of water-based cleaning systems on hard surfaces. In order to reproduce the general composition of commercial detergent formulations[1], we investigated the behavior of a model system made of an anionic surfactant (Sodium Dodecyl Sulfonate, SDS), a cationic surfactant (Benzalkonium Chloride, ADBC) and a non-ionic surfactant (Triton X 100, TX100). Their ternary phase diagram was investigated and the stable compositions were characterized using physico-chemical techniques such as Dynamic Light Scattering, rheometry and Small-Angle X-ray Scattering. Glass surfaces coated with Argan Oil or Artificial Sebum were cleaned using the stable formulations. Atomic Force Microscopy (AFM), Optical Microscopy (OM) and Contact Angle have provided information about the soil removal efficiency. Aiming at modeling the performances of the cleaning formulations towards surfaces coated with soil, the results were then discussed in terms of the Hydrophilic-Lipophilic Difference (HLD) of each formulation. The HLD of a water-in-oil or a oil-in-water surfactant formulation is defined according to the characteristic curvature of the surfactant, to the salinity of the aqueous phase, to the temperature, and to the effective alkane carbon number of the oil phase. The obtained results suggest the possibility to use the HLD parameter to predict the cleaning performances of different formulations [2-3].

Figure 1 Ternary Diagram: correlation between HLD parameter and AFM e OM measurements for cleaning systems studied.