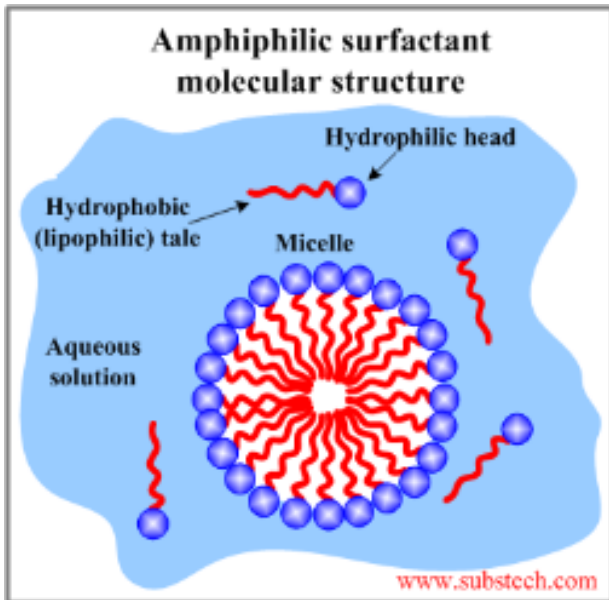


The Physics of AWT Formulations

AWT formulations (technology and uses) have been and are being patented worldwide for the simple reason that the physics behind them is revolutionary, unique and totally different to any other surfactants currently available.

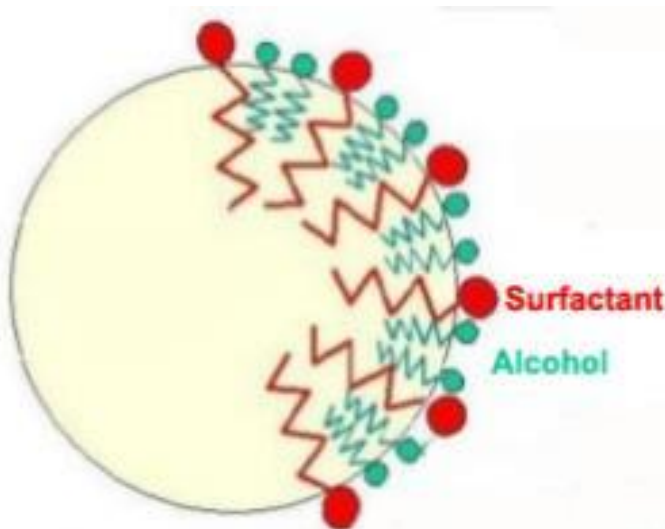
Current amphiphilic surfactants are limited by two basic principles of physics:

1. The self assembly of surfactant molecules above a certain concentration Critical Micelle Concentration (CMC)
2. The Marangoni Effect



All amphiphilic surfactants create micelles above a certain CMC which significantly limits the effectiveness of these surfactant given that micelles have to break down into individual molecules to be able to diffuse to the three-phase interface (liquid/solid/air) and enable the spreading of the liquid. As wetting occurs, the concentration of the individual surfactant molecules drops and wetting stops. This is called the “Stick/Slip” phenomena. Wetting does not reoccur until the micelles break down and increase the concentration of the individual surfactant molecules enabling continued diffusion to the three-phase interface and subsequent wetting. Increasing the dose rate of the surfactant does not enable a higher concentration of surfactant as micelles form and the concentration of the surfactant will never exceed the critical micelle concentration.

One of the major innovations with AWT formulations is that there is no micelle formation thus enabling different concentrations of the multi-phase wetting system resulting in faster or slower rates of wetting and penetration depending on the application. This is achieved by the close association of individual surfactant molecules with long chain linear insoluble alcohols through Van der Waals forces, stopping the self assembly of the surfactant molecules into micelles. Van der Waals force is a distance-dependent interaction between atoms or molecules. Unlike ionic or covalent bonds, these attractions do not result from a chemical electronic bond; they are comparatively weak and therefore more susceptible to disturbance. The van der Waals force quickly vanishes at longer distances between interacting molecules i.e. once the multi-phase super wetter is added to the spray mix.



Due to this innovation this technology has been accepted and patented worldwide.

However, given that micelle formation does not occur, one of the most significant innovations is that there is no surface tension gradient between the bulk of the liquid and the edge of the liquid at the three-phase interface (Marangoni Effect) as is the case with all other surfactants. For example, when the individual surfactant molecules migrate to the edge of the drop, this depletes the concentration of the surfactant molecules in the bulk of the droplet itself until micelles break down which does not occur rapidly. Therefore, due to the concentration of surfactant molecules at the edge of the droplet is higher than that in the bulk of the droplet, the surface tension at

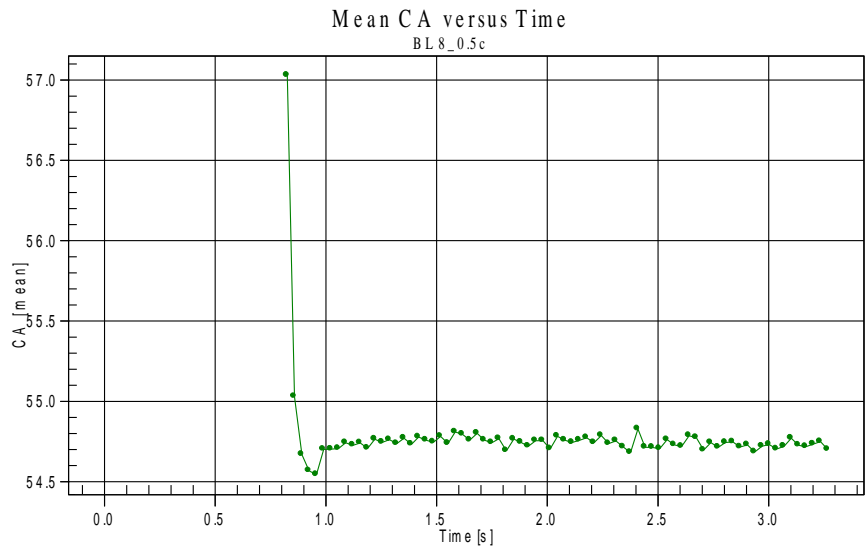
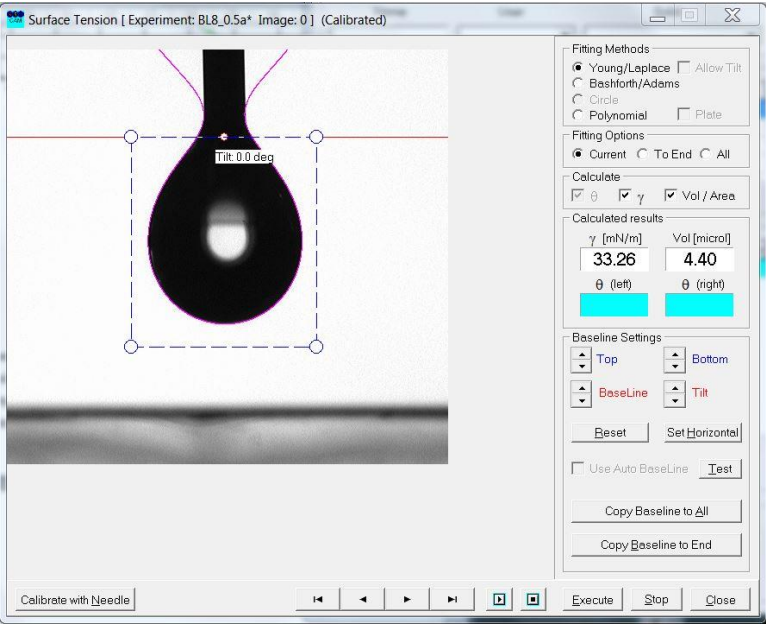
the edge is lower hence micro-droplets shear off either when the droplet is in flight, or when the droplet hits the foliage creating spray drift.

All of the above has been tested and proven at the Goniometry Laboratory at the Department of Applied Mathematics, Research School of Physics within the ANU.

It has also been proven at the Wind Tunnel at the Gatton Campus of the University of Queensland under the supervision of Prof Andrew Hewitt a world authority on Spray Drift. This is the subject of a separate detailed report.

The following image and graph show the surface tension and wetting curve of Teric BL8, one of the most common alcohol alkoxyates used in the agricultural industry. Note the surface tension at 0.5% only goes down to 33.26 mN/m.

Note also that the wetting curve shows no spreading of a droplet on a non-wetting surface after the droplet hit the surface. Due to micelle formation the wetting performance of this surfactant will never improve.



The following image and graph show the surface tension and wetting curve of 0.5% Envirowet PCLL8. Note the surface tension is 21.27mN/m which is at a similar level to organosilicone super surfactants and considerably less than alcohol alkoxylates. Note that the wetting curve is linear and actually wets faster than fluoro surfactants

