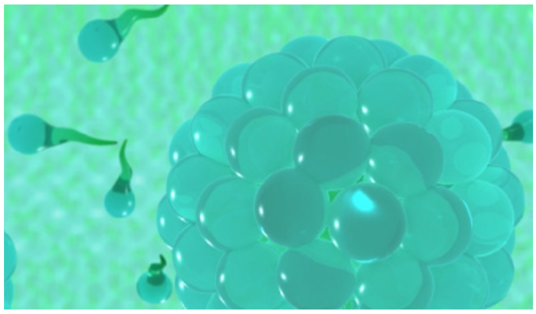
TECHNICAL PAPER

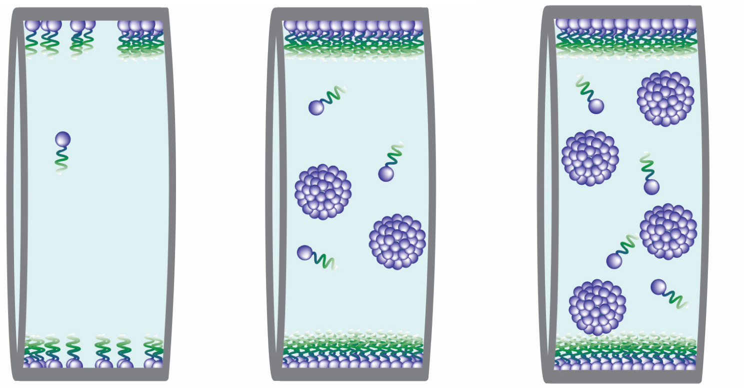
An Introduction to Critical Micelle Concentration



Corrosion inhibitors are complex mixtures made up of many components. Whilst these individual 'active' components may have a variety of chemistry types, they all tend to fall into one primary class of chemical, known as surfactants. These surfactants contain a functional polar head group and a long hydrocarbon tail, in the region of C10-C16+. It is largely accepted that corrosion inhibition occurs by chemisorption (chemical adsorption) of the surfactant functional group onto the metal surface, forming a barrier film that prevents water contact with the metal surface and thus retarding the electrochemical corrosion process.

Upon saturation of the metal surface the surfactant molecules may exist in the bulk fluid, this is generally the water phase in oilfield systems. Due to the hydrophobic nature of the hydrocarbon tail and the hydrophilic nature of the head group the surfactant molecules face energetic repulsions. When these molecules exist above a certain concentration and their local number and proximity is enough, they will spontaneously form aggregated structures to overcome the repulsions faced in the bulk phase. This structure is called a micelle and the concentration at which micelles form is the Critical Micelle Concentration (CMC). Further addition of surfactant molecules i.e. increased corrosion inhibitor dose, will lead to the creation of more micelles without offering further corrosion protection.

Many papers have been published stating that the theory of CMC should be applied for determining the optimal functional dose rate of corrosion inhibitors. Historically the CMC has been determined using measurements of surface tension. This involves measuring the surface tension whilst increasing the surfactant concentration, at the point at which there is no further decrease in surface tension, CMC is determined to have been reached. This can be done easily in the laboratory setting however the real value in determining CMC must be in actual oilfield fluids, which tend to be extremely variable.



Under-dosed; threat of corrosion

Optimally dosed; inhibitor working to maximum effectiveness

Over-dosed; threat of environmental damage

LUX Assure's CoMic technology is a game changing technology, capable of detecting micelle presence in a fluid sample, a technique which has not been previously possible.

Further reading on the CMC theory can be found in the papers referenced below;

Paper 10326 Effect Of Corrosion Inhibitor Active Components On Corrosion Inhibition In A Sweet Environment. Kenny Tsui, Jennifer E. Wong and Neil Park, Champion Technologies CORROSION 2010

SPE 155107 Micelle Detection for Optimising Corrosion Inhibitor Dose on an Offshore Platform. Cameron Mackenzie and Emma Perfect, LUX Assure

CoMic™ Informing Better Corrosion Inhibitor Management

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