# In Praise of Spherulites® – Delivering Actives to Skin and Hair from Rinse-off Products

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## Abstract

Benjamin Franklin's fascination with oil and water not mixing and spreading "itself with surprising swiftness upon the surface" became an early milestone on our journey to today's sophisticated surfactants based products, in particular shampoos and shower gels. When surfactants' molecules are dispersed in water, as the concentration of surfactant increases, their molecules are known to spontaneously arrange themselves into micelles and other energetically stable configurations including Spherulites® [1]. Spherulites® are special. They are discrete onion-like structures, as illustrated in Figure 1 (on page 2), which are remarkably stable and can be made to contain useful cosmetic ingredients, which makes Spherulites® valuable encapsulation systems. They are especially exciting because Spherulites® (containing actives) are stable when included in rinse-off products and they will be deposited onto skin and hair when the rest of the product is rinsed away. They are therefore the perfect vehicles for delivering actives to skin and hair from shampoos and shower gels. Spherulites® technology could therefore be the next milestone in the development of cleansing personal care products [2,3].

## Introduction

> "I fetched out a cruet of oil and dropped a little of it on the water. I saw it spread itself with surprising swiftness upon the surface… Though not more than a teaspoonful, produced an instant calm over a space several yards square which spread amazingly and extended itself gradually till it reached the lee side, making all that quarter of the pond, perhaps half an acre, as smooth as a looking glass."
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> "After this I contrived to take with me, whenever I went into the country, a little oil in the upper hollow joint of my bamboo cane, with which I might repeat the experiment and I found it constantly to succeed."
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> Benjamin Franklin 1706 – 1790

It is an obvious paradox to expect 'products that clean oil and dirt away' to also deliver materials to the surface of skin and hair, however it is not impossible and Spherulites® offer one affordable way to achieve this aim. The advent of 2 in 1 shampoos started formulators thinking more and more about the different ways that useful materials could be deposited onto skin and hair from shampoos and shower gels. Our understanding of the complex behaviour of different surfactants in water is arguably an ongoing journey that has involved many scientists and still edges forward as better analytical techniques become available. As a result of this combined effort, the various energetically stable configurations formed by surfactant molecules dispersed in water, are now well documented. Despite this knowledge being the back-bone behind millions of rinse-off products, the potential of one stable configuration, i.e. the onion-like structures, might have been over looked if it was not for the work of a few physical chemists and in particular, of Didier Roux. Didier saw their potential as delivery systems and patented their application as vehicles to deliver actives from wash-off products back in the 1990s [4,5,6].

## Oil and Water

Benjamin Franklin was fascinated not just by oil and water not mixing but also by how a little oil spreads " …itself with surprising swiftness upon the surface" in what Langmuir and others would later understand to be a monolayer of oily molecules across the surface of water. Our scientific interest in how oil and water interact led to studies into the behaviour of soaps and then, more recently, onto the synthesis of new and better surfactants. Many Nobel prizes and most of the personal care industry owe their existence to our understanding and ability to control these interactions and so, when you next use a shampoo or shower gel, remember Benjamin Franklin's original preoccupation with observing oil droplets on water.

## Surfactant Phases in Water

Surfactant molecules have a water loving part (hydrophilic) connected to an oil loving part (lipophilic). When they are