New Emulsifiers Tested for Their Possible Use in Personal Care

Author: Nicole Häusler, Kolb Distribution Ltd, Hedingen, Zürich, Switzerland

Abstract

Most of all products realised in the personal care market contain surface-active substances that fulfil various purposes: emulsifying, stabilising, wetting, solubilising. The most common among these substances are emulsifiers. They play a vital role in the emulsifying process and influence the properties of an emulsion. The demands on the emulsifier a formulator needs are as different as the products he wants to formulate. The properties and abilities of ethoxylated emulsifiers are well explored, whereas in the field of emulsifiers for natural care products investigation is still necessary.

Our company is currently testing different substances for their emulsifying properties. Those possible emulsifiers should fulfil the needs of products for the natural care market. While testing their properties, we varied three quantities. Besides the polarity of the oil-phase, we changed the ratio between the amount of the oil-phase and the amount of the emulsifiers. Finally we varied the energy-input to the emulsion by varying the duration of the emulsification process. Measurements of particle size distribution and viscosity of the emulsions will help as much as justifying the emulsification power by comparing microscopic pictures to recommend how to use those emulsifiers and which are the most suitable application fields.

Introduction

Definition of an emulsion: an emulsion is a mixture of two unmixable liquids, one of which is dispersed in the other in the form of liquid droplets and/or as liquid crystals.[1]

In most cases cosmetic products consist of the oil-phase, a mixture of different oils and emollients, sometimes combined with waxes, and the water-phase, neither soluble into each other. Most emulsions are formulated with the help of emulsifiers. Further ingredients are added like preservatives, active ingredients, pigments, colourants, perfumes. From this listing it becomes clear that a cosmetic emulsion is a complex creation of various materials and that it is almost unpredictable how the diverse ingredients interact with each other. As shown by the experience of a formulator for Personal Care products, those materials can interact with each other in a way that the emulsion is only stable for a short time. Neither cosmetic formulators nor users of creams and lotions are aware of the complex physical chemistry which was applied when formulating these products. But how does an emulsifier really work?

Basic Principles of Emulsifying Properties of Surfactants

To cut a long story short, an emulsifier acts by two different effects: on the one hand it lowers the interfacial tension between the water- and the oil-phase, which means that it lowers the energy demand that must be applied to break up drops into smaller ones and therefore increases the size of the interphase. On the other hand, it helps to stabilise manufactured emulsions.

First we should have a look at the emulsifying process itself. Two liquids that are not soluble into each other, one of them containing the emulsifier, will be pre-dispersed by stirring. The result is an emulsion with rather large drops, which is not stable over a long period. For a better stability, either smaller droplets are required and/or a higher viscosity of the outer phase. Droplet size can be reduced by an energy-input during the homogenisation process. While decreasing interfacial tension between both phases to be emulsified, less energy must be used to break up bigger drops into smaller ones. In a system of two phases, the more effective an emulsifier is, the faster it reduces the interfacial tension to a value as low as possible with equal surfactant concentration. While an emulsifier adsorbs at the interphase between the oil and the water phase, it builds up an interfacial film. This effect reduces the interfacial tension[2].

From the thermodynamic point of view emulsions are not stable due to their large oil/water-interphase. By decreasing the interfacial tension, an emulsifier can reduce instability, nevertheless it is not overcome. The good news is that emulsions can be stabilised, as coalescence can be prohibited or at least slowed down. Adequate agents are:

1. Surface active substances that hinder coalescence mechanically, e.g. setting the interphase with particles, the so-called Pickering emulsions.