



## Thermolabile surfactants with controlled lifetime

During 2003 - 2009 YKI has developed a new **unique class of cleavable surfactants** that break down at a rate that can be pre-set from **minutes to years** by adjusting the temperature from 0-100 °C. The surfactants can be produced entirely from renewable raw materials, and are designed to **decompose into harmless (FDA approved secondary food additive-) products**. A thermo-stable precursor (alkyl ketene dimer, AKD), which can rapidly be transformed into the labile surfactant, is already present on the market as a bulk chemical, used today in papermaking (not as as a surfactant). This precursor can be stored without decomposing and can at a desired point in time be **activated into the thermolabile surfactant** just before/in the actual application, via protocols patented by YKI. In other words, the surfactant can be switched on at a given moment and then controllably be switched off at a given rate.

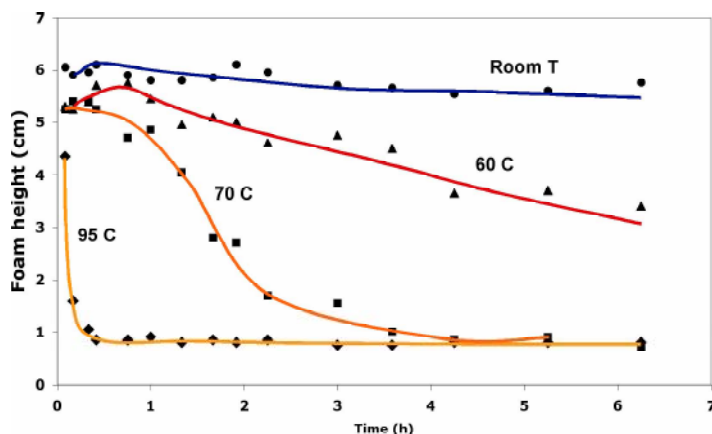
### Scientific claims

The surfactant, which is surface active in a pH range from ca 6-14 has proven to be an efficient emulsifier and gives very stable foams. The foaminess of aqueous solutions of the thermolabile surfactant decays within minutes at high temperature, but remains high for days at room temperature, see Fig 1.

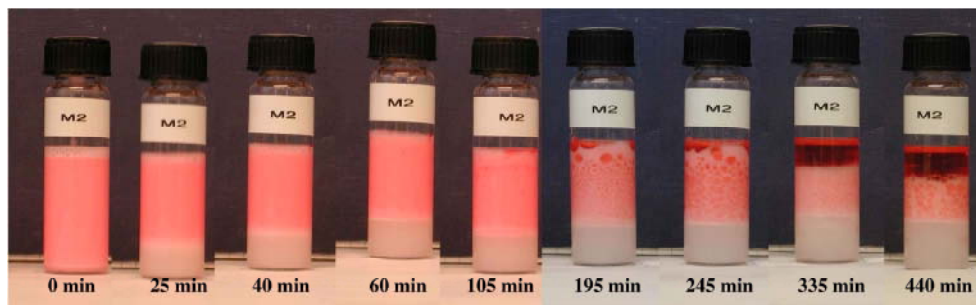
Furthermore, the time delay before onset of emulsion breaking can be controlled (Fig 2) from minutes to months through selection of temperature.

### Applications

The new surfactant could well open up several new possibilities for the formulation of novel products and give opportunities for innovative process developments all over a broad application field.



**Fig. 1.** The foaminess of aqueous solutions of the YKI thermolabile surfactant decays within minutes at high temperature but remains high for days at room temperature. This is in accordance with the expected kinetics for surfactant breakdown and shows that the decay of surface activity can be controlled within wide limits by temperature.



**Fig. 2.** Emulsion of red-coloured oil in water stabilised by a thermo-labile surfactant developed at YKI Institute for Surface Chemistry. The time delay before onset of emulsion breaking can be controlled from minutes to weeks through selection of temperature. In this case the temperature was set to 60 degrees C.

Some examples of application areas are:

#### ***Cleaning and degreasing formulation***

*The main benefit may be that the surfactant will decompose in a controlled manner aiding separation of oil. The decomposition may enable scanning of the surfactant mixture composition during the cleaning so as to optimize the cleaning of different substances at different times in the wash cycle.*

#### ***Alkaline cleaning composition***

*Activation of the surfactant precursor can be obtained in the dishwasher and the degradation of the surfactant will yield harmless substances.*

#### ***Agrochemical crop protection formulation***

*The surfactant will break down in the environment to harmless substances.*

#### ***Alkyd emulsion for paint formulation***

*The controlled break down of the surfactant will allow paints with enhanced water resistance.*

#### ***Ink formulations***

*The controlled break down of the surfactant may provide better printing properties, better adhesion and enhanced friction properties and will improve the application of subsequent coatings. The non toxic nature of the surfactant makes it suitable for food contact printing.*

#### ***Oil-in-water emulsions for lubrication***

*Upon heating, the emulsion will break, which facilitates separation of the oil phase and its subsequent destruction or re-use*



### **Legal and availability**

In order to secure a rapid time to market YKI is currently in contact with large scale manufacturers of AKD (the surfactant precursor).

YKI has filed US and European patent applications in order to protect the discovery and to be able to develop novel applications together with industry. The US-patent is granted.

### **Cooperation possibilities for YKI member companies**

Please contact us for a discussion on how we can work together to optimise your existing products, or develop new ones, utilizing the novel surfactants described above.

#### **Contact person:**

Dr Martin Andersson

Tel: +46 (0)10 516 60 25

Mobile: +46 (0)768 64 00 25

E-mail: [martin.andersson@yki.se](mailto:martin.andersson@yki.se)