Application Report

Characterization of detergents

Application report: AR214e
Industry section: Textiles
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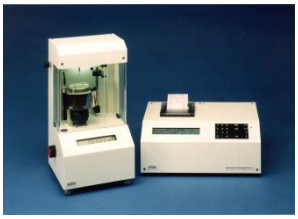

Force Tensiometer – K12

Maximum Bubble Pressure Tensiometer – BP2

Method:

Keywords: textile refining, washing, surfactant, alkylpolyglycoside, biodegradable detergent, dynamic surface tension

Analysis of Surfactants for Textile Refining using Static and Dynamic Surface Tension Apparatuses

Abstract

Washing processes are an important part of textile refining. Substances like size products, spool oils, spinning oils, applied to protect the yarn during the spinning process, have to be removed. This is usually done in aqueous media, containing synthetic surfactants. Ecological reasons force the industry to search for surface active substances with high biological decomposition potential. A well-known example are the alkylpolyglucosides (APGs).
Besides their excellent synergistic characteristics they tend to produce more and stable foam compared to other nonionic surfactants. This effect has to be reduced by foam inhibition. A C_{16}-C_{18}-alkylglucoside is tested as an antifoaming agent. Characterization of surface activity of aqueous solutions containing 1-3 g/l APG's and in some cases alkylglucosides are compared to standard surfactant solutions. The measurements are carried out both static and dynamic.

Experimental section

Static Surface Tension

Static surface tension measurements are carried out using the K12 with Wilhelmy plate method at 25 and 60°C. Samples to be used were Kieralon® EDB (nonionic/anionic mixture from BASF), APG and APG/SDS (Sodium Dodecyl Sulfate) (60/40)-mixtures. Results are shown in fig. 1.

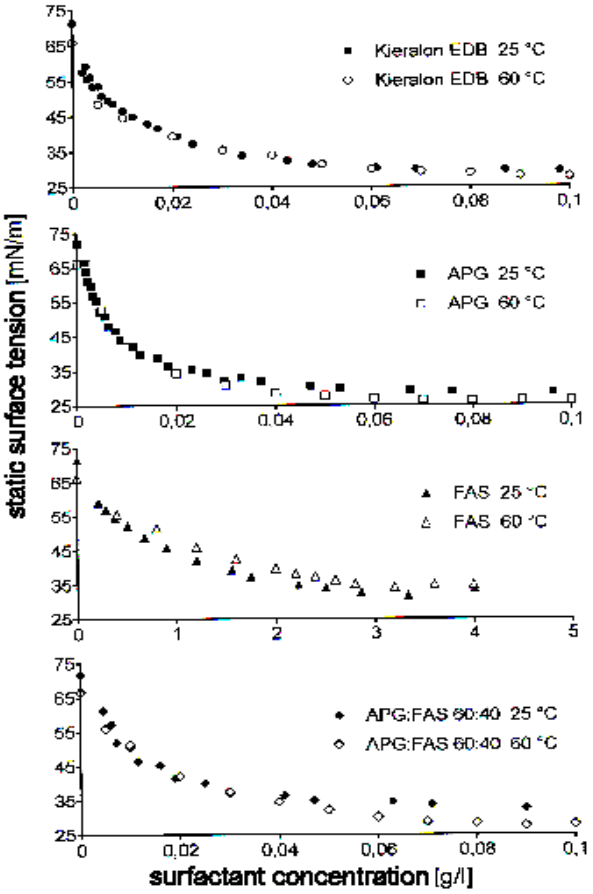

Fig. 1: Static surface tension of surfactants and mixtures depending on concentration and temperature

The alkylpolyglucoside and the Kieralon® EDB do show almost the same surface tension reduction for both temperatures. The APG reduces the surface tension of the solution to the same value at even lower concentrations. The slope of the SFT/concentration-curve is steeper. SDS is a lot less effective. A SDS/APG-mixture does show almost the same behavior as the Kieralon® EDB which is also a mixture of nonionics and anionics.

There is no significant temperature influence detectable.

Dynamic Surface Tension

Dynamic surface tension had been measured in the range of 1-10 Hz bubble formation frequency.

For the washing process specially the dynamic surface tension, which is a measure for the diffusion speed of the surfactant, characterizes the surfactant's performance (Fig. 2).

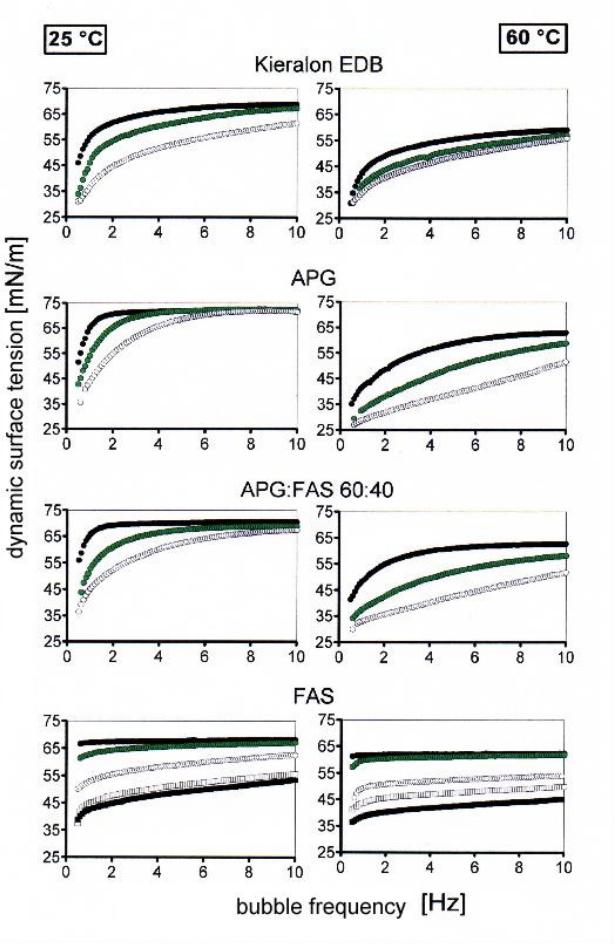

Fig. 2: Dynamic Surface Tension vs. Bubble Formation Frequency at various surfactant concentrations and temperatures. Surfactant concentrations:

● 0,5 g/l, ● 1,0 g/l, ○ 2,0 g/l, □ 3,0 g/l, ■ 4,0 g/l

The dynamic surface tension of all surfactants tested depends significantly on the temperature of the solution. At increasing temperature all surfactants show an improved ability to migrate to a new surface and reduce the surface tension of the sample.

At 20°C the Kieralon® EDB reduces the dynamic surface tension more efficient than the APG and its mixtures. At 60°C the picture has turned upside down. At 60°C, the temperature most often used for the washing process, the APGs show very good performance. The diffusion of APG monomers to the freshly created surface and its orientation at the new interface seems to be quicker than for traditional surfactant mixtures.

The APG/SDS mixture gives same results as pure APGs. This is in correspondence with the results of the static measurements. In a mixture the good performance of the APGs seem to predominate the behaviour of the total solution.

The anionic surfactant SDS does show an excellent dynamic behavior due to its improved solubility compared to nonionics.

Summary

Static and dynamic surface tension measurements showed the improved performance of APGs and APG/SDS-mixtures compared to conventional mixtures of anionics and nonionics used in the textile refining industry. Specially the dynamic surface tension measurements showed the superiority of the biodegradable surfactant.

Literature

[1] Tenside in der Textilveredlung – Wirkungsmechanismen von Tensiden in der Textilveredelung
TENSIDE, SURFACTANTS, DETERGENTS, 2/97, 95-101, Carl Hanser Verlag München