

DATA TO THE ANALYSIS AND PREPARATION OF NON-IONIC TENSIDES

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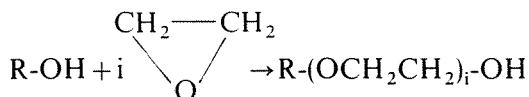
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Abstract

Hydroxyethylation has been stated to be equally well catalyzed by alkali hydroxides, amines and acids. In the case of different types of catalysts the effect of reaction parameters was investigated and the distribution of oligomer homologues determined. The Weibull-Törnquist effect was experimentally confirmed and its theoretical explanation given.

One of the important groups among surfactants is non-ionic tensides synthesized by the reaction of ethylene oxide and some other kind of compound containing active hydrogen (most frequently fatty alcohol, alkylphenol or fatty acid), e.g.:



The reaction may be catalyzed by acids, bases and amines.

The effect of various catalysts upon hydroxyethylation reactions has been studied on dodecyl alcohol model compounds and the distribution of oligomeric homologues and its dependence on the production parameters have also been determined.

For the isothermal examination of the highly exothermal reaction an appropriate method has been elaborated [1]. In order to have more effective gas chromatographic analysis of the reaction mixture a quantitative acetylation with ketene was developed [2] where the ketene was generated "in situ". The distribution of oligomer homologues was determined by gas chromatography. The homogenous tensides needed to the quantitative evaluation of chromatograms were produced in multistep Williamson-synthesis [3].

The role of various catalysts in hydroxyethylation was studied and Lewis-acids were found to be quite effective also in low concentrations. The reaction rate changes with the temperature (optimum 30—50 °C) and catalyst concentration according to a maximum curve. The distribution was of Flory type and practically independent of the catalyst's concentration and temperature [1]. A similar phenomenon was observed in the reaction catalyzed by magnesium perchlorate [4].

The amines were found to be good catalysts of hydroxyethylation. The temperature optimum ($\sim 80^\circ\text{C}$) of the reaction rate can be well explained by the reaction mechanism [5]. The reaction catalyzed by nitrogen bridged compounds, e.g. 1,4-diazo-bicyclo-(2,2,2)-octane a reaction rate several times higher than that measured in reactions catalyzed by open chained amines, was observed [6].

Hydroxyethylation reactions catalyzed by alkali hydroxides require higher temperatures compared to the previous ones ($> 100^\circ\text{C}$) and the reaction rate increases considerably with the temperature. The distribution of reaction products is of Weibull-Nycander-Gold type and is practically independent of the temperature and catalyst concentration [1].

According to Weibull and Törnquist the distribution constants are functions of the mean degree of hydroxyethylation. This hypothesis has been confirmed experimentally and the theoretical explanation of the phenomenon has also been given [7]. Oligomers with longer chains ($i > 6$) produced in the course of hydroxyethylation form complexes with alkali ions, contribute to the dissociation of alkali alcoholate thereby enhancing the reactivity of the anion. Complex forming agents (e.g. crown ethers) added to the reaction mixture facilitate the hydroxyethylation reaction by significantly increasing the reaction rate even if otherwise (e.g. at low temperature) the reaction would not take place at all [8]. Complex formation does not have essential influence upon the distribution of the products.

In addition to the hydroxyethylation of fatty alcohols, that of alkyl phenols [9] and fatty acids [10] has also been studied. In the case of both substrates two phases of hydroxyethylation could be observed, the formation of phenol ether and of glycol monoester and their further alkylation, respectively. The phenomenon can be explained by the differing nucleophilicity of the initial compounds and their alkylated derivatives.

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