

# WATER-THINNABLE UNSATURATED POLYESTER RESINS WITH HYDROPHILIC SULFONATE GROUPS FOR COATING APPLICATIONS

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An emission of volatile organic compounds (**VOC**) is an important problem, related to the production of polymers for paints, lacquers, pigments and other coating materials. The legislation of European Union restricts the content of **VOC** in coatings composition. Our research concerns reducing the emissions of **VOC** from polyester composition.

The main subject of presented works is investigations on UV-curable polyesters binders for water-borne coatings compositions for different kind of applications. Water-thinnable unsaturated polyester resins (**WTUPR**) are usually obtained by using carboxylic polyfunctional monomers in the process of polycondensation and afterwards the neutralization of the resulting carboxylic groups with volatile tertiary amines [1]. Moreover, other volatile organic compounds are often used in the manufacture of **WTUPR**, for example co-solvents and other additives supporting dispersion. A different concept of the **WTUPR** synthesis is the introduction of highly hydrophilic sulfonate groups ( $-\text{SO}_3\text{Na}$ ) into the polyester chain [2,3].

In our laboratory we have been working on this subject for many years. We have developed a new method of obtaining **WTUPR** with sulfonate groups using specially synthesised aliphatic sulfonate comonomers. This monomers can be incorporated into the polyester chain by polycondensation [4] or copolymerization [5] process. Elaborated methods are very sensitive to precipitation of sulfonate monomers in non-polar environment. This is a result of a strong hydrophilic character and a very low solubility of sulfonate monomers in non-polar reaction medium in the time of synthesis process. New solutions related to different types of sulfonate monomers and their incorporation into polyester chain are necessary. Innovative sulfonate monomers in polyesters synthesis environment should be more compatible.

Our present studies are focussed on the sulfonation of organic compounds which can be included into the polyester chain as hydrophilic monomers. The methods of the sulfonation of organic monomers were elaborated and optimized. Hydrogensulphate (IV) sodium was used as a sulfonating agent. The following hydrophilic monomers were obtained: trimethylolpropane ether with a sulfonate group, sodium salt of 2,3-dihydroxypropane-1-sulfonic acid (a new manner of synthesis), sodium salt of 3-hydroxypropane-1-sulfonic acid, sodium salt of 1,4-dihydroxybutane-2,3-disulfonic acid, sodium salt of 1,4-dihydroxybutane-2-sulfonic acid. The individual steps of the processes were elaborated. Particulars products of the reaction were isolated. The most effective way of the synthesis of each sulfonate monomer was suggested. All products were analyzed by  $^1\text{H}$  NMR and  $^{13}\text{C}$  NMR spectrums. Occasionally, mixtures of some products were obtained. It does not disqualify the application of mixtures of monomers in the syntheses of **WTUPR**.

The preliminary works on the practical applications of monomers for the syntheses of **WTUPR** with hydrophilic sulfonate groups were done. The pilot syntheses of polyesters were carried out. Selected **WTUPR** was diluted in water. The composition containing photoinitiator and other additives was applied by means of an applicator onto the glass plates. The film was cured by UV irradiation in air atmosphere. There was no emission of harmful organic compounds during hardening. In this manner coatings with high pendulum hardness and good properties were obtained.

The aim of further work will be focussed on the optimization processes of the synthesis of polyester resins with sulfonate groups and on the processes of obtaining their water dilution for practical applications as covers for different materials.

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