

## Functionalized vegetable oils for polyurethane materials

*Brykova O. M., Akhranovych O. R., Robota L. P., Savelyev Yu. V.*  
Institute of Macromolecular Compounds of the NAS of Ukraine, Kyiv, Ukraine  
[alexandra.brykova@gmail.com](mailto:alexandra.brykova@gmail.com)

The development of the polyurethane industry is going in the same direction as the polymer industry as a whole. The main directions of changes occurring during the synthesis of polyurethanes are: 1) the use of non-toxic substrates and auxiliary compounds (solvents and catalysts); 2) obtaining products with proper strength during use, but which are destroyed after their service life; and 3) the use of less energy-intensive processes. Equally important is the modification of polyurethanes with compounds of natural origin. Their presence in the polyurethane mesh or in its chemical structure increases the non-toxicity and susceptibility to degradation in environmental conditions of these materials. The results of the work of many authors indicate that a lot has already been done to make polyurethanes more environmentally friendly materials, which are obtained in accordance with the principles of green chemistry [1].

Vegetable oils are one of the most abundant and cheapest biological resources, and their use has many advantages, such as low toxicity and good biodegradability. They are considered one of the most important renewable raw materials for the production of bio-based thermosetting polyurethanes [2].

Therefore, the purpose of our work was the synthesis and research of new polyurethanes based on the polyols of fatty acids of hemp and epoxidized soybean oil synthesized by us in order to develop impregnating compounds and hydrophobic coatings.

Hydroxy functionalization of hemp and epoxidized soybean oils by their amidation and amido amination with the production of appropriate oil derivatives has been carried out.

IR spectroscopic studies confirmed the production of hemp diol - N,N-diethanolimide linoleate. By amidating epoxidized soybean oil with diethanolamine, the corresponding imido-amine derivatives of soybean oil were obtained.

Hydroxyfunctionalized amido- and imide derivatives of hemp and soybean oils are used in the synthesis of PU instead of, or in a mixture with, petrochemical raw materials. Film-forming polyurethane materials with N,N-diethanolimide linoleate as an extension agent of isocyanate-functionalized castor oil have been created, where it exhibits plasticizing properties, and the content of components of naturally renewable origin is up to 70%. Mesh polyurethanes resistant to alkaline-acid hydrolysis based on TDI-functionalized castor oil and extensions: hydroxylated derivatives of hemp and soybean oils were obtained. On the basis of native castor oil, diisocyanates of various nature (TDI/HMDI) and soy diol, film-forming polyurethanes have been created with different contents, where the content of naturally renewable components is up to 70%. The structure of the created materials, physical and mechanical properties, water absorption and resistance to acid-base hydrolysis have been studied.

The result of the work is new polyurethane materials obtained using hydroxyl-containing derivatives of hemp and soybean oils with a content of components of naturally renewable origin of 70%.

1. Brzeska J. A. A Brief Introduction to the Polyurethanes According to the Principles of Green Chemistry/ J. Brzeska, A.Piotrowska-Kirschling // Processes – 2021.- № 9. – P.1929-1952. <https://doi.org/10.3390/pr9111929>

2. Fatty acids and their derivatives as renewable platform molecules for the chemical industry /BiermannU., Bornscheuer U. T., Feussner I.[et al] // Angew. Chem. Int. Ed. - 2021. - № 60. -P.20144-20165. doi.org/10.1002/ange.202100778.