flocculants mostly used in waste water and industrial effluent treatment are highly efficient at very low doses, fragile and expensive.

Hence a new generation of flocculants have been developed by grafting polyacrylamidechains on purified polysaccharides. The grafting has been optimised. These flocculants are synergisticallyefficient at low doses, controlled biodegradable, shear resistant, inexpensive and ecofriendly. Dangling polyacrylamide chains on rigid polysaccharide backbone have easy approachability to contaminants in the suspensions. The higher the molecular weight and branching of polysaccharides, their grafts show better flocculation efficiency

Thus in conjunction with drag reduction model, a flocculation model has been developed which relates the settling velocity of the contaminant particles and radius of gyration, measure of pervaded volume by polymers in suspensions. The grafted polysaccharides outperform most of the commercially available flocculants. The grafted polysaccharides can be hydrolysed or can be cationised. Thus all the three classes of ionic, nonionic and cationic flocculants can be developed based on grafted polysaccharides.

These systems are multi functional and find applications in agriculture, biomedical systems, various industrial process and oil field operations and recently in nano technology. There are possibilities of improved synthesis and synergistic combination of there novel systems. Deatails of matertials, mechanisms and applications of these ecofriendly and inexpensive systems are being presented in the plenary lecture.

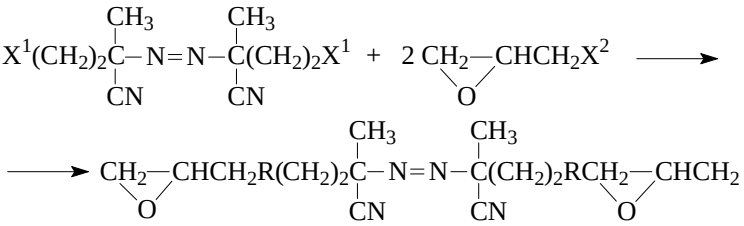
## THE OBTAINING OF EPOXY OLIGOMERS ON THE BASIS OF MONOMERS

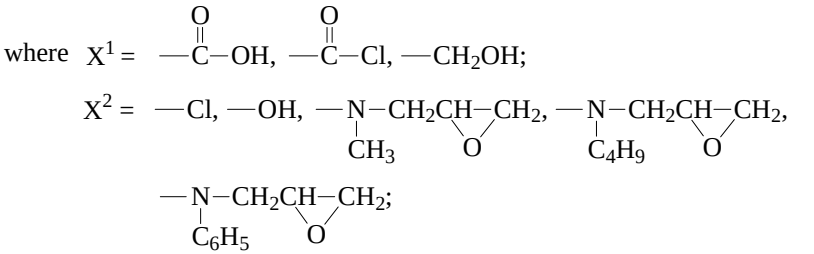
***Michael Bratychak***
*Lviv Polytechnic National University*

The epoxy oligomers on the basis of monomers are of great interest because products on their bases are characterized by the series of positive properties. Epoxy oligomers of such type are obtained by vinyl and diene

monomers ionic polymerization using lithium-organic substances. This method is multistage and requires the purification of initial compounds as well as special devices.

We propose to obtain the oligomers with epoxy end-groups on the basis of vinyl and diene monomers and the $C_9$ fraction containing unsaturated compounds by radical polymerization, using diepoxy derivatives of azodinitrile compounds by general formula:





Styrene, isoprene, divynile and also the $C_9$ fraction are used as monomers. The $C_9$ fraction is a product of hydrocarbon pyrolysis to ethylene, containing 40–50 wt % of unsaturated compounds, namely styrene, divinylbenzene, indene and pentadiene.

The diepoxy derivatives of azodinitrile compounds have been synthesized on the basis of known substances containing the –N=N– bonds in their structure and also carboxy, hydroxyl or chlorhydrine groups.

The effect of initiator amount, temperature and reaction time upon the synthesis proceeding has been studied. The increase of synthesis temperature decreases the molecular weight and double bonds content of oligomers and simultaneously increases the epoxy group content.

The increase of the oligomerization time results in the decrease of the epoxy number but leads to the growing of oligomer molecular weight.

Polydispersion of synthesized oligomers on the basis of isoprene is 1.9–2.1. In order to reduce polydispersion and increase the yield of oligomers with epoxy end-groups the polymerization of diene monomers has been carried out with continuous addition of initiator equal amounts to the mix. Obtained by such a way oligomers with epoxy groups are characterized by molecular weight ranges from 3500 to 5000.

## TNT-BASED SULFONATED POLYNAPHTHYLIMIDES USEFUL AS PROTON EXCHANGE MEMBRANES FOR FUEL CELLS (PEMFCs)*

***Alexander L. Rusanov[1], Vladimir A. Tartakovskiy[2], Elena G. Bulycheva, Margarita G. Bugaenko, Jean-Yves Sanchez[3], Cristina Iojoiu[3], Vanda Yu. Voytekunas[4,5] & Marc J.M. Abadie[5,6]***

*[1] A. N. Nesmeyanov Institute of Organoelement Compounds Russian Academy of Sciences - INEOS RAN, 28 Vavilov str., 119991 Moscow GSP-1., Russia*

*[2] Zelinsky Institute of Organic Chemistry of Russian Academy of Science - IOCh, Moscow, Russia, 119991 Moscow GSP-1., Russia*

*[3] LEPMI ENSEEG, UMR 5631 CNRS, INPG, UJF, Domaine Universitaire, 1130 Rue de la Piscine, BP 75, 38402 Saint Martin d'Hères Cedex., France*