

SYNTHESIS OF NOVEL BIOCIDAL POLYMER BASED ON POLY(HYDANTOIN-METHYL-*p*-STYRENE) AND CHARACTERISTICS OF ITS PROPERTIES

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Recently the great interest is devoted to biocidal polymers which can be applied for obtaining of products able to kill pathogenic microorganisms or at least characterizing by the high resistance to microbial attack. Such promising properties have polymers based on *N*-halamine, particularly hydantoins containing N-Cl bond (the term *N*-halamine signifies a compound with *N*-halogenated imide, amide or amine).

Hydantoins represent the group of compounds which over the past few years have attracted a great attention because of their diverse biological activities including antibacterial, antiviral, fungicidal, herbicidal etc.

A special kind of hydantoins are spirohydantoins which have hydantoin moiety chemically bonded to alicyclic ring condensed with aromatic group. Spirohydantoins were found to have high biological and anti-inflammatory activities^{1,2}.

The aim of this work was to synthesize a new polymer containing spirohydantoin, desired from 2-tetralone, (**Fig.1.**) and investigation of its physicochemical properties.

To synthesize this polymer, firstly a chloromethylated polystyrene via bulk polymerization of 4-vinylbenzyl chloride has been prepared. In the next step, polymer containing spirohydantoins moieties with N-H bond was obtained



Fig.1. 2-tetralone hydantoin

by *N*-alkylation reaction at the room temperature. Finally, this polymer has been chlorinated, during which N-H bond was transformed onto N-Cl³. The obtained polymer was totally insoluble in common organic solvents.

Polymer with 5,5-dimethylhydantoin has been also prepared as a model compound.

For confirmation of expected structures of polymers, ¹³C NMR in solid state and FTIR (in HCB) spectra have been done. The polymer was insoluble either in chloroform, dimethylsulfoxide or tetrahydrofuran even on heating.

Thermal stability of polymer before and after chlorination was studied using TA Instrument SDT 2920 Simultaneous DSC-TGA. It was found that the obtained methylstyrene-based polymer containing the spirohydantoin derivative in para-position is more thermally stable than chloromethylated polystyrene⁴. However, this stability decreased after chlorination.

A novel polymer was synthesised with high purity by new, efficient method. This compound are designed to obtain the materials with biocidal properties. The broad application of such polymers is predicted in textile industry, in production of water or air filters, hygienic articles and protecting coatings in hospital equipments, bathroom accessories or covers of ships.

1. Chylińska M., Kaczmarek H., POLIMERY, 2012, 57, 1, p.3-10.

2. Dhar et al., Patent US 7,078,420 B2.

3. Ziegler-Borowska M., Chylińska M., Kaczmarek H., Patent no. P.395.035. submitted 27.05.2011.

4. Kaczmarek H., Chylińska M., Ziegler-Borowska M., J. Therm. Anal. Calorim., DOI: 10.1007/s10973-011-2076-6J.