

Summary of the doctoral dissertation

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Novel polymeric and mixed polyvinyl chloride plasticizers

with significantly reduced or zero migration

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During the PhD project synthesis of series of new plasticizers and plasticizing mixtures were carried out based on the chemical modification of commercially available plasticizers produced by Grupa Azoty ZAK S.A. The main goal of the studies was to reduce the migration of plasticizers from the PVC plastics. Furthermore, a comparative study of the plasticization efficiency were performed for specimen fabricated through the two different methods, namely solution casting method and classical method that is usually used by PVC manufacturers during the processing process.

The first modification consisted in introduction of chlorine atoms to the plasticizer molecule in a transesterification reaction between commercial ester plasticizer and a suitable chloroalcohol. In assumption, such modification should result in intensification of the interactions between molecule of plasticizer and the polymer chains and this way enhanced the stability of polymer – plasticizer system. Several reactions were carried out with different molar ratios of the substrates leading to the synthesis of new type chlorine containing plasticizers. Even a small content of chlorine containing esters effectively restricts the migration phenomenon without deterioration the other tested properties characteristic for plasticized PVC such as thermal stability, strength parameters and glass transition temperature.

In the second modification method a coupling of modified TOTM with oligomeric siloxanes was carried out. The coupling was conducted using a hydrosilylation chemistry, i.e. the reaction between hydrosiloxane and compound with an unsaturated bond in the presence of Pt(0) catalyst. The properties of the plastics prepared using the newly prepared polymeric plasticizers were unfortunately worse than materials plasticized by nonmodified TOTM. As a reason of the bad plasticizing efficiency the crosslinking process leading to the poor solubility of a plasticizer was identified.

For the further implementation of thesis' results in Grupa Azoty ZAK S.A. the larger scale extended studies of new plasticizers were carried out and the results of them were presented in the confidential part of the thesis.