SUMMARY OF DOCTORAL DISSERTATION

Modifiers for plastics based on renewable raw materials

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The main goal of this dissertation was to develop an innovative migration-resistant poly(vinyl chloride) (PVC) bioplasticizer consisting of a combination of esters with varying hydrocarbon chain lengths, degrees of branching, and molar mass. The study focused on the synthesis and characterization of bioplasticizers based on renewable raw materials such as oleic acid, acetic acid, succinic acid, and propylene glycol.

The research involved the synthesis of several types of bioplasticizers using advanced analytical techniques, including gas chromatography (GC/MS and GC/FID), gel chromatography (GPC), infrared spectroscopy (FTIR), nuclear magnetic resonance spectroscopy (^{1}H NMR), and thermogravimetric analysis (TGA), to accurately determine the chemical structure and thermal stability of the synthesized compounds. Additionally, their biodegradation and physicochemical properties were evaluated.

The efficiency of the bioplasticizers in plasticizing PVC was verified by preparing PVC composites and determining their mechanical properties, thermal properties, plasticizer migration, and glass transition temperature. The results of these tests were compared with traditional phthalate plasticizers to evaluate the possibility of replacing them with safe and environmentally friendly bioplasticizers.

Studies indicate that bioplasticizers based on succinic acid, oleic acid, and propylene glycol can produce PVC materials with good mechanical and thermal properties, comparable to those achieved with commercial plasticizers. Furthermore, it has been demonstrated that bioplasticizers can effectively replace traditional plasticizers, reducing their migration and enhancing safety in use.

In conclusion, this work contributes to the development of modern, environmentally friendly plasticizing materials that can find wide application in the production of safe and sustainable PVC products.