Summary

Natural carbohydrate polymers are of great interest regarding to their possible use as materials in various industries. One of the most abundant polysaccharide in nature is starch. Hydrophilic nature, low moisture resistance, high fragility, incompatibility with hydrophobic, non-polar polymers significantly limit the application of native starch for industrial uses. Hydrophobisation of starch by esterification is one of the method which is carried out in order to improve its mechanical and processing properties. Usually, in order to enable an esterification reaction with the acids, a starch is first dissolved in common organic solvents as DMSO, DMF, pyridine or *tert*-butanol. However, the use of such solvents also has some limitations and disadvantages - volatility, flammability and high levels of toxicity. Lipase-catalysed synthesis of starch esters has been recognised as environmentally friendly method due to lack of by-products and very mild reaction conditions.

The objective of the study was to obtain new polymer materials, by biocatalysed esterification of potato starch with pure oleic acid (model reactions) or hydrolysed high oleic vegetable oils. Reactions based on oils were carried out in two steps. Firstly, the oils were hydrolysed with a fungal lipase in a buffer solution form. Then, hydrolysates (the mixture of higher fatty acids, without glycerol) were used as donors of the acyl group for the esterification of potato starch. The starch was formerly pregelatinised in an aprotic imidazolium ionic liquid, under atmospheric or reduced pressure conditions. Esterification was catalysed also by the fungal lipase but with the difference that it was immobilized on a polymer carrier. The synthesis of starch esters was conducted in the anhydrous conditions, with or without addition of small amount of non-ionic surface active agent. The products have been identified and characterized using the following methods: degree of substitution (DS) by volumetric and elemental analysis method, Fourier-transform infrared (FTIR) and nuclear magnetic resonance (NMR) spectroscopy, X-ray diffraction (XRD), scanning electron microscopy (SEM) and thermal analysis (TG/DTG, DSC). Additionally, in order to determine the possibility of using the obtained materials in the packaging industry, the film extruded from them were subjected to mechanical (tensile and tear strength), processing (hydrophobicity, water resistance) and environmental tests (biodegradability, phytotoxicity).

Regardless of the esterifying agent, medium substituted starch esters with a yield of 80% were obtained . The proposed two-step method for the synthesis of starch esters made it possible to obtain materials with improved processing properties compared to non-esterified starch. Additionally, the conditions for developing a new way of recycling waste oils from the food

industry were created. Esterification increased not only hydrophobicity of the starch, but also tensile and tear strength, without losing important environmental features such as biodegradability and non-toxicity. Such obtained polymer materials give hope for their use in the production of new eco-friendly and biodegradable packagings, as the main component or compatibilizer.

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