Nanocomposites and nanomaterials

Wettability of natural/synthetic polymers developed by air plasma processing. The effect of starch in PET system

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Polyethylene terephthalate (PET) because of its particular physicochemical properties, especially glass-like transparency and inflexibility is extensively applied. PET may undergo thermal degradation resulting in formation of acetaldehyde, which may influence organoleptic characteristics of packaged foods changing taste and smell. To omitt this problem thin layer of natural substance on the PET surface can be created. As a natural polymer starch was used because it is cheap, abundant and renewable. The poor oxygen permeability of starch films also controls lipid oxidation. These properties can have a potential for the preservation of various food products and pharmaceutics. To improve the interfacial adhesion of starch to PET it's surface modification by air plasma was applied [1].

The PET polymer surfaces were exposed to the air plasma at a radio frequency operation of 40 kHz and an average power of max. 400 W during 1 or 5 minutes. Air gas has a two-fold effect on the polymer surface, an oxidizing effect and a change of the cross-link density. As the surface is oxidized, the hydrophobic character of PET is changed to become gradually more hydrophilic. Thermal and mechanical properties of base polymer and that modified with air plasma were determined. Wettability of the surfaces and work of adhesion were obtained on the basis of measurements of advancing and receding contact angles (GBX, France). The achieved results were interpreted based on surface free energy and topography parameters. Surface free energy values were verified by applied theoretical models: LWAB, O-W and CAH. After air plasma treatment hydrophobic/hydrophilic character of polymer was changed. Switchable wettability may be convenient parameter providing information about PET and PET/starch surface properties. Significant differences in elongation at break were observed, but small differences in thermal stability and flexural properties of sample after plasma modification. These findings improve knowledge of wettability and interfacial properties of PET/ starch materials, which is valuable particularly to formulate controlled release of new starch coatings and new packaging starch films with specific properties.

1. *Espnídola-González A., Fernández-Escobar F., Brostow W., Datashvili T.,* Natural-synthetic hybrid polymers developed via electrospinning: the effect of PET in chitosan/starch system. Int. J. Mol. Sci. 2011, **12**.-P. 1908-1920.