DEVELOPMENT OF PE/PCL DOUBLE LAYER FILMS FOR FOOD PACKAGING WITH ALUMINIUM OXIDE AND ZINC OXIDE NANOPARTICLES

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Abstract

The development of new packaging plastics contributes significantly to the preservation of packed food quality. Especially important is polymer active packaging in which addition of active ingredients targets to improve one or more properties such as water vapour and oxygen permeability. Food packaging, except good barrier, needs to have good thermal and mechanical properties because it has to be flexible and endure higher temperatures, like during sterilization.

Low density polyethylene is a classic material used for food packaging due to numerous advantages it has, but low barrier property is its main weakness. To improve permeability properties, mechanical properties and thermal stability double layer polyethylene/polycaprolactone (PE/PCL) films were prepared with the addition of nanoparticles of zinc oxide (ZnO) and aluminium oxide (Al2O3) in PCL layer.

For the studied samples water vapour permeability, thermal stability and mechanical properties were determined

The results showed that addition of both nanoparticles significantly improves mechanical properties when compared to pure PE but samples with Al2O3 have much higher values of tensile properties. Water vapour permeability is decreased when nanoparticles are added but different behaviour is observed. For samples with ZnO permeability decreases at higher loading of nanoparticles while on the other hand, the lowest value for samples with Al2O3 is at the lowest loading and increase of loading causes increase in permeability. Thermogravimetric analysis was used to evaluate thermal stability and it showed that samples with nanoparticles had around 10 °C higher onset of degradation and maximum degradation rate temperature compared to PE.

Keywords: Low density polyethylene (LDPE), polycaprolactone (PCL), water vapour permeability, metallic oxide nanoparticles

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