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Service Temperature Enhancement of Bioplastics Based Materials for Food Packaging

Utai Meekum

Suranaree University of Technology, Thailand

The most common and commercial available bioplastics; poly(lactic acid)(PLA) and poly(butylene succinate)(PBS), have the service temperature by means of heat deflection temperature(HDT) around 55oC and 90oC, respectively. Unmodified polymers could not be used for hot-fill food and microwavable packaging, especially for the PLA. HDT above 110oC is desirable for that applications. Moreover, sterilization by autoclaving of the plastic packaging requires HDT above 120oC. To overcome those incompetency, biocomposites reinforced with natural fibers and bioplastics compounds based on PLA, PBS and PLA/PBS blends have been successfully established. The peroxide/silane macro-crosslinking systems have typically been applied on those materials. The natural fibers, derived from agro industries waste, namely empty fruit palm oil (EFPO), rice husk(RH), Bagasse(BF), coconut husk(CH) and cotton were employed as reinforcement. The used inorganic fillers, both commercial available and the refined industrial waste, for the properties enhancement were investigated. Some of them were used as natural pigment for material colouring. The research results showed that based on PLA, PBS and PLA/PBS blends matrices service temperature of biocomposites and bioplastics compound at 110oC with good mechanical properties had been easily succeed. It means that those materials can be used for manufacturing the hot-fill and microwavable packaging by injection molding. For the sterilisable, by autoclaving, packaging applications, it was found that only PLA and high fraction of PLA in the PLA/PBS blends matrices showed the good mechanical properties and HDT above 120oC. They were successfully survived in the autoclave chamber at 121oC for 30 minutes. With the PBS matrix, due to its low melting point, 120oC observed by DSC, therefore, its shape could not be retained at temperature above 120oC. The verdict of the research works reveal that, based on PLA and high fraction of PLA blends matrices, the peroxide/silane macro cross-linked biocomposites and bioplastics compounds had the service temperature, HDT, above 120oC. They could be used to manufacture, by injection molding, the hot-fill, microwavable and sterilisable food packaging. With PBS or high fraction of PBS blends matrices, hot-fill and microwavable applications are feasible but not for sterilisation.

umsut@g.sut.ac.th