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Soil burial-induced chemical and thermal changes in starch/poly (lactic acid) composites

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Abstract: Soil burial degradation was confirmed to be an efficient waste disposal method for the biodegradable materials with short service life, such as starch/poly (lactic acid) (PLA) composite. The biodegradation behavior about chemical and thermal properties of starch/PLA composite was analyzed by using X-ray photoelectron spectroscopy (XPS), infrared microscopy (IRM), differential scanning calorimetry (DSC), and thermal gravimetric analysis (TGA). XPS and IRM results indicated that the biodegradation of PLA occurred at the ester groups in PLA chains. XPS demonstrated the cleavage of C-O linkages between glucose rings in starch. DSC and TGA results showed that the starch/PLA composite degraded faster than the pure PLA. During the soil burial degradation, the glass transition temperature of starch/PLA composite exhibited an obviously decrease while it had a slight variation for PLA. The thermal stability of starch/PLA composite shifted towards to that of PLA when they were subjected to soil burial for the same time. It is established that the starch can accelerate the degradation of PLA-based materials, which will enlarge the markets of biodegradable PLA materials used for short service life products.

Keywords: poly (lactic acid); starch; biodegradation; surface chemical changes; thermal properties