DECOMPOSITION ANALYSIS OF BIODEGRADABLE FILM

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Abstract

Biopolymers are of great importance because of their biodegradability, environmentally friendly behavior, and being renewable natural resource. They can be used to produce biodegradable films, biocomposites, packaging materials, tissue as a medical materials. In this study, development of novel starch based biodegradable polymer and investigating of its decomposition process were objected. For this aim, the decomposition test was carried out by indoor soil degradation. Starch based biofilm was tested for their biodegradability by soil burial testing in a laboratory environment under temperature and humidity control. Soil was taken from the Belgrad Forest area of Istanbul, Turkey, from the surface layer of the ground. All inert materials were carefully removed to obtain a relatively homogeneous mass. Soil was poured into a plastic tray up to a thickness of about 4 cm. The samples were weighed and then buried in the soil to a depth of 1 cm. The decomposition process of the biodegradable film was observed. The results obtained in this study revealed that the starch based biodegradable film was significantly decomposed by microorganism in soil. It could be concluded that using the biodegradable film can help sustainable protection of nature.

Introduction

There is an increasing interest on biodegradable polymers in the world because of environmental issues. Biopolymers are of great importance because of their biodegradability, environmentally friendly behavior, and being renewable natural resource. They can be used to produce biodegradable films, biocomposites, packaging materials, tissue as a medical materials.

Various bioresources are used to procedure biodegradable polymers. Starch is a carbohydrate consists of a number of glucose. Potatoes, corn, rice, and wheat are starch source. Starch is one of the most promising biomaterial for biodegradable polymer manufacturing. Because, it has low price, wide-availability, and enough performance (Hizukuri et al. 1981; Mohanty et al. 2000).

In this study, burial soil degradation analysis of the starch-based fully biodegradable polymer was performed in laboratory conditions.

Materials and Methods

Materials

The biodegradable polymer used in this study is EnviPlast® which is commercially available product. The experimental test specimens were supplied from PT Inter Aneka Lestari Kimia, Jakarta, Indonesia.

The test specimens were cut from the polymer sheets. The specimens were 50 mm by 50 mm by 0.30 mm (width * width * thickness). Totally 21 test specimens were prepared from the polymer sheets. Three specimens were used for per day. The degradation procedure was observed during 7 days.

Biodegradation Analysis in Soil

Soil was poured into a plastic tray (10 cm by 20 cm by 5 cm) up to a thickness of about 4 cm. The samples were weighed and then buried in the soil to a depth of 1 cm. The tray was covered with an iron net and then with a thick paper moistened with tap water. Water was sprayed every a day to sustain the moisture. During the fixed periods, samples were carefully taken out, washed with distilled water, and dried under ambient temperature (22–25°C) and humidity (70– 80%) conditions for 24 h and then weighed.

Sterilized soil was prepared by heating the soil in oven for three days at 100°C. The sterilization process was performed to clear away the microorganism in the experimental soil.

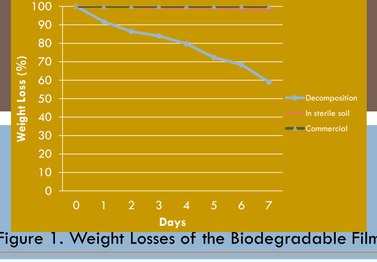


Figure 1. Weight Losses of the Biodegradable Film

Results

The weight losses values obtained in the degradation analysis in indoor conditions are showed in Figure 1.

As can be seen from Figure 1, around 40% of the biodegradable polymer was degraded by the microorganisms after 7 days. But there was no significant weight loss in the commercial plastic bag. In addition, no degradation was observed in the biodegradable polymer in the sterilized soil.

Figure 2 shows the biodegradable polymer's pictures during its degradation process in laboratory condition. Figure 2 clearly indicates burial degradation process of the biodegradable polymers during 7 days. The biodegradable polymer was used as a food source by the microfauna.

Figure 2. Appearances of the Biodegradable Films After the Specified Days of Soil Biodegradation (a; Initial, b; first day, c; second day, d; third day, e; fourth day, f; fifth day, g; sixth day, h; seventh day)

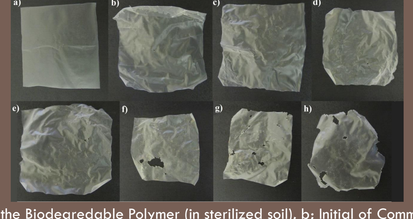
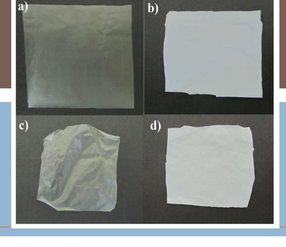


Figure 3. a; Initial of the Biodegredable Polymer (in sterilized soil), b; Initial of Commercial Plastic Bag, c; The Biodegradable Polymer in the end of 7th day (in sterilized soil), d; Commercial Plastic Bag in the end of 7th day



As can be seen from Figure 3, the observations indicate that the degradation rate decreased as the biological activity decreased

Conclusions

The findings obtained from this work indicated that 40% of the starch-based novel biodegradable polymer which is Enviplast® was decomposed by the microorganism in soil while no significant weight loss was acquired in the commercial plastic bag. It was concluded that the biomaterials could be used to produce shopping bag and food packaging so that natural resources could be protected.

Acknowledgements

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