

BIODEGRADABLE PLASTICS

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1. Introduction

Plastics constitute a wide range of synthetic or semi-synthetic materials that are used in a huge and growing range of consumer and industrial applications due to their great versatility, excellent strength to weight ratio, durability, conductivity, cost-effectiveness, low maintenance and corrosion resistance [1]. Their extensive use, however, has led to their accumulation because of their chemical inertia and consequently environmental pollution, as well as the depletion of their raw materials (oil). The last few decades, new polymeric materials based on renewable raw materials (starch, corn) have emerged that can degrade in the environment in a short period of time by the enzyme action of microorganisms, fungi and algae; biodegradable plastics [2]. They are an effective solution to the problems of environmental pollution, waste disposal and segregation of oil, but aren't they too good to be true?

2. Experimental Setup

We conducted four experiments. The first one was the production of biodegradable starch-based plastic, which was performed in two ways, using glycerol and acetic acid (A), and honey and red vinegar (B), for a simpler approach, to better understand their corporeality.

We then examined the different effect hydrochloric and sulfuric acid, as well as high temperatures had on pieces of biodegradable and conventional plastic bags. Lastly, we compared biodegradable and conventional HDPE raw materials under high temperatures up to 150°C.

3. Results

In the first experiment, the original solution was opaque in both experiments, but then became more transparent and viscous as it was heated. The plastic was placed on a nonstick surface and was soft.



Figure 1 (A)



Figure 2 (B)

As far as for the second experiment, under the influence of hydrochloric acid, there was no change in either bag. But, while the biodegradable plastic bag fully dissolved under the influence of sulfuric acid (left), the conventional one remained the same (right).



Figure 3



Figure 4

In the third and fourth experiment, there was no major difference between the biodegradable (left on the figures) and conventional (right on the figures) plastic bags and raw materials under high temperatures, but the biodegradable ones degraded a bit more in both experiments.



Figure 5



Figure 6

4. Conclusion

There was no major difference between the degradation of biodegradable and conventional plastic bags and raw materials under the influence of the two acids and high temperatures. In fact, biodegradable plastics rarely completely disintegrate, because they need to be exposed to temperatures as high as about 50°C for many years, as those dominated by industrial compactors, not nature [3]. However, any reduction in waste and the segregation of oil are very useful.

5. References

- [1] W.d. What are plastics? *PlasticsEurope*
- [2] Fridovich-Keil, Judith L. 29 Apr. 2016. Bioplastic. *Encyclopædia Britannica*.
- [3] Tokiwa, Yutaka et al. Sept. 2009 Biodegradability of Plastics. *National Center for Biotechnology Information*.