All natural bioplastics from cellulose and cellulose-rich agro-wastes

Susana Guzman-Puyol
José Alejandro Heredia-Guerrero, Ilker S. Bayer, Athanassia Athanassiou

Istituto Italiano di Tecnologia (IIT), Via Morego 30, Genoa, Italy

susana.guzman@iit.it

Since the middle of the 20th century, the need of functional and low-cost materials for the production of commodities for the growing population of our planet has led to a rapid development of the petroleum-based plastics industry. In fact, plastics prepared from fossil resources are everywhere. Nevertheless, the massive use of these materials is associated with numerous environmental problems (pollution, sorting, recycling, and greenhouse effects). As a realistic alternative, bioplastics, this is, plastics made from renewable raw materials have been developed.

In this work, we present a simple and direct method to produce bioplastics from cellulose and cellulose-rich materials from both terrestrial and aquatic plant wastes. In particular, we report the preparation of bioplastics from cellulose-rich plant residues such as parsley, cocoa or seaweeds, to mention a few, blended with cellulose using trifluoroacetic acid (TFA) as a common solvent [1-3]. Chemical, morphological and structural characterization was performed for all the films. Mechanical and hydrodynamic properties were also investigated, showing a wide range of results, Figure 1. Moreover, biodegradation tests were carried out, indicating that the films degrade completely in seawater, Figure 2. Finally, some bioplastics were characterized by a good compatibility, high antioxidant properties and an anti-inflammatory activity similar to commercial drugs. Hence, these bioplastics could be used in different applications such as food packaging or biomedicine.

References

[1] I.S. Bayer; S. Guzman-Puyol; J.A. Heredia-Guerrero; L. Ceseracciu; F. Pignatelli; R. Ruffilli; R. Cingolani; A. Athanassiou, 47 (2015) 5135-5143

[2] S. Guzman-Puyol; J.A. Heredia-Guerrero; L. Ceseracciu; H. Hajiali; C. Canale; A. Scarpellini; R. Cingolani; I.S. Bayer; A. Athanassiou; E. Mele, 2 (2016) 526-534

[3] S. Guzman-Puyol; D. Russo; I. Penna; L. Ceseracciu; F. Palazon; A. Scarpellini; R. Cingolani; R. Bertorelli; I.S. Bayer; J.A. Heredia-Guerrero; A. Athanassiou, 27 (2017), 1-11

Figures

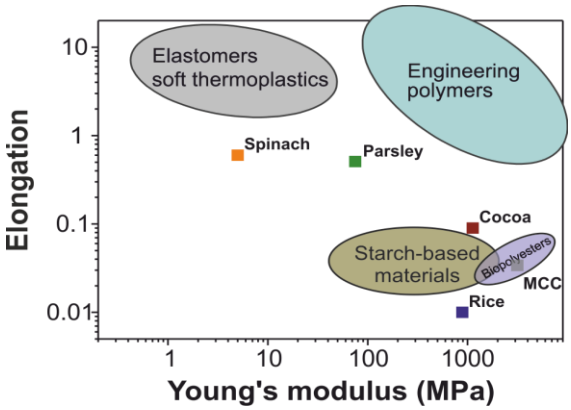

Figure 1: Mechanical comparison between bioplastics from plant wastes and commercial plastics.

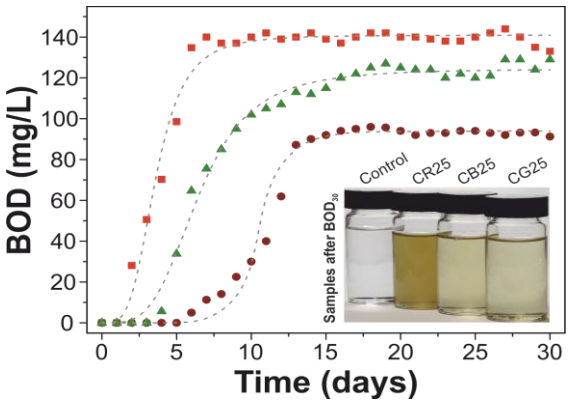

Figure 2: Biological oxygen demand of bioplastics prepared from seaweeds.