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Fatty acids as a source of original aliphatic polycarbonate materials

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PURPOSE OF THE ABSTRACT

Presently, most of the industrial chemicals are manufactured from petroleum resources. However, rapid depletion and price increase of fossil resources are encouraging chemists to orient point their research towards designing chemicals and materials from renewable feedstocks. Fatty acid derivatives (FAD) appear as a versatile platform to develop bio-based polymers. Based on FAD, a lot of work has been done so far in the field of polyurethanes, polyesters, polyamides, etc. [1,2] However, not as much attention has been paid in the preparation of aliphatic polycarbonates [3,4].

In this presentation Fatty acids were derivatized with the objective to design bio-based aliphatic polycarbonate (APC) materials. To that purpose, two platforms of lipidic 6-membered cyclic carbonates were prepared following synthetic routes either involving the ring-closure of a malonate intermediate or the coupling reaction between a fatty acid and 2-amino-1,3-propanediol. The ROP of these cyclic carbonates was investigated. The first platform of 6CCs was polymerized in the presence of Sn(Oct)2 as catalyst, yielding low Tg aliphatic polycarbonates ranging from -60.8°C to -26.1°C with respect to the size of the pendant aliphatic side chains. The polymerization of the second lipidic 6CC platform was performed in a controlled fashion using DBU/Schreiner thiourea as catalytic system. Taking advantage of the presence of unsaturation functions on the linear bio-based APCs, cross-linked polycarbonate materials were then prepared. Several cross-linking methods were tested such as the irreversible thiol-ene coupling, the thermo-reversible Diels-Alder reaction and the photo-reversible [2+2] cyclo-addition reaction between two cinnamate moieties.[5] Fatty acid-based cross-linked APCs were thus designed and characterized; the latter exhibit tunable physico-chemical properties as a function of the monomer structure and the cross-linking density.

FIGURES

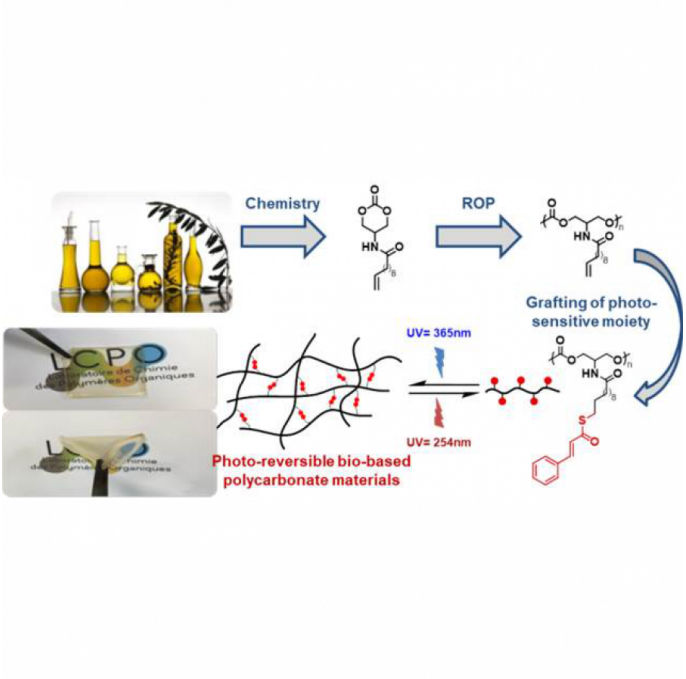

FIGURE 1

Fatty acid-based polycarbonate materials

Fatty acid-based polycarbonate materials

FIGURE 2

KEYWORDS

Fatty acid | polycarbonates

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