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Enzymatic synthesis of biobased polyesters: Influence of aromatic furan-based monomers

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Résumé

Polyesters represent around 10 % of the global polymer demand[1]. Such materials are generally oil based and are synthesised through harsh conditions using potentially dangerous organometallic catalysts and high temperatures[2]. Enzymes represent an environmentally friendly alternative to organometallic catalyst and allow reactions under milder conditions. The synthesis of biobased polyesters through enzymatic polymerisation has already been investigated by our group[3,4]. Most investigated polymeric structures were aliphatic, resulting in polyesters with low thermal transitions thus limiting their potential uses and applications. The use of aromatic biobased monomers such as the dimethyl 2,5-furanedicarboxylate (DMFDC) allows the synthesis of polyesters with higher thermal properties[5]. However, the impact of such monomers on enzymes in a process of enzymatic polymerization is not yet well understood[6].

In the present study, DMFDC was associated with different diols (1,4-butanediol or 1,6-hexanediol) and another diester (diethyl adipate) in different proportions. The impact of the DMFDC ratio on the molecular weight and the thermal properties of the final polymers was assessed. A direct relationship between the solubility of the growing polymer chains and the reactivity towards the enzyme was discovered. Based on these observations, new reaction solvents were investigated. For polyesters with the highest aromatic monomer ratios, the use of new solvents allowed the final molecular weights of the polyesters to be increased by 3.6 and 3.2 times, respectively. Such improvement in the final molecular weights of the polyesters also resulted in significantly enhanced thermal properties.

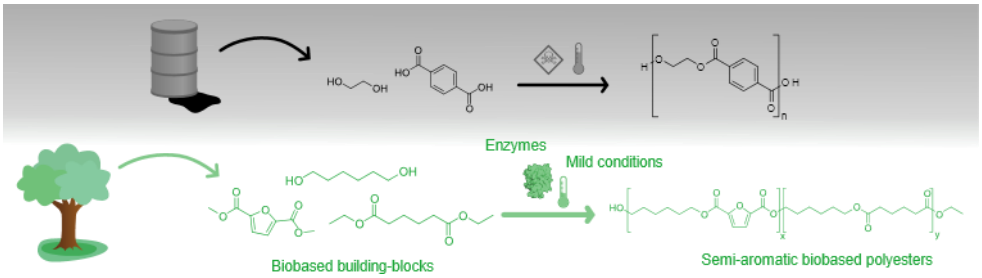

Figure. *Enzymatic synthesis of biobased aromatic polyesters.*

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