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Technical Brief

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Novel degradable polyoxalates from renewable monomers for coating and film applications

Technology Summary

CSIR-NCL scientists have invented novel, bio-derived polyoxalates that can be tailored to control the degradation kinetics, and can be a faster degrading substitute to polylactic acid.

Background

Polymers are commonly sourced from non-renewable fossil fuel reserves, which has triggered a widespread interest in renewable polymeric materials. Although considerable progress has been made in this area, most of these polymers display limited molecular weight, decomposition remains unattempted, and processing of these polymers to a useful item of daily use is largely missing. Because of these reasons, the contribution of renewable polymeric materials to the total volume of polymers produced is negligible.

Technology Description

Scientists at CSIR-NCL, led by Dr. Chikkali, have developed a patent-protected one-step, efficient synthetic process to produce isohexide dioxalates (IDs) from commonly available sugar-derived isohexides. The isohexides are treated with n-butyl lithium and methyl chlorooxoacetate to produce isohexide-dioxalates in excellent yields. Separately, they also managed to prepare dioxalates from plant oil. The resulting polymer had many interesting properties:

(a) sufficiently high molecular weight and narrow polydispersity

(b) can be cast into stable transparent films with high mechanical strength.

(c) Degradation speed of polyoxalates can be tailored

Market Potential

The global polylactic acid (PLA) market size was valued at USD 525.47 million in 2020 and is expected to grow at a compound annual growth rate (CAGR) of 18.1% from 2021 to 2028. The demand for PLA is mainly driven by end-use industries, such as agriculture, transport, textile, and packaging. Polyoxalates may be a faster degrading substitute for PLA**, and may substitute for PLA in certain applications such as packaging.

Value Proposition

- Faster degrading substitute to polylactic acid in packaging applications.
- Ability to tailor molecular structure to tune for hydrolytic degradation kinetics and mechanical properties
- Sufficiently high molecular weight and narrow polydispersity
- Can be cast into stable transparent films with high mechanical strength.

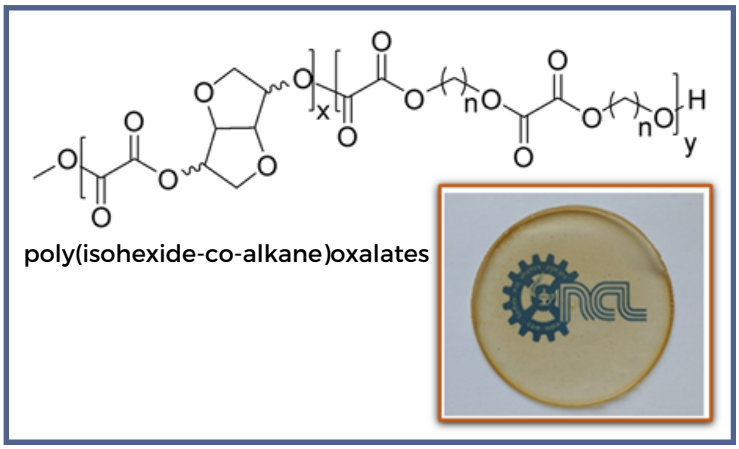
Applications

Bio-derived polyoxalates are expected to be an important contender in bio-degradable, high value, plastics applications. They can be used in biomedical applications such as coatings for sutures, drug delivery vehicles etc., and some advanced packaging applications.

Technology Status

- Demonstrated at bench scale (5-10 gm in one reaction).
- Patent protected.
- Seeking industry partners interested in technology licensing

Cross metathesis of biorenewable dioxalates and diols to film forming degradable polyoxalates, J. Polym. Sci. Part A: Polym. Chem., 56 (2018), 1584 - 1592.
(https://www.grandviewresearch.com/industry-analysis/polylactic-acid-pla-market)
**https://patents.google.com/patent/JP5582445B2/en



poly(isohexide-co-alkane)oxalates

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