

Efficient method for 'Chain Multiplication' of unsaturated fatty acids – synthesis of ultra long-chain compounds

Background

Terminally functionalized long-chain aliphatic compounds are of major importance in technical and biological systems. Of particular interest are ultra long-chain compounds with methylene sequences that significantly exceed the length of a typical fatty acid chain. The method described here can be applied for the production of high-melting, purely aliphatic polymers and nanocrystals, using readily available starting materials (renewable resources). Moreover, it can also be used to generate synthetic structures that correspond to the typical thickness of phospholipid bilayers and can imitate their function.

Problem

Currently, there are only very few, costly synthetic routes for the production of such ultra long-chain compounds, as they typically rely on tedious multistep reaction sequences. Additionally, by using these conventional methods, the starting materials are not properly exploited, resulting in significant amounts of waste and yielding only small quantities. Large-scale implementation is thus not an option.

Solution

At the University of Konstanz (in the course of a project funded by the Baden-Württemberg Foundation), an iterative method has been developed that produces terminally functionalized, purely aliphatic compounds through a 'Chain Doubling' approach starting from common monounsaturated fatty acids. The new method is based on a catalytic isomerization/crystallization combined with a catalytic olefin metathesis step. All starting materials are readily available and the individual steps of the catalytic process do not involve further reagents. Moreover, there is only a small amount of byproducts which makes the method very efficient. Exemplarily, it would be possible to generate high-melting, water-insoluble polymers containing no aromatic compounds using the ultra long-chain building blocks generated this way.

Advantages

- Synthesis of ultra long-chain aliphatic compounds with terminal functionalities in high yield
- Iterative method for 'Chain Doubling' of the fatty acid chain length ('Chain Multiplication')
- Efficient use of the starting materials
- No reagents containing halogens required
- No waste material containing halogens
- Highly scalable catalytic processes only

Application

Production of high-melting, purely aliphatic polymers and nanocrystals.

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Service

Technologie-Lizenz-Büro GmbH is responsible for the exploitation of this technology and assists companies in obtaining licenses.