New cobalt catalyst can reduce broad scope of biomass derived chemicals

- **Catalyst is more efficient, sustainable and cheaper than current technologies**
- **Catalyst consists of abundantly available materials**
- **Broad scope of substrates can be converted**

Homogeneous Catalyst | Carboxylic Acids | Sustainable Chemistry | Hydrogenation

Background

Many companies are continuously working on the development of processes that develop less waste and are safer. By making the chemical reactions less hazardous and more sustainable, companies will not only become friendlier for the earth, the businesses will turn out to be more efficient and profitable as well.

Korstanje et al., part of the UvA Research Priority Area Sustainable Chemistry, have found a catalyst that can reduce carboxylic acids and esters to alcohols. These compounds are mostly found in chemicals derived from biomass. This new catalyst can make businesses more efficient and sustainable. It is cheaper and does not use any undesirable materials or metals. It can drastically reduce waste output.

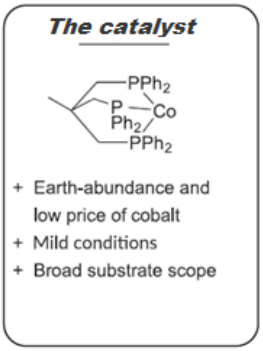
The Technology

This homogeneous catalyst is made of cobalt and is paired with a tridentate phosphine ligand. Contrary to current technologies this catalyst operates under mild conditions (100°C, 80 bar H_2) and reaches high turnover rates. Other similar homogeneous catalysts require a ruthenium or iridium core, which are scarce and more expensive metals. This cobalt catalyst is thus more efficient and sustainable in comparison with these other catalysts. Also great selectivity and high turnover rates have been achieved.

Applications

A broad scope of substrates can be converted into alcohols with this catalyst. In the table below you can find some examples that can be hydrogenated with this catalyst, but more carboxylic acids and esters can be reduced to alcohols.

Many of the top 12 biobased chemicals contain carboxylic acids. This catalyst can convert these bio-based chemicals to other usefull chemicals used in



Substrate	Obtained from	Product	Use	Extra benefits
Levulinic acid	Lignocellulose	2-methyltetrahydrofuran	- Solvent - Fuel additive - Building block	- No solvents needed - catalyst easy to separate - No y-valerolactone intermediate
CO_2	Burning fuel	Methanol	- Fuel additive - building block - H_2 carrier	- also dehydrogenate Methanol
Fatty acids	plant oils and animal fats	Fatty alcohols	- detergents - surfactants - cosmetics	- no transesterification needed
Succinic acid	fermentation of glucose	- Tetrahydrofuran - 1,4-Butanediol	- solvent - building block	- substrate can be easily obtained from biomass

different kind of markets. For example succinic acid, Korstanje et al. have found good yields turning succinic acid into 1,4-butanediol and tetrahydrofuran. Also for levulinic acid good yields were produced.

Partnership Opportunity

We envisage a partnership with companies who want to make their process more sustainable. We already collaborate with many research groups across the globe to improve their performance while reducing their carbon foot print. Do you also want to benefit from this innovative knowledge? Please join us and contact us at the Amsterdam Science Park.

Key publications

Korstanje, Ties J., et al. "Hydrogenation of carboxylic acids with a homogeneous cobalt catalyst." *Science* 350.6258 (2015): 298-302.

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