Screening for Enzymes Catalyzing the Hydrolysis of Plasticizer Analogues

Start: February / March 2020

Joint Master Thesis at the Institute of Technical Microbiology and the Institute of Technical Biocatalysis

Introduction

Plasticizers are widely used for obtaining flexible products from polyvinyl chloride (PVC). Depending on the application of the plasticized PVC, up to 40 wt.-% of the plasticizer are added. The worldwide annual production of plasticizers is about 6 mio. tons, which most are phthalate based plasticizers (Figure 1 - left). Due to toxicological reasons, the application of phthalates has been restricted during the last years. An alternative is the commercial available plasticizer Hexamoll® DINCH (Figure 1 – right), which is however still produced from fossil resources. Within the project "*Bio-Weichmacher"* new potential, bio-based plasticizers are developed and tested. For obtaining a fully bio-based product, an enzymatic esterification is required. Therefore a screening for suitable catalysts needs to be done. Additionally, enzymes could be used for the degradation of plasticized PVC reducing the ecological footprint.

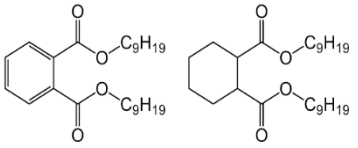

Figure 1: Commercial available, fossil-based plasticizers. Left: Diisononyl phthalate (DINP), right: 1,2-cyclohexane dicarboxylic acid diisononyl ester

Content

Since plasticizers are non-water soluble, as model substrates short chain esters are used to screen for enzymes catalyzing the hydrolysis (Figure 2). At the Institute of Technical Microbiology, enrichment cultures of extremophile microorganisms are set up to induce the production of respective hydrolases. After purification of the enzymes, they are used within a photometric assay to investigate the hydrolysis of the model substrates. Here a robotic platform is used for enabling a higher throughput. After positive hits are found using this approach, the enzymes can be applied for testing the esterification reaction in organic solvents leading to fully bio-based plasticizers.

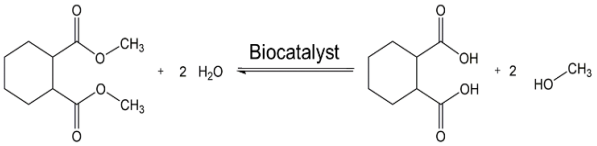

Figure 2: Model reaction for the screening of potential enzymes for the hydrolysis and esterification of alternative bio-based plasticizers

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