

Scientific Paper:

Microbial Biotechnology (2017)

Production of functionalized oligo-isoprenoids by enzymatic cleavage

Wolf Röther¹, Jakob Birke¹, Stephanie Grond², Jose Manuel Beltran², Dieter Jendrossek¹

¹Institute of Microbiology, University of Stuttgart, Germany

²Institute of Organic Chemistry, Eberhard Karls Universität Tübingen, Germany

Abstract:

In this study, we show the proof of concept for the production of defined oligo-isoprenoids with terminal functional groups that can be used as starting materials for various purposes including the synthesis of isoprenoid-based plastics. To this end, we used three types of rubber oxygenases for the enzymatic cleavage of rubber [poly(cis-1,4-isoprene)]. Two enzymes, rubber oxygenase RoxA_{Xsp} and rubber oxygenase RoxB_{Xsp} originate from *Xanthomonas* sp. 35Y; the third rubber oxygenase, latex-clearing protein (Lcp_{K30}), is derived from Gram-positive rubber degraders such as *Streptomyces* sp. K30. Emulsions of polyisoprene (latex) were treated with RoxA_{Xsp}, RoxB_{Xsp}, Lcp_{K30} or with combinations of the three proteins. The cleavage products were purified by solvent extraction and FPLC separation. All products had the same general structure with terminal functions (CHO-CH₂- and -CH₂-COCH₃) but differed in the number of intact isoprene units in between. The composition and *m/z* values of oligo-isoprenoid products were determined by HPLC-MS analysis. Our results provide a method for the preparation of reactive oligo-isoprenoids that can likely be used to convert polyisoprene latex or rubber waste materials into value-added molecules, biofuels, polyurethanes or other polymers.

Keywords: oligo-isoprenoids, rubber oxygenase, *Xanthomonas* sp., polyisoprene latex, enzymatic cleavage