Bachelor Project

Karlsruhe Institute of Technology

Microsystems in Bioprocess Engineering, Institute of Process Engineering in Life Sciences
Karlsruhe Institute of Technology, Fritz-Haber-Weg 2, 76131 Karlsruhe, Germany

Product Purification of novel Antioxidants: Analytical Advances and Downstream Potential

About us:

The BIOSCALE group is situated within the Chemical Engineering (CIW) Faculty of the KIT. Our goal is to tackle challenges in bioprocess development with a novel and interdisciplinary approach involving bioprocess engineering, molecular biotechnology and data science. Our team envisions a biologically driven bioprocess development while applying cutting edge next generation sequencing technology and pioneering a harmonization of the molecular and technical nature of biotechnological processes. Utilizing the acquired knowledge, our aim is to improve bioprocess development and facilitate novel bioprocess innovations e.g. for the production of colorants and fragrances. Our group is collaborating with internal and external experts from academia and industry in *e.g.* bioinformatics, engineering and synthetic biologists.

Project-Background:

Carotenoids are naturally occurring pigments that have long, conjugated double-bond systems. Most have a C_{40} backbone derived from eight isoprene units, including compounds such as β-carotene and lutein. C_{50} carotenoids are rarer and are primarily produced by bacteria and archaea. One example is decaprenoxanthin, a yellow carotenoid that is the main pigment found in the bacterium *Corynebacterium glutamicum*. Due to its extended polyene chain and hydroxyl groups, it exhibits strong antioxidant and photoprotective properties, rendering it attractive for use in pharmaceuticals, and cosmetics. The genetic accessibility and industrial relevance of *C. glutamicum* also support its use as a host for the high-yield biotechnological production of decaprenoxanthin and its pathway engineering. A key challenge is the accurate quantification of decaprenoxanthin. Currently, it is estimated by comparison with related carotenoids, such as β-carotene, which reduces precision.

Project aim:

This project aims to develop a reliable strategy for the absolute quantification of decaprenoxanthin using advanced analytical techniques, such as preparative and analytical liquid chromatography. Additionally, the antioxidative activity of decaprenoxanthin should be examined to better understand its functional potential. These efforts will enable precise measurement, support efficient downstream processing and unlock the full industrial potential of this promising microbial pigment.

Your tasks:

- Cultivation of *Corynebacterium glutamicum* in shake flasks and stirred bioreactors
- Purification and quantification of decaprenoxanthin from microbial biomass
- Determination of antioxidative effect of decaprenoxanthin
- Reporting of experiments and results

Your qualification:

- Background in bioengineering, biotechnology or similar
- Knowledge and interest in downstream processing and analytics
- Good communication and team member skills
- Fluent English and/or German

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