Metabolic engineering of *Amycolatopsis japonicum* for optimized production of [S,S]-EDDS, a biodegradable chelator.

Edenhart S, Denneler M, Spohn M, Doskocil E, Kavscek M, Amon T, Kosec G, Smole J, Bardl B, Biermann M, Roth M, Wohlleben W, Stegmann E (2020) Metabolic engineering of *Amycolatopsis japonicum* for optimized production of [S,S]-EDDS, a biodegradable chelator. *Metab Eng* 60, 148-156.

Abstract

The actinomycete *Amycolatopsis japonicum* is the producer of the chelating compound [*S*,*S*]-ethylenediamine-disuccinc acid (EDDS). [*S*,*S*]-EDDS is an isomer of ethylenediamine-tetraacetic acid (EDTA), an economically important chelating compound that suffers from an extremely poor degradability. Frequent use of the persistent EDTA in various industrial and domestic applications has caused an accumulation of EDTA in soil as well as in aqueous environments. As a consequence, EDTA is the highest concentrated anthropogenic compound present in water reservoirs. The [*S*,*S*]-form of EDDS has chelating properties similar to EDTA, however, in contrast to EDTA it is readily biodegradable. In order to compete with the cost-effective chemical synthesis of EDTA, we aimed to optimize the biotechnological production of [*S*,*S*]-EDDS in *A. japonicum* by using metabolic engineering approaches. Firstly, we integrated several copies of the [*S*,*S*]-EDDS biosynthetic genes into the chromosome of *A. japonicum* and

replaced the native zinc responsive promoter with the strong synthetic constitutive promoter *SP44**. Secondly, we increased the supply of *O*-phospho-serine, the direct precursor of [*S,S*]-EDDS. The combination of these approaches together with the optimized fermentation process led to a significant improvement in [*S,S*]-EDDS up to 9.8 g/L with a production rate of 4.3 mg/h/g DCW.

Involved units

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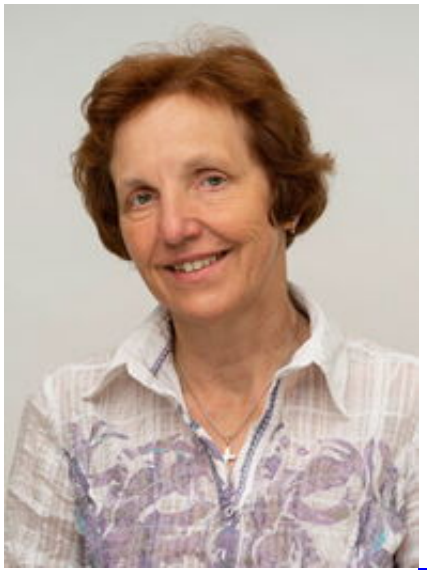

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