

ACIT – A new tool for fermentation processes with non-model bacteria

Sustainability, usage of waste streams, curdlan, polyhydroxybutyrate (PHB)

DESCRIPTION OF TECHNOLOGY

Biotechnological manufacturing of compounds and materials by fermentation is the most important way of transforming chemical manufacturing to sustainability. But there are two major disadvantages of currently available fermentation processes: First, often feedstock material is needed which should preferably be used for food production (cf. for example the plate-tank issue with bio fuels). Second, many fermentation processes are performed with model bacteria (e.g. *Escherichia coli*), which are not naturally producing the desired product, so that it can hinder growth of the microorganism and reduce the yield of the product.

Both problems can easily be solved with the invention presented herein, being called **ACIT** ("**A**lphaproteobacteria **C**hromosomally **I**nserting **T**ranscription-control **C**assette"). The method allows to easily modify not only model bacteria, but also any type of non-



© Dr. Matthew McIntosh / JLU, Purified curdlan from *Agrobacterium tumefaciens*

model bacteria, so that for the production of a desired product a bacterium may be chosen which is already naturally producing (and therefore being adjusted to) the desired product.

Because this bacterium is by nature already used to producing the desired product, genetical modification in order to raise the yield should not negatively interfere with the viability of the bacterium. Alternatively a bacterium may be chosen for modification and fermentation which is able to use biological waste material, so that instead of using food crops as feedstock, waste material may be used for production.

AT A GLANCE ...

Application Field

- Chemical manufacturing
- Biotechnology
- Waste management

Business

- Biologically based polymers
- Active pharmaceutical ingredients (APIs)
- Food additives

USP

- Applicable to model and non-model bacteria

Development Status

- Proof of principle shown on laboratory scale
- Samples of produced material (curdlan) available on kg-scale for own experiments

Patent Status

Priority application, filed August 17th 2021 at the European Patent Office.

APPLICATION FIELDS

The fields of application of ACIT are numerous due to the general applicability of the method for model bacteria as well as non-model bacteria, ranging from sustainable chemical manufacturing (compounds, polymers, fuels etc.) over production of pharmaceuticals to handling and using biological waste materials, for example from food industry.

ADVANTAGES OVER PRIOR ART

The two major disadvantages of currently available fermentation methods, viability-problems of model bacteria if modified to produce non-native products and difficulties for using biological waste material as feedstock for fermentation processes can be solved with ACIT by either genetically modifying and applying non-model bacteria already adapted to the desired product (improving yield) or genetically modifying and applying non-model bacteria already able to digest biological waste material for fermentation.

STATE OF PRODUCT DEVELOPMENT

Functioning of the ACIT-System for genetic modification of non-model bacteria has already been shown by example of applying it to *S. meliloti*, *A. tumefaciens*, *R. capsulatus* and *R. sphaeroides* for producing curdlan and PHB.

MARKET POTENTIAL

Transforming the whole economy towards sustainability is one of the major global challenges humanity is facing. Fermentation processes are important instruments for sustainably providing material supply for many production processes of chemistry, pharmacy and energy supply. The market potential of ACIT is therefore considered to be quite enormous in many areas.

COOPERATION OPPORTUNITIES

On behalf of its shareholder Justus-Liebig-University Giessen TransMIT GmbH is looking for cooperation partners or licensees for further development in Germany, Europe, US/Canada, and Asia/Australia.

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