ENGENES BIOTECH GMBH

Non-confidential information

Introduction

enGenes develops **cost-effective**, customized solutions for the production of recombinant proteins and plasmid DNA in microbial expression systems. The company, based in Vienna (Austria), was founded in February 2014 as a spin-off company of the University of Natural Resources and Life Sciences, Vienna (BOKU).

Based on the unique, proprietary **enGenes-X-press technology platform**

- substantially higher soluble product yields,
- easier downstream processing, resulting in
- up to 80% COGS reduction,

are achieved.

enGenes-X-press technology features

- *Escherichia coli* based, growth decoupled production system,
  - Allowing decoupling of protein/DNA production from cell growth
    - Host cell growth is stopped at defined cell concentration
    - Protein of interest production triggered
    - Host cell resources are used exclusively for product of interest
- Proprietary IP (PCT/EP2016/059597)

Benefits

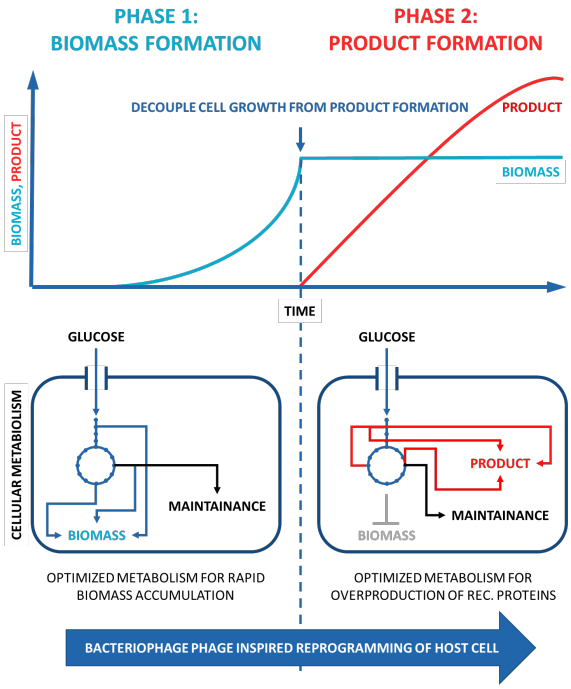
- Higher product yields
- Secretion of protein to cell supernatant possible
- Production of growth-interfering or toxic proteins/plasmids
- Improved genetic stability due to lack of cell division
- Continuous manufacturing possible
  - Allowing improved Space/Time/Yield
  - Significantly better than the GoldenStandard

Examples for protein yields achievable with enGenes-X-press technology

- GFP = 20 g/L
- Soluble enzyme (hydrolase) = 13 g/L (cytoplasm)
- Affinity ligand = 8-10 g/L (cell supernatant)
- Glycosyltransferase = 1 g/L (cytoplasm)
- Antibody fragment = 250 mg/L (cell supernatant)
- Single domain antibody, VHH = 1 g/L (cell supernatant)

Technology fully scalable from lab scale to industrial scale (**successful upscaling** at client facility to **17 m³ scale**).

Key facts - enGenes-X-press technology



The company's technology platform allows the decoupling of recombinant product formation from cell growth, enabling bioprocessing with a **clear separation of biomass growth and product formation.**

Using this procedure, **significantly higher specific and volumetric yields** compared to the state of the art (*Escherichia coli* BL21 (DE3)) can be generated. The developed bioprocesses are **characterized by improved genetic stability, robustness and scalability**.

The technology is based on a **genetically modified host cell** (based on BL21 (DE3)) in which one can introduce **standard expression vectors** (with T7 promoter) without cumbersome adaptations. The fermentation process can be implemented with **standard fermentation equipment**.

Reprogramming of the host cell is performed by **co-expression of a bacteriophage-derived peptide** that stops cell division and host mRNA production and at the same time modulates the host cell metabolism for improved soluble, high level protein production.

The technology also allows **secretion of proteins targeted to the periplasmic space to the cell free supernatant**, thereby allowing a cost-effective manufacturing option comparable to yeast-based expression systems (see protein yields examples above).

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