



Engineering *Saccharomyces cerevisiae* towards the production of curcumin

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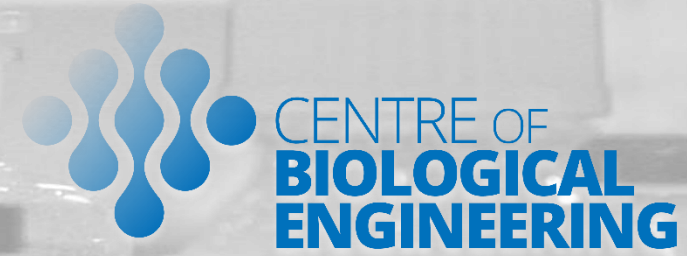
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Curcumin, a polyphenol produced by turmeric (*Curcuma longa*), has attracted increased attention due to its potential as a novel cancer-fighting drug. However, to satisfy the required curcumin demand for health-related studies, high purity curcumin preparations are required, which are difficult to obtain and extremely expensive. Curcumin accumulates in low amounts over long periods in the plant and its extraction process is costly and not environmentally friendly. In addition, its chemical synthesis is complex. All these reasons limit the advances related to the *in vitro* and *in vivo* curcumin biological activities. Herein, we intend to develop a genetically engineered *Saccharomyces cerevisiae* capable of producing pure curcumin from simple carbon sources such as glucose. The curcumin biosynthetic pathway in plants starts with the phenylpropanoid pathway, whose reactions convert the aromatic amino acids (phenylalanine/tyrosine) to the curcumin precursor ferulic acid. Afterwards, curcumin is produced under the catalysis of 4-coumarate-CoA ligase (4CL) and type III polyketide synthases (PKSs) with the involvement of one malonyl-CoA molecule. As starting point for the development of a yeast cell factory, we tested the curcumin production using 2-micron plasmid vectors carrying the 4CL1 from *Arabidopsis thaliana* and the PKS curcuminoid synthase (CUS) from *Oryza sativa* in a wild-type *S. cerevisiae* strain. This modified strain was able to produce 111 µg/L of curcumin from supplemented ferulic acid.

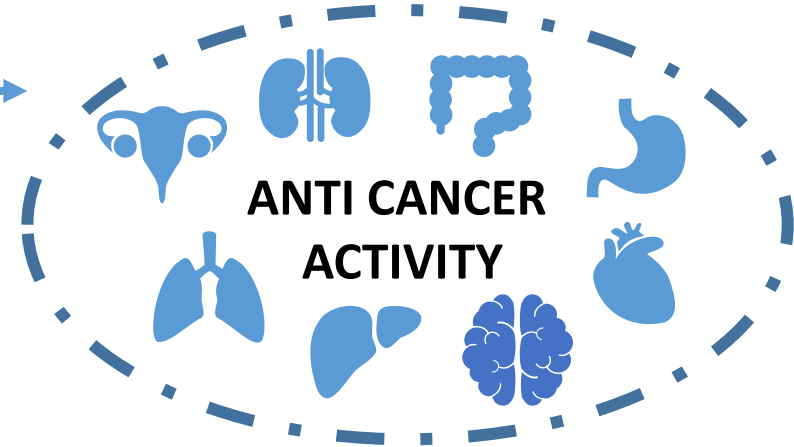
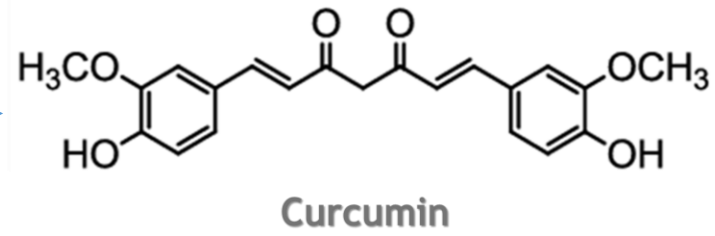


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CURCUMIN?



Curcuma longa



For health-related studies are required:



High purity **curcumin** preparations

Limits the obtaining of:

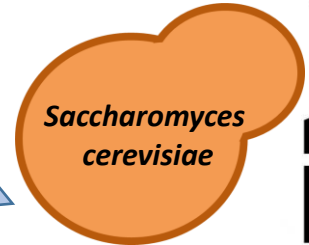
Extraction/production limitations



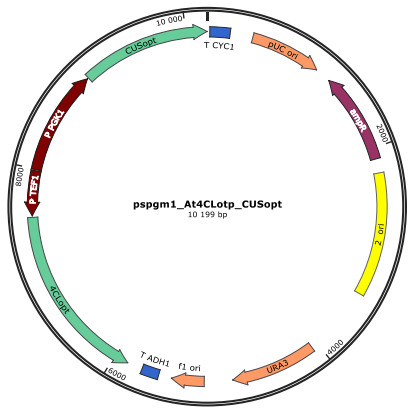
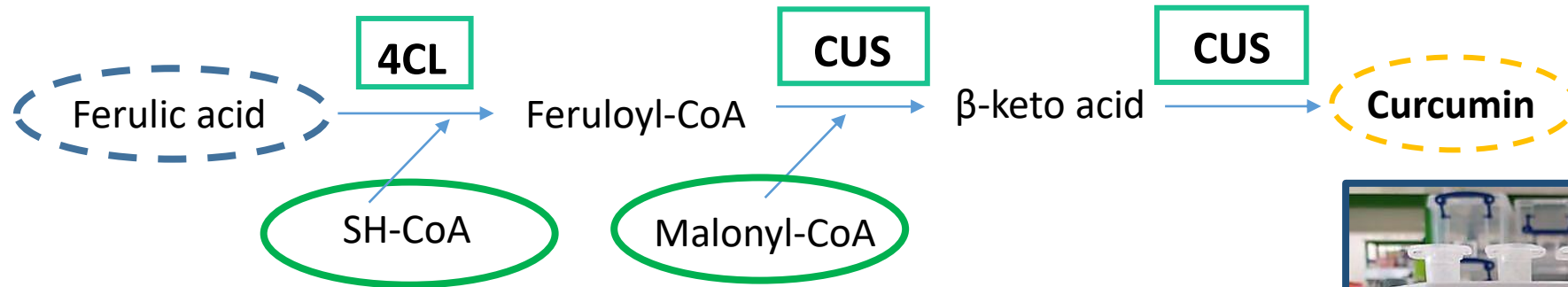
Difficult and expensive to isolate



Hard to chemically synthesize

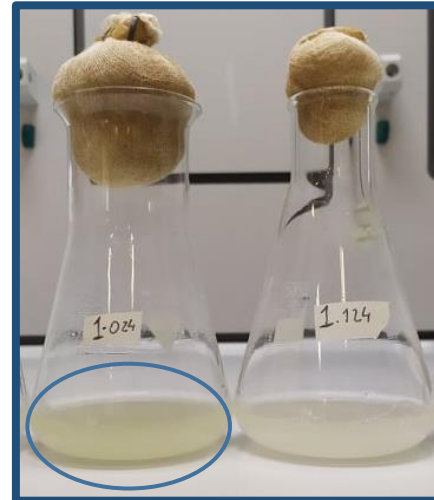


Develop a **yeast cell factory** to produce **curcumin**



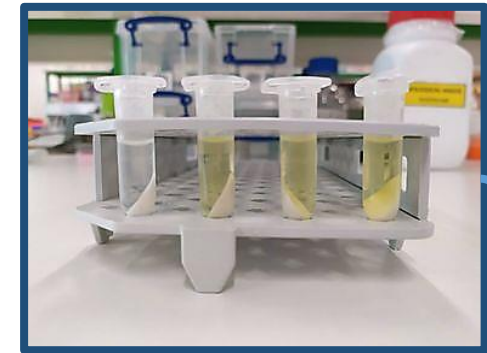
4CL1 from *Arabidopsis thaliana*
CUS from *Oryza sativa*

Transformed into
S. cerevisiae BY4741



Flask cultivation w/ supplemented ferulic acid

Curcumin extracted from
cells with methanol



UHPLC
quantification

Colony	[Curcumin] $\mu\text{g/L}$
BY4741_pSPGM1_4CL_CUS 1	97.7
BY4741_pSPGM1_4CL_CUS 2	111.0
BY4741_pSPGM1_4CL_CUS 3	92.4



Linking life and technology to shape the future



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Thank you!

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