

# Small-molecule inducible promoters for tuned gene expression in *Yarrowia lipolytica*

## Proposed use

The proposed invention is the use of a promoter (or a series of variants of the promoter) that responds to formic acid (or sodium formate) as an inducer to fine tune gene expression.

## Problem addressed

The non-conventional yeast *Y. lipolytica* is an increasingly significant organism in industry, biotechnology, and synthetic biology. *Y. lipolytica* is an important industrial production host of products including lipids, lipid by-products, fatty acids; oils, biofuels; proteins; organic acids, and secondary metabolites such as terpenoids.

Despite the significance of *Y. lipolytica* in industry and biotechnology, currently there is no readily available, robust molecular switch (promoter) to control these processes in an efficient manner. There are only two kinds of inducible promoters in *Y. lipolytica*, POX2 and EYK1 promoters, that require oleic acid and erythritol respectively to induce gene expression. However, oleic acid and erythritol are complex chemicals which are produced by fermentation and they are expensive and labour-intensive to produce. Thus, existing inducible promoters are unsuitable for use in large-scale manufacturing and biotechnology applications.

## Technology overview

The presented promoter controls the expression of the downstream genes in the presence of formate, which is readily available, soluble and cheap, making it highly suitable for industrial bioprocesses. This allows to control metabolic pathways and only express certain genes when desired, reducing metabolic burden and toxicity whilst maximising titers, yields and productivities. It also allows expression at high levels. This tool-kit can be applied to other organisms as well.

## Intellectual property information

WO2022008929 – Formate inducible promoters and methods of use thereof

## Inventor information

**Dr Rodrigo Ledesma Amaro**

Department of Bioengineering

**Prof Dr Johannes Kabisch**

Norwegian University of Science and Technology

**Dr Stefan Bruder**

Technische Universität Darmstadt, Germany

**Eva Moldenhauer**

Technische Universität Darmstadt, Germany

## Benefits

- Inducible series of promoters with high level of expression
- Capable of generating the highest gene expression levels ever found in native *Yarrowia*, promoters
- Can be used in other organisms
- Various promoters are induced to different degrees that can be used in bio-production of various compounds
- Induced by a cheap, easy-to-produce and soluble inducing agent, formate (or sodium formate).

Dr Marika Reay

Senior Executive

Industry Partnerships and  
Commercialisation - Engineering

e: [m.reay@imperial.ac.uk](mailto:m.reay@imperial.ac.uk)

t: +44 (0)20 759 46867

Technology reference: 9051