



Development of bio-based pigments

High Performance Bio-based Functional Coatings for Wood and Decorative Applications

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Objectives:

- 1) Develop high producing non-conventional yeasts to produce orange/purple
- 2) Develop two formulations of red color based on novel pigment



Binder



Solvents



Pigments



Fillers



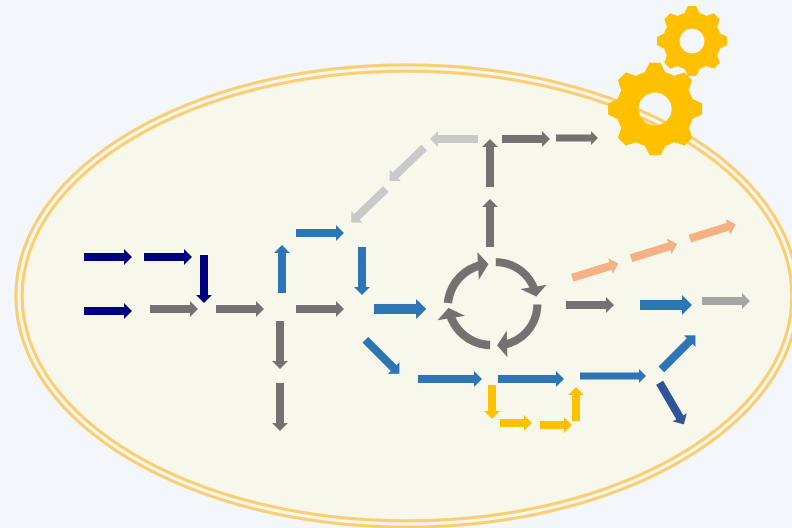
Additives

Pigment

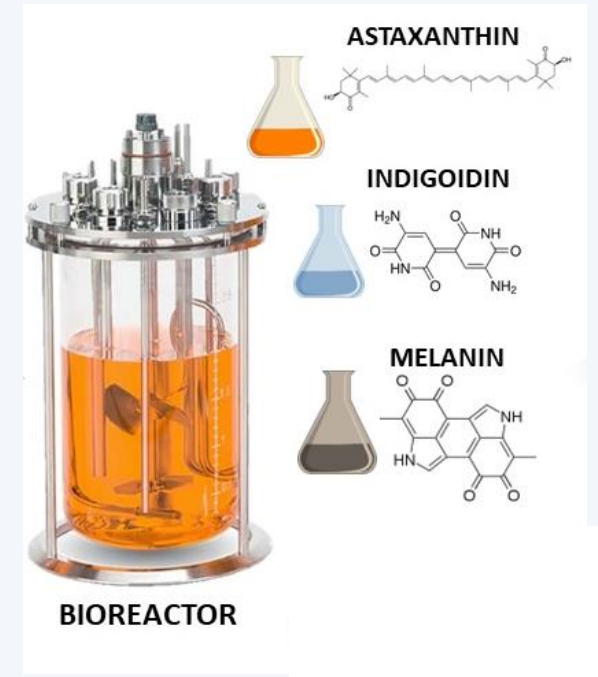
Development of bio-based pigments



Genes from natural sources



Metabolic engineering
Synthetic biology



Production of pigments with high yield and efficiency

Development of bio-based pigments

Using non-conventional yeasts to produce orange/red/blue/purple

- Safe-to-use (GRAS, QPS status)
- Oleaginous yeasts – high lipid accumulation

Imperial College
London



Yarrowia lipolytica



Rhodotorula toruloides

TAL
TECH

β -Carotene production by *Rhodotorula toruloides* (natural producer)



Controlled fermentation



Biomass with pigment

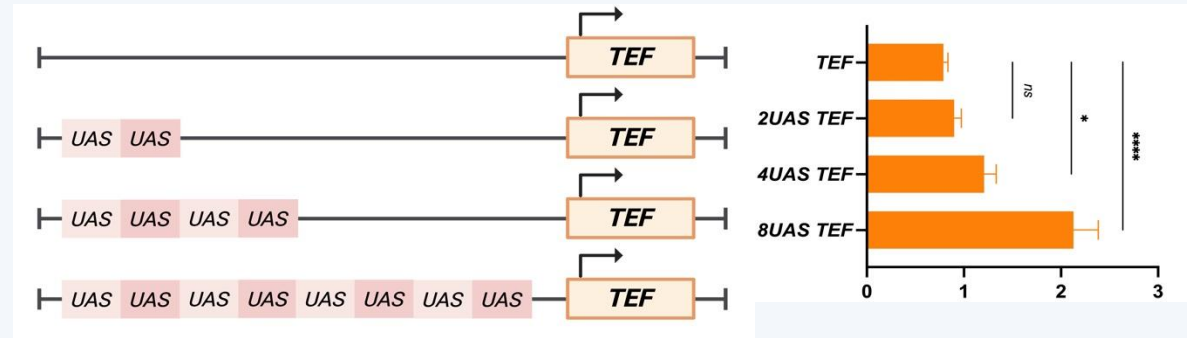


Pigment extracts

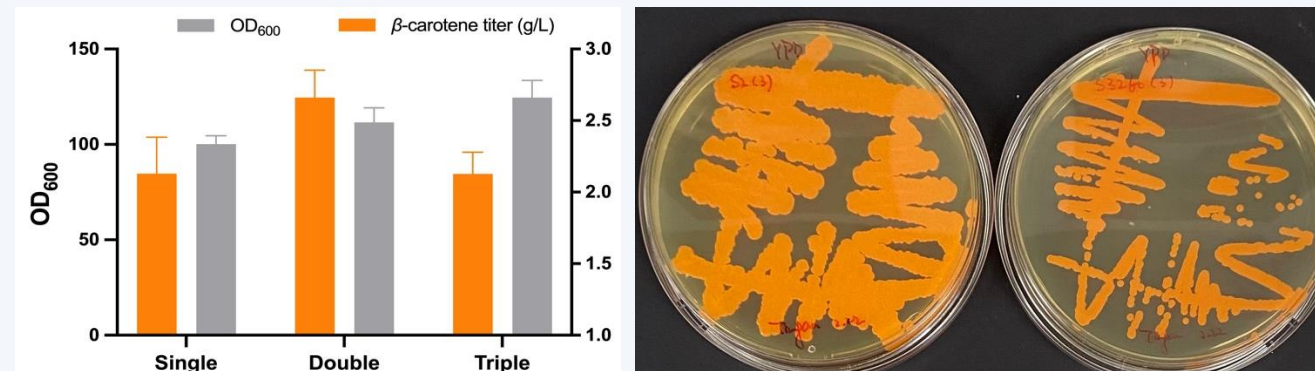
Development of bio-based pigments

β -Carotene production by *Yarrowia lipolytica* (heterologous producer)

1) Promoter engineering



2) Increase copy number

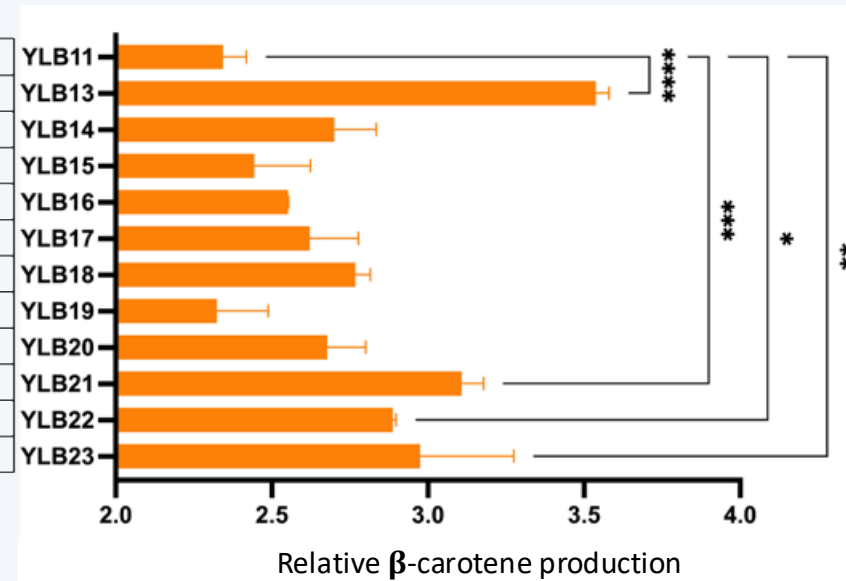
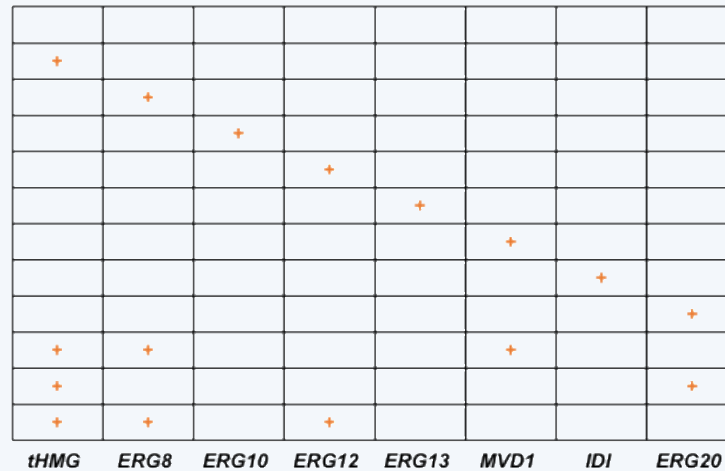
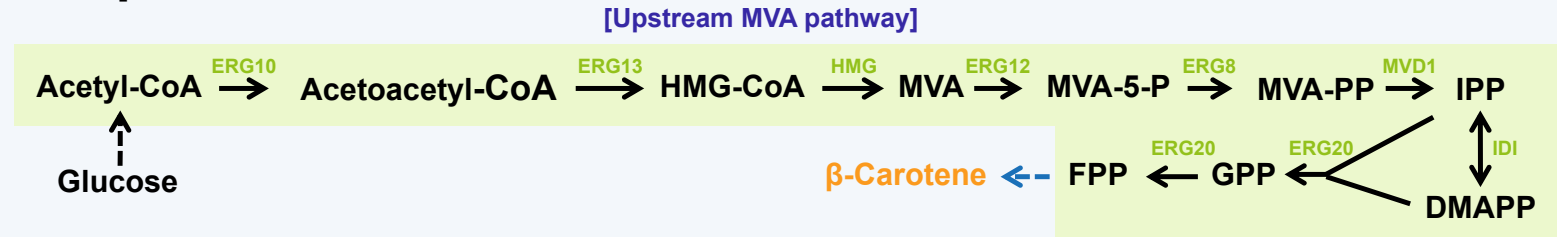


Zhou et al. Submitted

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β-Carotene production by *Yarrowia lipolytica* (heterologous producer)

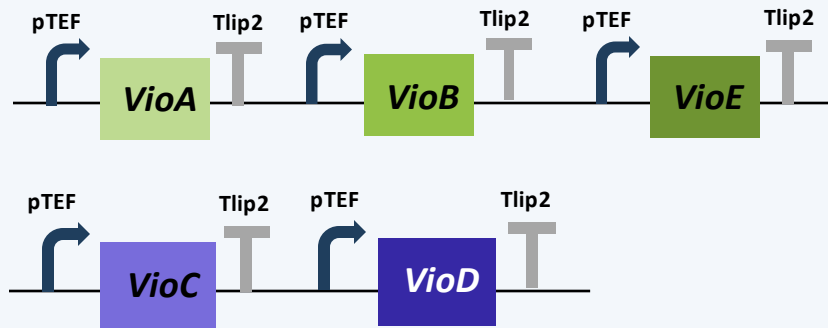
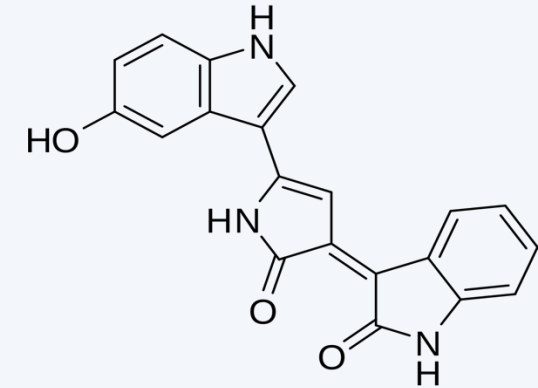
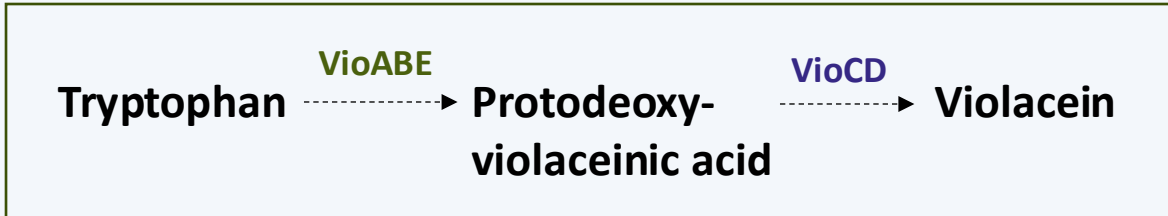
3) Boost precursor pools



Zhou et al. Submitted

Development of bio-based pigments

Violacein production by *Yarrowia lipolytica* (heterologous producer)



VioABE



VioCD



VioABE + VioCD



Biomass with pigment

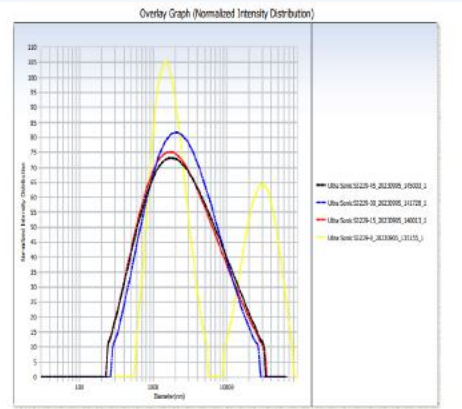


Pigment extract

Test Yarrowia biomass with pigments

Evonik analyzed the pigment biomass

- Solubility, Grinding power, Hiding power, Tinting strength, Fading after sun light exposure).
- Need improvement of particle sizes, preventing fading after light exposure



io	Date	Repet. No	pH	Ave.Diameter(nm)	PD	P100r.(nm) D (20%)	P10r.(nm) D (50%)	P10r.(nm) D (90%)	nm ³ %
1	Ultra Sonic S1229-46_20230905_145303_1	1	NA	2193.6	0.632	4448.5	531.9	2066.6	111495
2	Ultra Sonic S1229-38_20230905_145320_1	1	NA	2271.3	0.583	4072.8	618.5	2256.2	5987
3	Ultra Sonic S1229-15_20230905_140813_1	1	NA	2231.8	0.630	4008.3	528.8	2078.1	10690
4	Ultra Sonic S1229-0_20230905_123155_1	1	NA	2061.5	0.725	13396.3	835.1	2506.8	38874.5
Average:				2480.1	0.648	6558.4	653.6	2252.4	17574.6



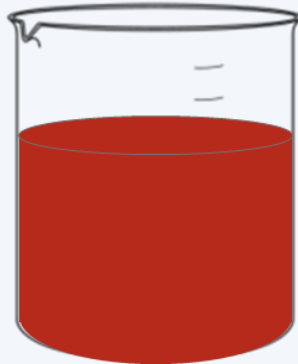
pigment	S3229	P.Y. 110
Particle size, μm	≈ 4000	≈ 500
Visco @ D=100 s-1	1700	119,5



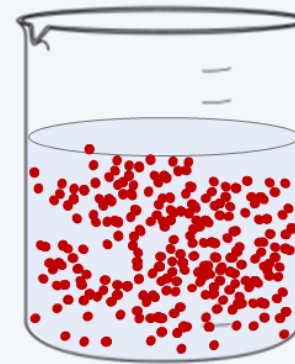
Development of bio-based pigments

Develop two formulations of red color based on novel pigment

→ Chromologics has developed 2 formulations of their red color



Dye – water soluble



Pigment – water insoluble



CHROMOLOGICS

Sustainly.Red dye: Highly water soluble – however decolorisation is significant



Development of bio-based pigments

Sustainly.Red Complex: Patent developed during the project to develop a complexation of Sustainly.Red to aluminium. This powder is insoluble, and a dispersion was developed to incorporate it into paints.



Long term light stability is an issue – decoloration over 1 year is significant.



Thank you for your attention!