A Molecular Rheostat Design that Maintains ATP Levels Needed to Drive Cell-Free Synthetic Biochemistry Systems

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SUMMARY

UCLA researchers in the Department of Chemistry and Biochemistry have developed a system for regulation of cofactors in cell free biochemical production.

BACKGROUND

Plant and microbe based production of chemicals offers several advantages over petroleum-based methods such as a lower carbon footprint, use of sustainable energy source and in some cases biodegradability. However, the low yields and productivity, in part due to the complexity of living systems has limited their industrial applications. Additionally, the production methods are expensive and do not allow for modulation as an in vitro method would. Therefore, an optimized system with high yield is desired.

INNOVATION

UCLA researchers have developed a cell-free approach for production of chemicals. Their method involves combining different metabolic pathways *in vitro*. They have optimized the method to include a 'molecular rheostat' that regulates and recycles ATP, an expensive cofactor utilized in nearly all bio-based chemical production methods. They have utilized the rheostat for production of isobutanol from glucose and obtained a two-fold increase with yields of up to 24 g/L.

APPLICATIONS

- Production of isobutanol
- Production of bioplastics
- Production of biofuels

ADVANTAGES

- Can be scaled up for industrial applications
- Regulates and recycles ATP
- 91% yield obtained
- Completely in vitro approach

STATE OF DEVELOPMENT

Proof of concept system designed and tested for isobutanol production

PATENT STATUS

Country	Type	Number	Dated	Case
Australia	Issued Patent	2017345324	06/08/2023	2017-391
Singapore	Issued Patent	11201903429Q	03/31/2023	2017-391
Japan	Issued Patent	7206202	01/06/2023	2017-391
European Patent Office	Published Application	3529365	08/28/2019	2017-391
India	Published Application	201917019483 A.	08/09/2019	2017-391

Additional Patents Pending

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OTHER INFORMATION

KEYWORDS

Bioplastic, metabolic engineering, synthetic engineering, cell-free production, biofuels

CATEGORIZED AS

- **Biotechnology**
  - Industrial/ Energy
- **Energy**
  - Bioenergy

RELATED CASES

2017-391-0

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