Turning the petrochemical market green - with RIBOSELECT

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A GLOBAL NEED FOR SUSTAINABLE PRODUCTION METHODS

Today most chemicals are manufactured by chemical, oil dependent processes. In the long run, this is neither environmentally nor economically sustainable. With the petrochemical industry being heavily dependent on fossil fuels and/or hazardous chemicals, production of chemicals will meet a future challenge, when oil resources become scarce and demand for sustainability and environmental impact becomes higher. Production of chemicals using enzymes and cell factories has the potential to displace petrochemical synthetic routes, and poses as a highly sustainable solution to these future challenges. Currently, the major limitation for bio-based chemicals is the long and expensive development process required to create efficient and cost-competitive biocatalysts.

RIBOSELECT – UNLOCKING NATURE’S BIOCATALYSTS

We have developed RIBOSELECT, a novel screening technology with ultra high-throughput capacity that accelerates the discovery and development rate of efficient biocatalysts by several orders of magnitude compared to existing technologies. The principle of the technology is positive selection. By a unique genetic system that couples growth of a cell (E. coli and yeast) to the presence of a chemical, we have enabled positive selection for chemical producing enzymes that are not normally essential for cell survival. The modular system can be tailored to respond to any compound of interest, and is thus currently being further developed as a platform technology for discovering biocatalysts for multiple compounds. The technology has been developed during Hans Genee’s master thesis at the Novo Nordisk Foundation Center for Biosustainability.

The potential of this disruptive technology lies in its application to develop biocatalysts required for cost-competitive, bio-based production at a rate that far exceeds competing technologies. We have performed a preliminary analysis and identified vitamin B1, - B7 and - B12 as target chemicals that are currently produced by hazardous and unsustainable chemical methods, and we are currently working on applying RIBOSELECT in order to enable a bio-based production. Our analysis shows that manufacturers do not only gain a more sustainable production, but may also cut production costs with up to 80% by using our biocatalysts.

In conclusion, we believe that RIBOSELECT offers a solution that will be a major driver in the transformation of the chemical industry towards a green future and contribute importantly to revolutionizing, bio-based, chemical production.

REFERENCES


Proceedings in the Development of PCM Modules for Seasonal Heat Storage

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ABSTRACT

This thesis deals with thermal energy storage (TES) by the aid of supercooled phase change materials (PCM) based on sodium acetate trihydrate, and addressing certain issues encountered in on-going research, while elucidating the importance TES with PCM might hold in a future energy system. This technology seeks to counter the consequences of the fluctuating supply of renewable energy sources of energy and provide seasonally independent heat at a high security of supply, whilst aiding the introduction of higher shares of renewable power into the energy system.

Thermal energy storage have been researched and utilized for well over a century, while the supercooling property of several heat storage materials have been largely overlooked. Using this property actively, significant amounts of energy can be stored latently for extended periods of time - without any losses related to the length of storage. When combined with solar heating, this proves an interesting opportunity for dwellings to be self-sufficient with heat for all building technical services, like heating and hot water, etc. Simulations conducted by Schultz & Furbo (2007) demonstrates that a reasonably small amount of collector surface and storage volume respectively proves sufficient to supply a Danish household, without any auxiliary heating, if constructed in accordance with Energistyrelsens Bygningsklasse 2020-directive. Issues surfacing during the attempts do develop successful prototypes of such PCM-modules are being addressed during the course of this project, and among them follows:

- Small-scale experiments on the PCM composition (ratio of water to sodium acetate) for improved stability during supercooling, and;
- Determine latent heat of fusion for compositions exceeding 42 % water.
- Strength analysis to determine and improve problem areas in preceding, deformed and failed module prototypes, incapable of coping with high pressure.
- Socioeconomic perspectives on potential impacts on the existing energy system.
- Private economic analysis, simulating performance on the tested compositions and degree of solar fraction.

Recognizing the world as an entity with a finite amount of resources, mankind is quickly running out of our primary carriers of energy as fossil fuels are being depleted at an ever-increasing rate. While renewable sources of energy are being implemented worldwide as a response to the fossil depletion, one common denominator identifies and problematize them: With the exception of hydropower, they are all highly fluctuating and rather unpredictable - very much in contrast to mankind’s demand for power and heat, thus emphasizing the importance thermal energy storage might hold in a future energy system.

REFERENCES