Bio-derived Feedstocks for Sustainable, UK-Based Manufacture of Chemicals and Pharmaceutical Intermediates (BFSUKMCPI)

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Research Areas

Product Development

At a Glance

- Status: **Active Consortium**
- Year Launched: **2013**
- Initiating Organization: **University College London**
- Initiator Type: **Academia**
- Location: **Europe**

Abstract

The project, Bio-derived Feedstocks for Sustainable, UK-Based Manufacture of Chemicals and Pharmaceutical Intermediates (BFSUKMCPI), aims to establish a variety of new technologies to enable the synthesis of a range of chemicals from sugar beet pulp (SBP) in a cost-effective and sustainable manner.

Mission

The project aims to establish a variety of new technologies to enable the synthesis of a range of chemicals from sugar beet pulp (SBP) in a cost-effective and sustainable manner. The chemical and pharmaceutical industries currently rely on petrochemical-derived intermediates for the synthesis of a wide range of valuable products. Decreasing petrochemical reserves and concerns over costs and greenhouse gas emissions are driving the search for renewable sources of organic synthons.

The United Kingdom (UK) is self-sufficient in the production of SBP, which is a byproduct of sugar

beet production (8 million tons grown per year) and processing. Currently SBP is dried in an energy-intensive process and then used for animal feed. The ability to convert SBP into chemicals and pharmaceutical intermediates will therefore have significant economic and environmental benefits.

SBP is a complex feedstock rich in carbohydrate (nearly 80 percent by weight). The carbohydrate consists of roughly equal proportions of two biological polymers: cellulose and pectin. If the processing of SBP is to be cost-effective, then it will be necessary to find uses for each of these substances. The consortium will develop a biorefinery approach for the selective breakdown of both polymers, purification of the breakdown compounds, and their use to synthesize a range of value-added products such as specialty chemicals, pharmaceuticals, and biodegradable polymers. It is already well known that cellulose can be broken down into hexose sugars and fermented to ethanol for use in biofuels. The focus is on the release of galacturonic acid and arabinose (from pectin) and their conversion, by chemical or enzymatic means, into value-added products. Synthetic biology methods will also be explored to test the feasibility of metabolically engineering microbial cells to simultaneously break down the polymeric feed material and synthesize a desired product, such as aromatic compounds, in a single integrated process.

In conducting this research, SBP will adopt a holistic, systems-led, approach to biorefinery design and operation. Computer-based modeling tools will be used to assess the efficiency of raw material, water, and energy utilization. Economic and life cycle analysis (LCA) approaches will then be employed to identify the most cost-effective and environmentally benign product and process combinations. The project is supported by a range of industrial partners from raw material producers to intermediate technology providers and end-user chemical and pharmaceutical companies. This is crucial in providing business and socioeconomic insights regarding the adoption of renewable resources into their current product portfolios. The company partners will also provide the material and equipment resources for the large-scale verification of project outcomes and their ultimate transition into commercial manufacture.

Consortium History

2013: Project start date (February)
2017: Projected project end date (July)

Structure & Governance

Principal investigator: Professor G. Lye, Department of Biochemical Engineering, University College London

Co-investigators:

- Professor D. Leak, Centre for Sustainable Chemical Technologies/Department of Biology and Biochemistry, University of Bath
- Dr. C. Kontoravdi, Professor N. Shah, Department of Chemical Engineering, Imperial College London
- Professor P. A. Dalby, Professor J. M. Ward, Department of Biochemical Engineering, University College London
- Professor H. C. Hailes, Dr. T. D. Sheppard, Department of Chemistry, University College London

Project partners:
ALMAC Sciences, AstraZeneca, Biocatalysts, British Sugar, Centre for Process Innovation, Chemistry Innovation, Chemoxy International, GlaxoSmithKline, Ingenza, Process Systems Enterprises, TMO Renewables

Financing

Project costs of £1.9 million are funded by the UK Engineering and Physical Sciences Research Council (EPSRC).

Intellectual Property

Steering Group members are offered first refusal to license intellectual property (IP) arising from the project and the opportunity to review all publications in advance of submission. The IP expected to be generated by the consortium will most likely be related to new biocatalysts, synthetic routes, USD devices, and modeling software.

Data Sharing

The data are accessible programmatically using one of three application programming interfaces: GtR, GtR-2, and CERIF.

Impact/Accomplishment

The principal investigator (PI) and co-investigators in the three collaborating centers have extensive experience in working with industry and translating research findings into industrial practice. The overriding priorities will be to first establish a project consortium agreement and then to quickly secure IP arising from the work for the benefit of consortium members. Each of the participating institutions has established technology transfer offices that will help with patent applications and actively pursue technology licensing agreements. Funds have been requested to support a range of outreach and impact activities related to knowledge exchange and dissemination. One of the initial activities will be to launch an MBI training program module on Industrial Biotechnology & Biorefining. This will provide hands-on training opportunities with the USD devices and software tools established in the project. Later, through involvement of the Chemistry Innovation and Bioscience KTNs, the consortium will organize a series of project dissemination events to benefit the wider academic and industrial communities. These will be used to explore opportunities for further collaboration with other UK groups and commercial exploitation of project IP. Further details can be found in the Pathways to Impact document.

Links/Social Media Feed

Other website	http://gtr.rcuk.ac.uk/project/239F234A-6BF7-4E28-8964-E B77
Other website	http://www.bath.ac.uk/csct/research/projects/20130201-bi feedstocks.html
Other website	http://gow.epsrc.ac.uk/NGBOViewGrant.aspx?GrantRef=E 1

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