THE LAB CO_2

Clean chemistry on a commercial scale

Green Technology Applications for Carbon Dioxide at the BioComposites Centre, Bangor University

PRIFYSGOL BANGOR UNIVERSITY

Carbon dioxide (CO_2) has attracted a very negative image as a "Greenhouse gas" over the last few years, but it can be successfully used as a highly tuneable solvent to replace traditional petrochemical solvents. The BioComposites Centre (BC) at Bangor University promotes the development and implementation of green and sustainable chemistry and related technologies in order to create new products and processes. BC has invested in the most versatile laboratory and pilot-scale CO_2 equipment in the UK, to make this technology available to commercial companies and academic groups. This equipment can be used for extraction, fractionation or for carrying out reactions.

Benefits of CO_2 as an extraction solvent:

- Non-toxic, non-flammable, recyclable, odourless and tasteless
- More efficient and environmentally friendly than traditional organic solvents
- Comparable or lower operating costs and energy requirements than conventional solvent extraction processes
- Extraction conditions can be optimised by varying the solvent polarity through adjustments to temperature and pressure
- Low temperature and pressures generally used for processing ensure that neither the extracts or residual material are degraded during the procedure
- Solvent free process with the potential to recycle the CO_2 for continued reuse
- Extraction using CO_2 is a certified process and extracts can be used in organic products

Equipment Specifications	Laboratory equipment	Pilot Equipment
Extraction capacity	10, 100 and 1000 mL	2 x16 litres or 2 x 12 litres
Operating pressure range	50 - 600 bar	up to 700 bar
CO_2 Flow Rate	Maximum of 200 g/min	10 -50 kg/hour
Operating temperature	5- 120°C	5-80°C
Separator capacity	25 or 500 mL	2 x 1000 mL
Solvent	Liquid or supercritical CO_2 with ancillary pump for high pressure addition of co-solvents	
Data capture	CO_2 throughput, temperature, pressure and energy capture from heater/chiller units and all pumps	

Commercial applications using CO_2 as a solvent:

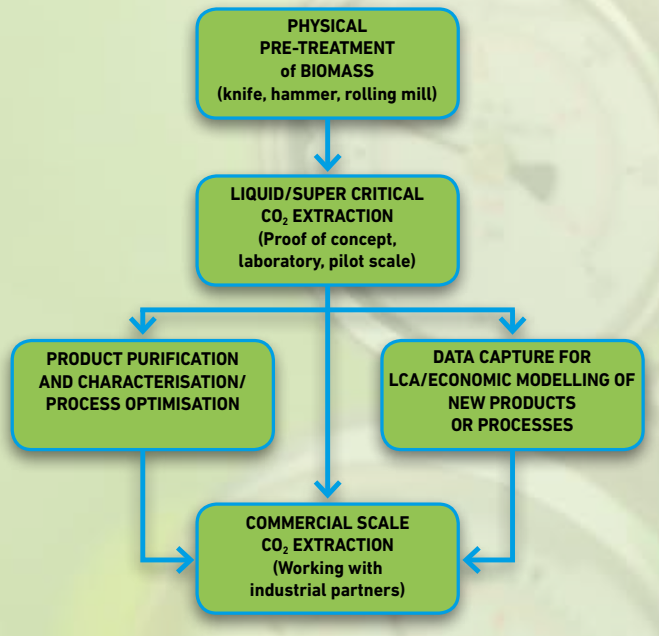
- Extraction of bioactive molecules from herbs and spices for food and beverage use
- Extraction of waxes and oils for cosmetic, personal care products and neutraceuticals
- Extraction and fractionation of pharmaceutical molecules
- Biocatalytic and conventional chemical reactions
- Recovery of valuable molecules from end-of life electronics

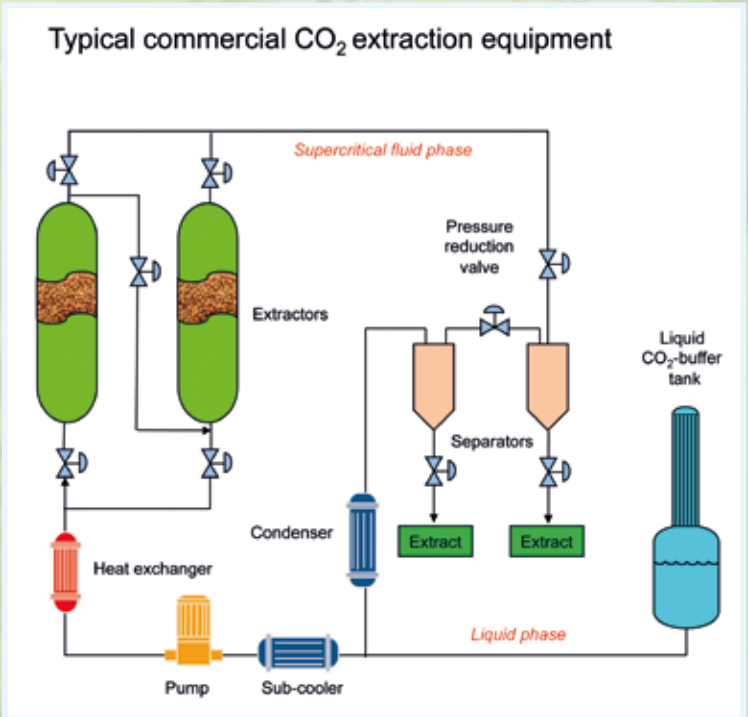
The equipment within BC allows trials to be carried out on as little as 5g of material through to intermediate laboratory and pilot scale (see table). In addition there is an experimental data capture capability linked to both laboratory and pilot scale equipment, which offers companies the ability to access crucial information for conducting Life Cycle Assessments (LCAs), to evaluate the economic/ environmental impact of new products or processes developed. BC has LCA expertise to assist in collating this information and also works closely with large scale extraction companies, to provide opportunities for the production of commercial quantities of target compounds. Reactions can also be carried out in supercritical CO_2 and the laboratory plant is equipped with fixed bed and stirred batch reactors that can use conventional or biocatalysts.

The extraction equipment is also supported by a wide range of physical pre-treatment (knife, hammer and roller milling) and purification equipment (short-path distillation). In addition there is a suite of analytical facilities within BC to assist with characterisation of materials including: GC, GC-MS, LC-MS and HPLC with various detectors.

The flexibility of operation and scale of the equipment at Bangor University, coupled with pre-treatment and analytical capabilities are unique in the UK, and offer companies the opportunity to work across a number of areas from proof of concept to prototyping and onto pilot and ultimately commercial scale.

The BioComposites Centre - Processing, extraction and support capabilities





THE LAB CO_2

Clean chemistry on a commercial scale

Since 1989, The BioComposites Centre (BC) has been at the forefront of research, development and the commercial application of bio-based alternatives to synthetic materials in manufacturing and industry.

Today, in a world where sustainability and the environment are moving to the top of the agenda, we offer businesses of all kinds the knowledge and technical alternatives to help them lower costs, increase productivity and make their activities more environmentally and socially responsible. BC's services encompass all stages of the evaluation, research, product development, product trial and manufacturing process. Reflecting a client base drawn largely, but by no means exclusively, from the resins coatings and plastics, fine chemicals, composites and forest products industries, BC is structured into three service groups offering different expertise: BC Polymers, BC Chemistry and BC Materials. BC also operates the BioProducts and Biorefining-Technology Transfer Centre, a specialist demonstration unit, focusing on pilot scale prototyping of various technologies, including plant fibres in a range of composite material applications, blending and extrusion of biopolymers and large scale extraction of bioactive molecules from plant material.

To find out more about the application of these technologies in your business or research area contact the Biocomposites Centre

Contact details:
Dr Adam Charlton
Tel: 01248 388072
E-mail: adam.charlton@bangor.ac.uk

Prof. Ray Marriott
Tel: 01248 382283
E-mail: r.marriott@bangor.ac.uk

The BioComposites Centre,
Welsh Institute for Natural Resources,
Bangor University,
Alun Roberts Building, Deiniol Road
Bangor, Gwynedd, LL57 2UW
Fax: 01248 370594
www.bc.bangor.ac.uk

Bangor University gratefully acknowledges support for this project which has been part-funded by the European Regional Development Fund through the Welsh Government

BC

Llywodraeth Cymru
Welsh Government

ERDF
Llywodraeth Cymru
Welsh Government
Ewrop & Chymru: Buddsoddi yn eich dyfodol
Cronfa Datblygu Rhanbarthol Ewrop
Europe & Wales: Investing in your future
European Regional Development Fund