The BioComposites Centre
ANNUAL REPORT 2017

PRIFYSGOL
BANGOR
UNIVERSITY

The BioComposites Centre
ANNUAL REPORT 2017

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BEACON
From plants to products
O blanhigion i gynhyrchion

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

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Annual Report 2017

Welcome Dr Rob Elias: Director

This year has seen many challenges for collaborative research in our sectors with changes in funding streams and the uncertainty associated with Brexit. However we continue to collaborate with companies and the demand for sustainable materials in applications in the packaging, agritech and construction sectors remain strong.

Successes this year include two new projects funded through Innovate UK and NEWTON. The NEWTON fund was launched in 2014 and is now heading toward £150 million by 2021. The fund helps to increase capacity in science and innovation through linking institutions in partner countries and supporting collaborative research and development. A key aim of the Newton Fund is to promote economic development, improve social welfare and address the well-being of communities.

With this fund new links with Malaysia and Brazil are now established. Our project with Malaysia is seeking to develop new food packaging products that will help reduce food waste and contamination. This will bring environmental benefits to the rapidly growing urban areas of Malaysia. Our 2nd Newton project with Brazil is looking at innovative pest management techniques to help reduce the chemicals sprayed by the cotton farmers. A reduction in pesticide use will decrease run off into drinking water so helping improve the health of poorer rural communities. The chance to collaborate with scientists in new countries is bringing a new approach to our work that has already encouraged us to think more widely about the impact of our research.

Research impact is defined as a demonstrable contribution to society and the economy and is an increasingly important measure of the success of our activities. In the past much of our focus was linked to the economic impact created by our work but now we are encouraged to think about how this may influence future strategy through technical specifications, standards and policies related to the bio-based sector.

Dr Rob Elias: Director

In Wales we have successfully used European Regional Development Funding and through the BEACON project we have assisted over 150 companies to develop new products and processes bringing economic benefits to Wales. Our successful spin out joint venture company Suprex Ltd has resulted in a clear and direct impact with the creation of 4 new jobs in the bio-based sector.

Looking ahead in 2017/2018 an important objective will be working with the key stakeholders in Wales and the UK to promote the opportunities that the biobased sector can offer industry. Innovation and collaboration with companies will be critical in achieving this aim and the early signs are that this will continue to be supported. I hope we will be well placed to help companies access this funding and that investment in R&D post-Brexit will continue to grow.

Table 1. Staff numbers for 2016/17

Staff Category	
Research Staff	17
Technicians	6
Administration & Finance	4
PhD Students	3
KTP Associates	1

National and International Funding

Newton Funding helps secure link with Malaysia

This year the Centre successfully won significant funding through the Newton Oongar Fund. The collaborative research brings together project partners from the UK and Malaysia seeking to develop a new range of biobased packaging materials. The new packaging will help extend shelf life, reduce food waste, and can be composted. The collaboration includes companies in Malaysia and the UK and is an important strategic link for the Centre.

In May 2017, Centre Director Rob Elias and Project Manager, Dr Qiuyun Liu travelled out to join industrial partners on a series of excursions and meetings. The UK team was also represented by Parkside Flexible Packaging, Nextek Ltd and Scitech Adhesives.

The project lead in Malaysia is Dr. Mohammad Jawaid. Dr Jawiad is Head of the Department of Biocomposite Technology at the Institute of Tropical Forestry and Forest Products in the University Putra Malaysia (UPM), a leading institute in Malaysia. He and colleagues from Malaysia were excellent hosts and the UK visitors enjoyed learning about their innovative research and development plans.

In a packed schedule the team visited Parkside's Asian factory located just outside Kuala Lumpur. The team were shown the state of the art flexible packaging production lines that supply a range of products for their Asian markets. Their role in the project is to help develop compostable lidding films for trays and punnets.

Parkside's Asia factory, Malaysia

National and International Funding

The next visit was to Eco Premium Packaging. This innovative company have developed a range of pulp moulded products using fibres from the oil palm's empty fruit bunches. These are co-products generated by the oil palm processing industry. The fibre is pulped along with wood fibre and moulded to produce high quality plates, bowels and punnets.

The final industrial visit was to PolyComposite, where the team were shown around a natural fibre reinforced plastic extrusion line where components for the car industry are made. Here the project will look at developing biopolymer formulations for thermoforming into food trays.

The moulding process at Eco Premium Packaging

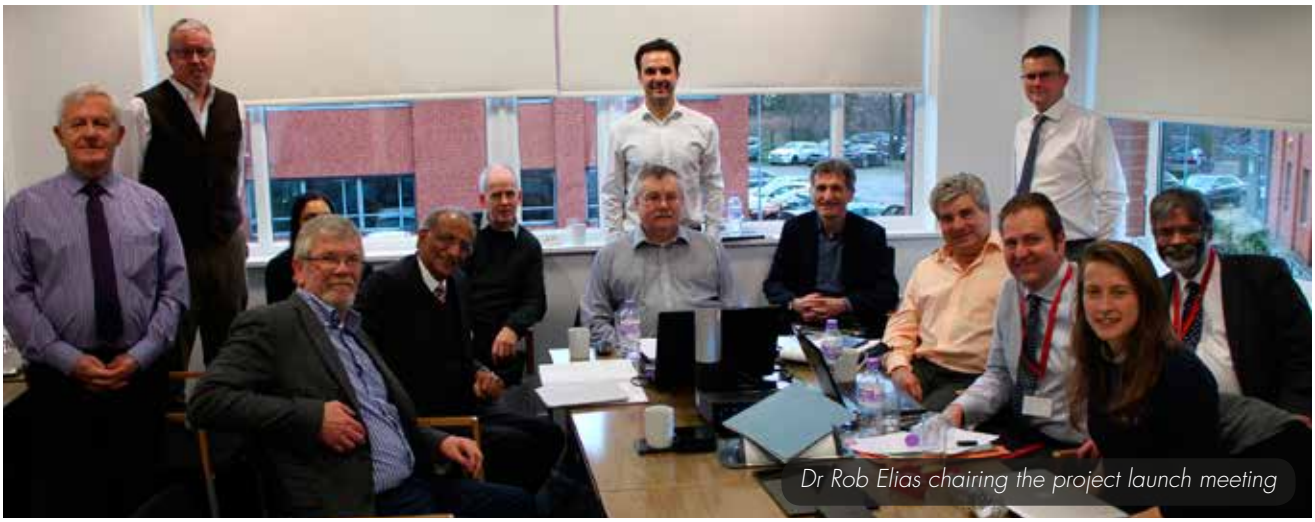
Extruded components at Polycomposite

The final day of the tour consisted of a well-attended workshop in UPM. Speakers from the UK and Malaysia gave an update on specialist topics covering composting to LCA of biopolymers. Prof Dato'Ir Dr. Hoho Salen Jaafar, Dean of The Faculty of Engineering at UPM thanked all the speakers for their contributions in a special award ceremony.

Further visits are planned next year and the project team hopes to organise a major conference in February 2018 that will build on this important link with UPM.

Dr Qiuyun Liu receiving her award

Centre aims to help cotton farmers in Brazil with research funded by Newton



Dr Rob Elias chairing the project launch meeting

Know-how developed from research into biopolymers for food packaging applications is now being exploited in a novel approach to insect traps for cotton farmers in Brazil.

The boll weevil is a major pest of cotton and growers use vast amounts of pesticide that end up polluting local water courses. This level of contamination can lead to health issues for local farmers so technologies that can help reduce the reliance on chemical pesticides are needed.

To achieve this aim a UK project team has joined forces with partners in Brazil to develop a "lure-and-kill" trap that is biodegradable and treated with a small amount of insecticide. BC Innovation Manager Dr Radek Braganca explains "These traps are used in cotton fields at planting and will selectively attract the boll weevils during the season and then kill them. At the end of the season they are ploughed back into the soil where they can decompose, avoiding the expense and labour needed for collection. Dr Braganca is fluent in Portuguese and has enjoyed talking with the Brazilian companies. "We are working on the biopolymers" explained Radek, ''It is great being able to use my language skills and we have a fantastic team with support from NIAB and Greenwich University. They really understand the behaviour of these pests and this combined with Hockley International's experience in pesticides will really help solve this problem for the farmers in Brazil"

The prototype traps will be made by Hull based plastics specialist Rainbow Professional Ltd. Rainbow manufacture and supply agricultural plastics and they have teamed up with Dr Owen Jones of Lisk and Jones Associates. They are specialists in plant pheromones that will be used to lure the pest to the trap. A key to the success of the project will be the deployment of the pheromone and this will be optimised through the use of a bio-based plastic component.

Cotton boll infested by the boll weevil

National and International Funding

BEACON+ continues to pioneer the Welsh bio-economy

From plants to products
O blanhigion i gynhyrchion

The BEACON+ project is increasing the successful translation of research and innovation into new and improved commercial products, processes and services, associated with the bioeconomy. This flagship project is a partnership between Aberystwyth, Bangor and Swansea Universities, and is funded from 2015-2019 through the European Regional Development Programme (with support from the Welsh European Funding Office).

The project sees researchers from the three universities working collaboratively with SMEs across the West Wales and Valleys Convergence Zone, in order to boost their businesses, and the Welsh bioeconomy more broadly, through innovative research projects.

BEACON+ funds ten of the Centre's research and technical staff, either in whole or part, and continues to play a key role in our work. At the project's mid-point in 2017, BEACON+ has collaborated with over 60 Welsh SMEs and has resulted in the creation of one new company. Dr Adam Charlton, the Centre's Head of Biorefining, is project lead at BC.

BC's Adam Charlton and Rob Elias with Julie Jones AM

Dr Ahmad Al-Dulayymi

Extracting High Value Chemicals from Algae Sources

Our EU-funded project looking at high value-added chemicals and bioresins from algae sources (Bisigodos) held its final meeting in WMG at Warwick University this year, with a workshop summarising the key findings from the research.

The aim of the project was to address the production of valuable algae-derived chemicals, amino acids and high added-value bio-resins starting from algae biomass fed directly with CO_2 from industrial emissions. The algae are grown in bioreactors on land utilising solar radiation in an approach that is based on technology developed by Spanish partner Biofuel Systems (BFS) to produce bio-oil.

"Our role here in the Centre was to help develop molecules and compounds for applications in coatings, inks and cosmetics'' explained Dr Ahmad Al-Dulayymi. To achieve this Ahmad worked alongside three UK project partners: Beckers, SunChemicals and Croda. ''It's been a great experience for me too and I have had a real chance to develop some new skills, but what I really enjoyed was working with industry.''

The project had some ambitious targets. The biggest success came from the work to develop new anti-corrosive coatings with Liverpool based paint company, Beckers. The Beckers Group is a global industrial coatings company that employs almost 1,800 people over 24 manufacturing sites and makes specialist coatings to protect surfaces. A key drive for change in this industry is the reduction in chromate additives that stop metal rusting. Working with Sonny Ngo of Beckers, Ahmad developed new compounds that could replace these chromate additives. Using accelerated weathering tests the best compounds were selected for trials on Beckers' pilot-scale coating line. Steel was coated using the primers and will now be tested outdoors to see if the coating can outperform the older chromate paints.

"Taking an idea from lab to pilot scale is fantastic" explained Ahmad. ''We have looked at the scale-up of multi kilo batches to run the trials at Beckers and I have seen that it is feasible to have a bioderived molecule used in this demanding application. The only downside is that I now have to wait for the real life weathering data'' added Ahmad.

National and International Funding

Collaborative partnership with Welsh SME continues to thrive

Pennotec is a Welsh SME based in Pwllheli and a long-standing collaborator of BC's. The company specialises in developing bio-refinery and industrial biotechnology processes that can develop products from bio-waste, in particular from seafood shells.

This year a number of research projects have been conducted in partnership with the company. Initially, biologically active polymers produced by fermentation were isolated and characterised as a part of a BEACON collaboration. Then an SBRI (Small Business Research Initiative) award funded an ongoing investigation into sustainable materials for phosphorous removal from wastewaters.

Dr Jonathan Hughes, MD of Pennotec (Pennog Limited) commented "With access to BC's specialist facilities and expert support, Pennotec has been able to develop innovative processes that add value to waste and better understand the nature of the bio-materials we produce."

Pennotec and BC received funding from BBSRC network FoodWasteNet for the proof-of-concept research project. "We aim to investigate applications of industrial biotechnology processes for extractions of antimicrobial polysaccharide from agricultural waste" explained BC Scientist, Dr Olga Tverezovskaya.

WRAP funding allows Centre to provide free assistance to Welsh businesses

The Centre continues to work with WRAP Cymru, the circular economy and resource efficiency experts, to support the sustainable resource management programme in Wales.

In collaboration with Bangor University's Sustainability Lab, the Centre provides technical advice, assistance and support to companies in Wales on further developing the recycled content in manufactured products and packaging.

This WRAP Cymru funding allows Welsh businesses to enlist the University's support free of charge and can therefore be an invaluable R&D option, in particular for smaller and newer businesses in the region.

Current projects the Centre is working on include the valorisation of waste glass fibre, the development of a new supply chain for waste paper fibres and the development of new plastics using waste.

Spin Out Company

Suprex open day

On Monday 10th Oct 2016 our new joint venture spin out company, Suprex, opened their doors to visitors. Joint venture partners Andrew Beggin and Sir Roger Jones welcomed Julie James AM, Minister for Skills and Science, Welsh Government to open the new facilities.

The open day was an opportunity to celebrate the huge effort in moving and setting up the pilot scale supercritical CO_2 facility from Bangor to its new location in Caernarfon.

The visitors were impressed with the state-of-the-art laboratories and new home for the pilot scale extraction equipment. Technical Director Prof Ray Marriott explained "It took a tremendous effort from the team to make this happen over a short time scale and I would like to thank everybody for all their support. We now have a great facility here in Caernarfon and our clients are really impressed with the new labs we have created. With the new facility we can really offer a better service and many customers both old and new have congratulated us on what we have achieved" explained Ray.

Welsh minister Julie James AM officially opening Suprex

Spin Out Company

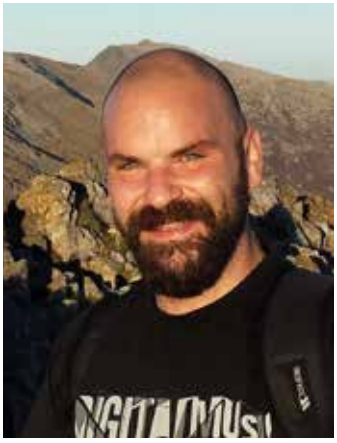
Professors David Shepherd (Deputy Vice-Chancellor) and Ray Marriott with Suprex board members

The newly created company is jointly owned between Bangor University and Phytovation. Suprex undertakes contract research and processing at laboratory, pilot plant and commercial scale. "Having these facilities as part of a company has helped to develop the service we can offer commercial companies" explains Centre Director Rob Elias. "We can also undertake collaborative research through Innovate UK funding and as Ray is also a member of staff at the Centre so we can maintain our academic links helping us to develop new research projects. Any future profits from the venture will be invested back into the Centre to help pay for new equipment so I hope we can have the best of both worlds" added Rob.


Suprex open day event

People & Awards

Athanasios Dimitriou – KTP Associate



I achieved my BSc (Hons) at the Department of Wood and Furniture Design and Technology at the Technical Educational Institute of Larisa, Greece. My dissertation focused on the development of oriented strand board (OSB) with cement as a bonding agent. In 2015 I obtained a PhD in wood science at Bangor University entitled "Surface pre-treatment methods for improving adhesion ability in wood polymer composite for frame and furniture construction applications". Since then I have worked as a Research Technician at BC and am currently employed as a KTP associate. My main research area is the characterization of wood products and biomass in general. I am currently exploring the potential for using new technologies and practices to add value to UK grown timber for construction materials.

Samuel Wright – 3rd Year PhD student

After graduating from Bangor University with a BSc in Chemistry, I was given the opportunity to work towards my PhD here at the Centre. My research is focusing on the production of sorgoleone, a naturally occurring herbicidal compound. The aim is to manufacture sorgoleone from renewable sources by utilising biotechnological and green chemical methods. This study is a direct continuation of the project that I assisted on as an intern at BC, between the second and third year of my Bachelor's degree, and is an area of much interest for me.

Laura Brandish – Project Clerical Officer

I am a Psychology graduate from Bangor University and returned to work at BC one year ago. I was interested in the Centre because of the wide variety of projects they are involved in and in an exciting and innovative area of research. I am currently working in the administration and finance side of the Centre and am looking forward to becoming more involved in the running of some of the new projects in the near future.

Jonathan Williams – Embedded Scientist, Pennotec

I have a Chemistry degree from the University of St Andrews and studied for my Masters in Environmental Science at the University of Aberdeen. Following this I worked as a research assistant doing wide ranging research including chemical extractions and analysis of soil, water, vegetation, manure, and odour samples. While there I also designed, oversaw the construction of, and operated a pilot scale biogas plant that used agricultural feedstocks. Following this I completed a PhD in organic geochemistry at Newcastle University before starting my current work as Project Manager at Pennotec. I now spend much of my time based at BC working on research we undertake collaboratively. This has allowed me to build a strong fruitful relationship with the Centre which I hope to strengthen going forwards.

Centre wins 'Best Environment Project in 25 Years' at the EU LIFE Awards

Enrique Moliner receives the award on behalf of the BREAD4PLA team (photo: AIMPLAS)

There can be few nicer examples of the circular economy than the idea behind this award-winning project: take waste from bread and other bakery products, extract useful chemicals from it to make a biodegradable plastic, and then use that bio-plastic to package new bakery products.

Judges at the EU LIFE 'Green Awards' ceremony in Brussels this May agreed. They voted the BREAD4PLA project as one of two best Environment Projects of the programme's 25-year history.

In this international collaboration, researchers from BC and Bangor University's School of Chemistry worked alongside partners at AIMPLAS, the Technological Institute of Plastics and CETECE in Spain; and ATB and the Agricultural Engineering Institute in Germany to successfully develop the new biodegradable packaging.

Dr Viacheslav Tverezovskiy, the Centre's project lead explains, "Wastes from bread crusts, sliced bread and sponge cakes underwent fermentation and enzymatic treatment to obtain lactic acid. Lactic acid was polymerised to form a biodegradable polymer, PLA. This was then processed using existing extrusion techniques to produce a packaging film with excellent barrier properties, suitable for different products of the bakery sector, even for packing pasta and sweets. The new packaging materials are fully biodegradable and compostable."

The ceremony was part of the EU Green Week and attended by representatives from local authorities, government agencies, educational institutions, students,

BREAD4PLA research team

private companies and NGOs from all over Europe. The event highlighted the impressive achievements of LIFE during the past quarter century and its contribution to sustainability, reducing human impact on the environment, protecting Europe's natural heritage and tackling the challenge of climate change.

The European Commissioner for Environment, Maritime Affairs and Fisheries, Karmenu Vella, described the impact of the LIFE funding programme: "A quarter century is a long time, and over that time [LIFE] has achieved a great deal. It has funded more than 4 000 projects to the tune of over €3 billion." He also stated that the awards symbolise the Commission's "appreciation for the efforts of thousands, the hard work and dedication of everyone who has contributed to the programme as a whole".

"The project's success really helps demonstrate the benefits of a circular economy and there are so many more food wastes we could work with. The Centre continues to research bio-derived PLA and other bioplastic materials, in its work towards a more sustainable future." added Viacheslav.

BC's polymerisation reactor

Reactor room at BC's pilot plant on Anglesey

KTP award seeks to further develop home grown softwood timber market

The Knowledge Transfer Partnership (KTP) is a long-running Innovate UK funded research programme designed to support collaborations between business and academia. Its main objective is to transfer advanced scientific knowledge from academic approaches into business practice, thereby supporting innovation and competitiveness.

In this latest project, Dr. Athanasios Dimitriou of BC has teamed up with Welsh timber company Clifford Jones Timber Ltd to investigate ways of adding value to UK grown softwood timber. Presently, the main use of this wood is in fuel products (pellets or briquettes) or as a source of fibre for panels, pulp and paper production, each of which are relatively low value products.

Clifford Jones Timber Group Est.1948

This two year collaboration seeks to overcome obstacles associated with using UK-grown softwood for construction materials (such as its relative dimensional instability), which currently sees sawn timber as the third most imported material in the UK construction market.

One possible solution is cross laminated timber (CLT), which has been developed to produce dimensionally strong construction panels from fast-growing timbers, though this is not yet produced in the UK. Other approaches are also under investigation. The project runs to 2019 and is supervised by the Centre's Head of Materials, Dr. Graham Ormondroyd.

Dr Athanasios Dimitriou discusses his work with Welsh minister, Julie James AM

Networks

Dr Adam Charlton at the BioPilots launch

New biorefining alliance aims to position UK bioeconomy as global leader

This year saw the launch of BioPilots UK, an alliance of five established open access, pilot-scale biorefinery R&D centres across the UK. The alliance seeks to position the UK as a global leader in biorefining technology development and bio-based product manufacture – two key elements of the bioeconomy.

BioPilots UK brings together the nation's leading expertise and facilities to help innovative ideas navigate the so called 'valley of death' – the gap faced by many new technologies and start-ups between proof of concept and securing commercial-scale investment. By providing facilities and expertise at an intermediate (pilot) scale, the alliance seeks to help demonstrate the viability of new technologies and thereby allow businesses to secure onward investment.

One of the five centres involved in the alliance is BEACON, which includes staff and facilities at BC, along with colleagues in the School of Chemistry and at Aberystwyth and Swansea Universities. The other four centres are the Biorenewables Development Centre (York), the Centre for Process Innovation (Redcar), IBioIC (Scotland) and The Biorefinery Centre (Norfolk).

"What we are all about is supporting the transition away from fossil resources by making the best use of biorenewable materials and unavoidable wastes," explains Adam Charlton, BEACON Project Manager at BC. "As an alliance, we can significantly de-risk the innovation process for anyone exploring a bio-based idea."

By working collaboratively, the alliance seeks to significantly speed up the commercialisation of new green processes and products from biomass, including: plants, algae, and wastes. Due to the varied nature of these raw materials there is no 'one size fits all' approach to biorefining, rather a series of technologies that must be trialled and combined. Now, the new alliance can quickly assemble the right team for any given bio-based project using expertise and facilities from across the five centres.

BC strongly involved in research on the performance of biobased materials in buildings

Conference delegates and organisers

The Centre was well represented at the COST Action FP1303 (Performance of Bio-based Building Materials) conference in Sofia this year, with 5 of the papers and 2 of the posters presented featuring input from BC scientists.

The conference had a packed program of high quality research from both established and early career researchers and students from across Europe and was a clear example of the value of collaboration under the COST program.

Centre staff gave a series of talks on their work with Dr Simon Curling explaining the effects on product durability when combining different biobased materials within a constructed wall system. In Dr Morwenna Spear's talk she explained how the plant wall cell structure can be used to inspire the design of new materials and structures. This work forms part of the Welsh National Research Network looking at how plants can have a roll in architecture. BC's expertise in bio-based materials is helping to shape the innovative uses of plants in the built environment.

The conference was also an opportunity for Dr Athanasios Dimitriou to talk about his work following a Short Term Scientific Mission (STSM) at CNR-IVALSA in Italy. STSM funding allows early career scientists to travel and work in other labs to gain new skills. Athanasios studied the surface characterisation of spruce wood in a pan-European round robin test coordinated by his host in Italy, Dr Jakub Sandak.

STSM's are a great mechanism to support inter lab collaboration and this was highlighted by a presentation on 'Emissions from biobased materials' by Dr Lothar Clauder from Eberswalde University in Germany. Dr Clauder visited BC on a STSM to work with Dr Graham Ormondroyd and PhD student Elie Mansour.

The conference was a great success and with a strong presence of BC staff it demonstrated our in-depth knowledge of the wide-ranging subject area of bio-based materials.

Research continues through the NRN-LCEE 'Plants and Architecture' network

The Sêr Cymru NRN-LCEE (National Research Network for Low Carbon, Energy and the Environment) 'Plants and Architecture' research cluster is an ongoing collaboration between Bangor, Aberystwyth, and Cardiff Universities.

Through this programme, BC scientist Dr Durai Prabhakaran is focused on developing energy-saving low carbon building materials from plant resources. His work investigates low carbon insulation fibres that can be used to develop bio-based panels with good thermal and mechanical performances.

Bashayer Al Mishari (BC intern) testing the performance of single plant fibres

Other research is looking at mycelium and miscanthus plant resources as possible building materials. This work aims to optimize mycelium growth on miscanthus fibre and/or flax fabric surfaces as a potential high-performance building product.

The work carried out through the NRN-LCEE research network has led to a number of academic publications over the past two years and BC's Dr Graham Ormondroyd has submitted proposals to continue the work of cluster beyond the current funding period.

Indian workshop focuses on potential role of nano-biomaterials in water purification

Dr Durai Prabhakaran opens the workshop

Dr Durai Prabhakaran received a British Council grant to organise a five-day workshop in India in December. The workshop was organised in collaboration with the Mahatma Ghandi University in Kerala and focused on the use of nano-biomaterials in water purification systems.

Durai travelled to India with BC's Dr Graham Ormondroyd and Professor Rakesh Kanda of Brunel University, where they were joined by senior scientists from other Indian universities and around thirty early career researchers who attended the workshop.

The event opened up new scientific links with Indian universities and new collaborations were started or are planned as a result of the initiative. While in India, Graham also participated in a scoping workshop in Kanpur, organised by KTN and Innovate UK. This time the area of discussion was 'Industrial Waste and Solutions for Recovery'. The event provided opportunities to further strengthen collaboration with industrial scientists and academic researchers in attendance.

Networks

Drs Ormondroyd & Prabhakaran attend the workshop opening ceremony


Workshop organisers and delegates, Kerala, India

Meeting with Chinese delegation gives opportunity to discuss BC's biorefining expertise

Drs Adam Charlton, Qiuyun Liu and Rob Elias met with Dr David Joyner and Professor Yanjun Xin (of the Confucius Institute at Bangor University) and a high ranking Chinese delegation in March.

Mr Wang Yangli (Minister Counsellor, Embassy of the People's Republic of China), Mr. Shi Lei (First Secretary), and Mr Feng Zhi (Second Secretary) visited the university to hear about UK-China collaborative links and the Innovate UK project with Beijing Forestry University.

During the talks, regional biorefining initiatives such as the Welsh BEACON project and the UK alliance of open access biorefining centres (BioPilotsUK) were also highlighted to the delegation. These were seen as a great example of regional and national interconnectivity between UK research centres.

Building Networks with Woodknowledge Wales

Inspiring innovation through collaboration

woodknowledge WALES

BC's Ceri Loxton undertook a one year part time secondment to Woodknowledge Wales (WKW) as Events Manager during 2016/17. The secondment started as WKW moved from being financially supported by the Welsh Government into a membership-funded organisation. "It was just such a fantastic opportunity to be able to combine my knowledge and experience of wood science with the aims of Woodknowledge Wales including the development of Welsh wood-based industries" said Ceri.

The secondment has allowed the two organisations to exchange skills and knowledge for the mutual benefit of both. Organisation of a joint event in Bangor in February 2017 on the topic of timber cladding allowed BC staff to highlight our research capacity in this area and make potentially important new contacts and networks for future projects.

In June 2017 well over 100 delegates attended "Woodbuild Wales – New opportunities and innovative solutions" to discuss how timber can play a central role in tackling the country's acute need for affordable, fuel–efficient housing while also creating local jobs. Shayne Hembrow, Deputy CEO of Wales and West Housing emphasised that timber is ideally suited to new technologies that open the way to volume building while hitting environmental, economic and social sustainability targets.

"Bangor has a long history of excellent research and innovation in both forestry and wood science" said Gary Newman, Chief Executive of WKW. "BC and Bangor Uni have fantastically knowledgeable and skilled staff and unique world class facilities for wood based research at its Mona facilities." Gary went on to explain that WKW is keen to work with that talent in Bangor, and to build and guide the research topics and teaching which will help take the whole Welsh timber sector forward.

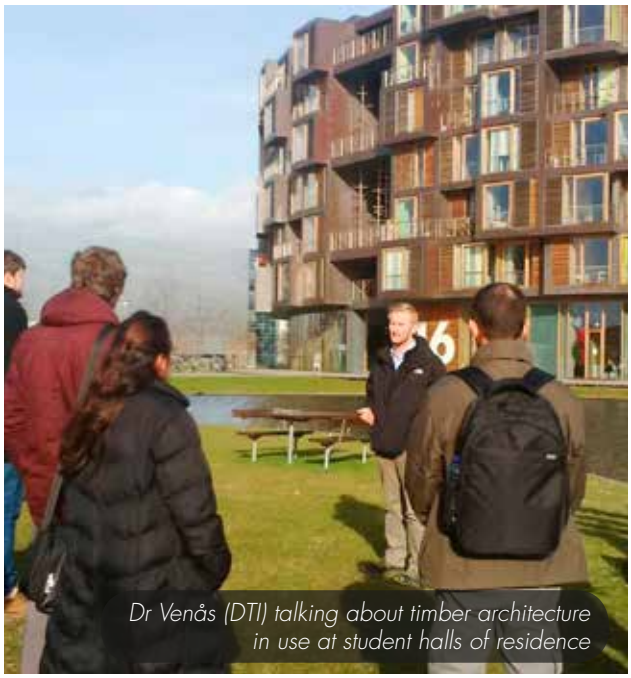
Currently WKW has approved sponsorship of a PhD at Bangor University looking at the impacts that growing more trees in Wales will have on the environment and economy. WKW is looking at further areas for research and partnership and also into how the success of the secondment with Ceri can be continued.

BC scientists provide training at Danish Technological Institute event

Two BC staff travelled to Copenhagen to provide training at the COST FP1303 training school on 'Performance of Bio-based Materials' this spring. Graham Ormondroyd provided a session on the manufacture of board products and Morwenna Spear talked about the utilisation of bio-based composites in their many applications.

The event was very successful, bringing 30 academics, researchers and early career scientists together for three days, including talks, laboratory visits, and an architecture field tour combined with sightseeing.

FP1303 training school delegates and trainers



Dr Venås (DTI) talking about timber architecture in use at student halls of residence

Highlights included demonstration of a wide range of novel bio-based materials, demonstration of various testing techniques and many discussions between the delegates. Some great new contacts were made, and existing connections between institutions strengthened.

Events

BC host European training school on service life of modified wood

Delegates assessing the performance of modified wood

The Centre recently hosted 15 PhD students and early career researchers from across Europe at a training school organised for COST Action FP 1407 (ModWoodLife). The themes of the school were life cycle assessment (LCA) in relation to modified wood and how the properties of these forms of wood product can be characterised and tested.

Professor Callum Hill of NIBIO and BC's Campbell Skinner gave participants a thorough grounding in LCA in relation to wood modification via presentations and discussion groups. Dr Morwenna Spear and Dr Simon Curling led practical sessions covering both thermal and acetylation treatments of woods. These treatments were then further characterised with some experimental sessions investigating water uptake and moisture sorption of the materials – a key characteristic when looking at performance. Dr Graham Ormondroyd talked about the present state of the industry and its future development.

The training school was very fortunate to have two trainers from CNR-Ivalsa in Italy, Dr Anna Sandak and Dr

Jakub Sandak, who led interesting discussions on service life and characterisation of the aesthetics of materials. Their innovative approach to investigating the 'human factor' in the use of materials was an exciting addition to the training school.

There was also a chance to showcase the Centre's work with a visit to the new Halen Môn building which uses Welsh grown larch cladding. The product was developed by a consortium of BC scientists and partners from the timber industry. Over all it was a busy and very worthwhile three days where the students and trainers alike were able to learn about and appreciate new methods and techniques for use with assessing modified wood.

Dr Morwenna Spear fielding questions from the delegates

Visiting speaker Dr Sandak speaks about modelling wood behaviour

4th annual BEACON conference shines bright

The 4th annual BEACON conference was held in the seaside resort of Llandudno over two of the hottest days of the year. Titled 'Developing a Sustainable Bioeconomy for Wales: A Future Roadmap', the conference focused on issues relating to strategy, funding and incubation of the Welsh bioeconomy.

The event was opened by John Hughes, Vice Chancellor of Bangor University. The audience heard from BEACON Project Manager Adam Charlton of the valuable work undertaken by all 3 partners at Aberystwyth, Bangor and Swansea Universities to support the bio-economy in Wales. Successes include the assisting of 150 companies leading to new jobs being created, new products and processes developed. Rebecca Colley Jones, Director of Ynys Resources Ltd, challenged the audience to think about waste, recycling and the circular economy, with the discussions continuing long into the evening over the conference dinner. Mike Shaw, Group Manager of the Mid Wales Regional Engagement Team at Ceredigion County Council, shared the vision for Mid Wales as a rural powerhouse, while the day's proceedings were rounded off by Steven Fish, Head of Business Partnerships and Enterprise at Lancaster University, on how ERDF has supported the creation of InfoLab21 and other projects focused on business innovation and engagement.

Future strategy was a major focus for the event and Paul Henderson from the Department for Business, Energy & Industrial Strategy (BEIS) gave a presentation on the current state of the UK bioeconomy. Paul considered some of the barriers and opportunities raised by stakeholders and discussed the major future opportunities for the

industry. Roger Kilburn, CEO of IBioIC also looked at the future for Scotland with their National Plan for Industrial Biotechnology and how they will tackle the projected market of £900 million in 2025.

The conference also offered the chance for BEACON companies to talk about their experiences and challenges of bringing new products to market, and seeing their businesses and staff numbers grow as a result, in a series of flash presentations chaired by Rob Elias. These included Ahmed Ali, CEO of International Gums and Oils, whose work with frankincense has led to novel medical applications with patents granted and licensed, and a new cosmetic product due to be launched shortly; Muyiwa Akintoye, Head of Research & Development at Quorn Foods, who discussed the mycoprotein that forms the well-known product; Ray Marriott, Technical Director of Suprex Ltd, a spin-out company from Bangor University specialising in the applications of supercritical CO_2; and Jonathan Hughes, Director of Pennotec, on his numerous collaborations with BEACON on chitin. "A key outcome of this session will be further discussions within Wales on developing a plan to maximise the opportunities within the bio-economy'' explained Rob.

Centre takes centre stage with visit from Minister

Julie James AM, Minister for Skills and Science for the Welsh Government, visited the Centre's Mona facility on the 6th of July on a fact finding mission.

The visit offered the opportunity to showcase the collaborative projects underway at the Centre that utilise the pilot scale facilities. On a guided tour through the

Julie Jones AM with members of the team at our pilot plant on Anglesey

Events

BC's Morwenna Spear discusses her work with the Minister for Skills and Science

Rob Elias with Dr Gary Reid, Bangor University's Director of Research & Enterprise, and Julie Jones AM

building the Minister met with Dr Adam Charlton and Dr Rob Elias and talked with members of staff to learn all about some to the exciting projects underway.

"Key to developing a new technology is helping companies de-risk their ideas so that they can attract additional or future funding" explained Adam. "The fact finding mission really helped show how we do that here in Mona using our pilot scale equipment. Companies can demonstrate their ideas at scale and make products that they can show prospective customers" added Adam.

The Minister had a chance to meet with some of the companies working with the Centre and they were able to explain how they had benefitted from this support. "In a post BREXIT future having funding access to pilot scale equipment is even more critical and I hope we can develop a new bio-economy strategy for Wales" added Centre Director Rob Elias.

Links with Uganda continue to develop

In July the Centre hosted a high-ranking delegation from the Ugandan High Commission to discuss our work and explore opportunities for further collaboration within the country.

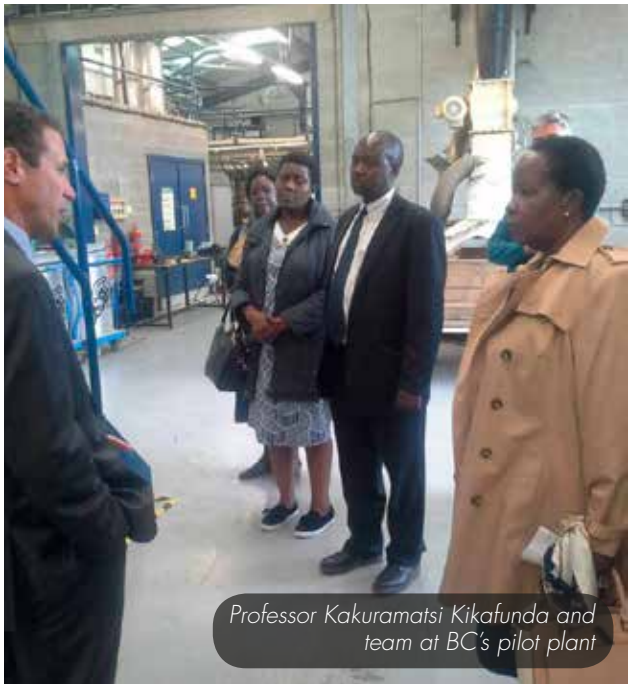
The visit was part of a wider tour incorporating the university's Sustainability Lab and organised by the Lab's International Sustainability Liaison Officer, Jalia Packwood.

Professor David Shephard hosts the welcome dinner

Professor Joyce Kakuramatsi Kikafunda, the Ugandan High Commissioner to the UK, and her team of officials met with BC staff to discuss research opportunities and learn more about the development of regional biorefining programmes such as BEACON. The visit included a tour of our laboratories on the main University campus as well as a trip to our biorefining pilot plant on Anglesey.

Following the tour, discussions continued and the visitors' day ended with a dinner hosted by Deputy Vice Chancellor, Professor David Shephard, and attended by colleagues from the Sustainability Lab and from Gwynedd Council.

The visit builds on an ongoing UNIDO-funded project led by Graham Ormondroyd, working with researchers from Makerere University to explore potential options for adding value to Ugandan pineapple waste.



Professor Kakuramatsi Kikafunda and team at BC's pilot plant

LCA workshop kicks off successful visit for Malaysian partners

This summer the Centre hosted a delegation of Malaysian business and academic partners as part of the Newton funded SafeBioPack project. The visitors enjoyed a workshop on Life Cycle Assessment given by BC's Campbell Skinner, before embarking on a series of meetings with Centre staff involved in the project.

A tour of the Centre's laboratories on campus followed, as well as a trip to our pilot-scale research plant on Anglesey, where there was much interest in our wide ranging refining capabilities.

After a busy first day, the visitors were treated to a boat trip along the beautiful Menai Straits in full sunshine – an experience that will surely be a highlight of their working visit to Wales.

Over the next two days, the delegation visited our three UK industrial project partners, accompanied by BC Director Rob Elias and Co-Project Leader Qiuyun Liu. These are Welsh SME Scitech (based in Flint), Yorkshire-based Parkside Flexibles and supermarket giant Tesco, at whose headquarters the project's third quarterly meeting was held.

SafeBioPack is a three year project that aims to develop safe, sustainable food packaging using waste palm fruit fibres and degradable bio-plastics that incorporate an antimicrobial bio-film. The film will provide protection against food-borne diseases, such as campylobacter, while also extending shelf life and thereby reducing food waste.

LCA is being used to measure the environmental performance of the new packaging and compare it with other forms of food packaging currently in use. Campbell, who works as the Centre's LCA analyst, is leading this aspect of the project.

Dr Dave Preskett and Dr Harmaen (UPM) in deep discussion

Visitors tour of Scitech's factory, Flint

Trevor Jones (Scitech) and visitors share a joke

Events

SafeBioPack project partners (1)

SafeBioPack project partners (2)

Centre promotes its research at public farm event

In June, Dr Adam Charlton attended the Open Farm Sunday event at Henfaes, the University's Research Farm near Abergywngregyn. This was part of an annual event involving hundreds of farms across the UK, which aims to give members of the public a chance to visit a farm and learn more about agriculture.

Managed by LEAF (Linking Environment and Farming), Open Farm Sunday enables the public to see practical demonstrations of various aspects of farming and was attended by nearly 200 people at Henfaes this year. Adam was showcasing the Centre's research into biobased food packaging made from agricultural residues, including prototype products made from wheat straw and ryegrass.

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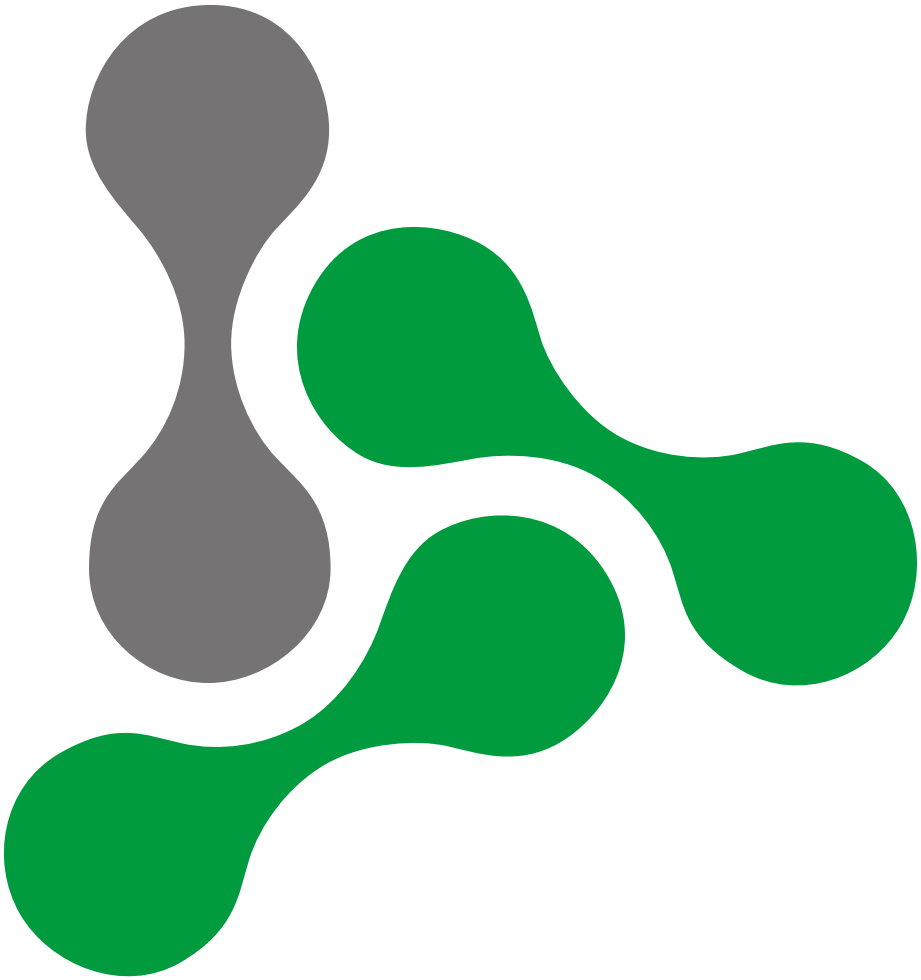

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