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NEWS

EVOLVING A CIRCULAR PLASTICS ECONOMY

Evolving a Circular Plastics Economy

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Researchers

Lead



Professor Pauline Deutz

A Professor of Human Geography in the Department of Geography, Geology and Environment, Pauline has held a variety of posts at the University of Hull since 1999. She is a board member of the International Sustainable **Development Research** Society (ISDRS), having been president 2019-20 and vice president 2012-2018.

Pauline's research interests are focused on the political and economic aspects of environmental issues. A particular focus is the building, and implications, of a Circular Economy, encompassing multidisciplinary collaborations with colleagues in a wide variety of social, natural sciences and technical disciplines. She was the co-PI for the EPSRC-funding Evolving a Circular Plastics Economy project and is currently the principal investigator of the EU-funded project Cresting: Circular economy: Circular economy: sustainability implications, guiding progress.

Pauline has a BA in Geography from the University of Oxford, a MA in Climatology from the Ohio State University and a PhD in Geology from the University of California Riverside



Professor Carl Redshaw

Having studied for a BSc (Hons) and PhD at the University of Newcastle, **Carl was a Welch Fellow** at the University of Texas, Austin, a postdoctoral fellow with the late Sir **Geoffrey Wilkinson at** Imperial College, and at the IRC Durham.

He was awarded a Leverhulme Fellowship and moved to UEA as a lecturer (1999). Senior Lecturer (2007) and Reader (2009), before being appointed Professor of Inorganic Materials at Hull in 2012.

He has many links with the Far East, including previous visiting professorships at the Shanghai Institute of Organic Chemistry (SIOC), the Institute of Chemistry, the Chinese Academy of Sciences, Beijing (ICCAS), Sichuan Normal University (Chengdu), and the National Institute of Technology, Akashi Japan. He is now Guest Professor at Northwest University in Xi'an. He has published around 400 papers in the peer reviewed scientific literature, mostly on coordination chemistry and catalysis. Current research interests include catalyst design for accessing new biodegradable polymers, and metal-based anticancer agents.

Foreword from Professor Dan Parsons



The Evolving a Circular Plastics Economy Project was founded on one, clear vision: to harness the broad expertise across a range of disciplines at the University of Hull to achieve results that could, genuinely, address the emerging 'plastics crisis'. This transdisciplinary approach has allowed us to fully explore the plastics all around us; their production, our interactions with them on a societal level and how we can develop solutions to the global issues that we all face.

There can be no doubt that informed, systemic change is required to address this the global issues we all face concerning the accelerating production of plastics and their subsequent release into the environment. Engaging the wider public is absolutely vital to communicate the need for change, and demonstrate that fundamentally, the power is in all of our hands to drive that change. The decisions we make as individuals, and as a society, can have a profound impact; leading discussion around the issues at hand and building a greater understanding of the different ways that we can work together to fix them, was a key focus across the project.

Whilst the Evolving a Circular Plastics Economy Project has reached its formal conclusion, this important work continues through our Plastics Collaboratory; from chemistry to logistics to human rights and the law through to the performing arts, there is so much more for us to explore. The management of plastics is a global issue and requires urgent attention. If we do not act now in a decisive and dynamic, yet considered, way, our unsustainable footprint on this planet will leave future generations with an insurmountable challenge.



Throughout the project, active and dynamic collaboration with a range of stakeholders played a fundamental role in its success. We are proud to have facilitated the bringing together of so many individuals, groups and businesses and we sincerely thank every one of them for bringing their insight, perspectives and expertise to the table to support this important research.

As an institution, we are on this journey for the longterm, with a global perspective and very real aspirations to change the future outlook through collaboration and innovation.

Every generation leaves a geological 'message in a bottle' for the future. Let's work together to ensure that ours isn't a planet covered in the remnants of single use plastic.



Everv generation leaves a geological 'message in a bottle' for the future. Let's work together to ensure that ours isn't a planet covered in the remnants of single use plastic. **Professor Dan Parsons**



Understanding **behaviours**: Stakeholder engagement

From the outset, we carefully designed the transdisciplinary stakeholder engagement programme to underpin the ECPE Project as a whole. As such, the team took a dynamic approach to building a compelling picture of the challenges and opportunities around the circular plastics economy.

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From our experience, many businesses throughout the supply chain are keen to improve the sustainability of their plastics use. They need support that is tailored to them that will facilitate this. That was a key learning for us.

Professor Pauline Deutz, Researcher



The ECPE Project engaged with around 25 key stakeholders in the region and beyond and brought them together to participate in an initial workshop to facilitate meaningful, structured discussion on how we can work together to support the circular plastics economy. By bringing together individuals and businesses who operate within the supply chain with academics, researchers and governmental bodies, we were able to facilitate the exchange of knowledge and insight, from a broad range of perspectives, to help us better understand behaviours and identify the key challenges.

As well as workshops, our researchers met with individual stakeholders and businesses on a one-toone basis to gain a greater depth of understanding and to build meaningful relationships that will play a vital role in this work as we look to the future. The findings of this work have been collated and will inform the development of best practice guidance on how to perform as a transdisciplinary team - an important piece of work that will underpin our collective approach to upcoming projects involving multiple partners and stakeholders.



What did we discover? **Empirical findings** from stakeholder workshops

Across the board, stakeholders were fully engaged and keen to participate in the study and to play their part in looking for solutions to the 'plastics problem'. We found, though, that there were some fundamental differences in perspectives on what the key challenges are, and that there were contradictory views of consumers as driving or resisting change.

The need for trusted, viable solutions regarding biodegradable plastics was identified especially in the food industry and by suppliers of (highly regulated) medical products, who feel that they do not yet have sufficient information. It became clear, through the stakeholder engagement process, that these are highly complex issues that will require a delicate balance when considering what the best options will be to manage the challenges in identifying viable solutions. Based on empirical findings from focus groups at workshops it became clear that some stakeholders do not yet know enough about novel biodegradable plastics and need more information about their development.











For most stakeholders, clarity and certainty are of a paramount importance when it comes to government measures/policies on biodegradable and nonbiodegradable (e.g., single use) plastics in terms of medium to long term planning. These considerations were deemed more important than the type of policy instrument (e.g., regulation, tax, fiscal incentives and voluntary agreements) adopted by central/local government. Empirical findings from workshops also showed that most stakeholders preferred financial incentives for the implementation of new technologies and operational procedures rather than the burden of regulation that can be costly and challenging to implement.

The issue of plastics won't disappear because of Covid-19 but it's important that we maintain the dialogue and ensure it remains high on the agenda. Dr Anne Kildunne, Researcher



Case Study Scarborough Borough Council

Scarborough Borough Council is committed to eliminating the use of single use plastics in the borough. To support them in this aim, this collaborative project sought to foster a greater understanding of consumer behaviours to develop a solution for the single use plastic sacks currently used.

Scarborough has a distinct infrastructure and architectural identity, with many multi-storey dwellings that present challenges for recycling, such as a lack of wheel bin and storage space. To examine and tackle these challenges, we engaged with households through the use of a survey and worked in partnership with the waste collection teams who operate in the project area, whose insight proved invaluable in the development of potential solutions.

The project team developed several different potential waste receptacle options, which were reviewed by the waste crews. The crews were fully engaged in the process, through which they highlighted practical challenges that had not been previously been considered and supported the team in developing plans for the roll out of a trial with households.

One of the key outcomes of this project was the submission of a report, with a recommendation to roll out a trial with woven sacks. The recommendations made were based on a five-year period and took account of the volume of household waste that would need to be managed. The next phase of this project would see the recommended solutions trialled with selected households, with a view to refinement and eventual roll out.



There was an enthusiasm and appetite across the board to find the right answer. Claire Lea, Researcher

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Highlights and outcomes

Life cycle analysis on each of the proposed potential solutions

Cost/benefit analysis of each of the proposed potential solutions

6-month project engaging with partners and stakeholders

Background research on the activities of local authorities throughout the UK

Final report featuring the recommendation to use woven polypropylene sacks





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Something that is particular to coastal towns such as Scarborough is the gulls; Any solution proposed need to be gull proof. This was another key consideration.

Not all plastics are bad. Sometimes they are the best for the job. We just need to be responsible and have the right labelling and infrastructures in place. Claire Lea, Researcher



Developing a new biodegradable plastic

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One possible solution to the evergrowing plastic pollution problem is to replace traditional petroleum-based plastics, which can take centuries to degrade, with more environmentally friendly alternatives. This research sought to address the challenges of making greener polymers that will degrade more quickly but still retain some of the positive properties of plastics for multiple use.

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Significant investment is required to scale up the project and to facilitate wholesale change.

The biggest myth is that plastics are bad.

We are looking at a flexible approach with endless possibilities - from packaging to tree guards. Professor Carl Redshaw, Researcher



There will always be a need for polymer materials due to their unique properties such as strength, flexibility, low weight and ease of fabrication. One of the central objectives of this work package was to develop a new kind of plastic that will have better environmental credentials at the end of life, which can also be made at lower temperatures to reduce the energy required to create it. Access to such new plastics needs to be achieved at low cost and be amenable to mass production.

Many plastic (polymeric) materials are accessed via the use of metal-based catalysts which can convert monomers into polymers and, by varying the structure of the catalyst, the properties of the polymerization process (and the resultant polymer) can be controlled. With this in mind, the use of monomers that originate from natural resources such as corn starch gives, via a metal-catalysed polymerization process, access to new, greener plastics. We have been investigating the use of earth abundant metals as catalysts, which are both lower in cost, and can operate in air under mild conditions (better for wide industrial use). We have found that by using the metals titanium or molybdenum in a particular chemical environment, catalysts can be formed that do operate under such conditions. This has allowed us to grow new plastic films, which have more favourable decomposition properties than traditional plastics.

Weathering experiments and life cycle analysis, to understand the degradation profile and environmental impact of new biodegradable polymers.

Following the development of these new, 'greener plastics', our researchers conducted a suite of experiments to explore their degradation profile, ascertain if they break down completely and discover what they leave behind when they do. The biodegradable plastics were tested in different, controlled conditions, against other commercially available biodegradable plastics that are in the supply chain.

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Nature and animals - just two things you have to deal with out in the field! Dr Karen Rodgers, Researcher

One key challenge is to drive consumer demand for more biodegradable plastic product. That will require greater understanding, lower cost solution and a scale up across the board. Dr Karen Rodgers, Researcher The plastics were tested in a range of environments from roof tops to riverbanks and were analysed in the lab using state of the art technology to capture the findings. The final report is comprised of anecdotal and qualitative findings that will assist in the further development of biodegradable plastics for multiple use. Experiments are on-going to assess the strength of our new products, as well as helping to identify possible applications.

Developing this suite of tests to understand the endof-life properties of novel biodegradable polymers led to an innovation grant from ERDF funding AURA Innovation Centre to work with a novel biodegradable plastic manufacturer, to help them understand how their plastics degrade. (Rainbow Professional Ltd.) The company makes tree shelters, which are expected to degrade harmlessly once the trees have grown to a sufficient size. Weathering experiments are being conducted in soil and water, which represent the environment where the shelters are used. Disposal of the shelters is likely to be in an industrial composter so some samples are weathering in conditions similar to industrial compost. Preliminary results show some degradation in the polymers. The key findings from these experiments will provide us with a fuller picture of the impact of different environmental conditions, how they accelerate or decelerate the weathering process and the extent to which these novel plastics degrade.

Mapping the current plastics supply chain to support circularity

This work program had the central objective of mapping the current value chain of plastic flow to support circularity. To facilitate this, it was necessary to build a comprehensive understanding of inbound and outbound flows of plastic usage, including the processes for waste collection and disposal within business units in the whole supply chain.

Through interviews and wider discussions with companies throughout the supply chain, it was found that short-term collaboration requires higher levels of engagement in order to achieve the desired outcomes. On the other hand, companies that portrayed a longterm vision of being "environmentally sustainable", usually indicated with clear sustainability goals and report, inherit a long-term collaboration function between departments that are naturally embedded in their day-to-day tasks. It is hoped that this valuable insight and the outcomes of this project can be used to influence policy makers and influence future decision making. The team also explored the challenges in circularity in relation to plastic and sought to identify the key problems and concerns citizens also have with the management of plastics after they leave the supply chain. As part of this work, the team analysed 37,792 newspaper article comments to understand both the viewpoint of consumers and the drivers of change. During this process, sentiment analysis revealed that:

Citizens have many interests in UK's 2025 plastic pact goal and the proportion of comments on news related to plastic waste initiatives was high during and after the peak of policy initiatives in 2018

Citizens pay more attention to government related topics than to business related topics in the policy debate

Sentiment scores of the topics are positive over time, which indicates a positive public opinion towards UK's 2025 plastic pact







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Because of this project, I can see how valuable transdisciplinary working really is. Having the chance to work with the chemistry department, for example, was fascinating, I really learned a lot.

A lot of businesses are investing in managing plastics. I think the consumer is ready and willing to help them.

This project let us look at the issues from multiple angles. We have identified the different challenges and have a greater understanding than ever before. Professor Nishikant Mishra, Researcher

Case Study

Development of Decision Support System for Morrisons to better manage plastic value chain

It takes about 400 years for a polyethylene bag to degrade in a landfill site. The persistence of plastic waste in the environment, and the reliance of fossil fuel derived polymers for their creation, are unsustainable. The ECPE project worked with a number of stakeholder groups, including retailers, who are seeking out new, viable ways to reduce their use of plastics.

From our initial stakeholder workshop and through our ongoing dialogue thereafter, Morrisons showed a keen interest in playing their part in supporting a circular plastics economy. These initial conversations laid the foundations for an ambitious project to provide Morrisons with a standardised web enabled application (Decision Support System [DSS]), capable of tracking plastic usage, managing waste collection, recycling and disposal. To deliver on these objectives, The University of Hull's Logistics Institute, in collaboration with Morrisons, has successfully developed a cloud-based Decision Support System (DSS) for effective mapping of their supply chain.

The DSS allows you to:

Simplify the complex supply chain through the visualisation and flow of plastics between business units

Assist management by addressing fragmented data capture and storage issues within the business by using a central database

Speed up the data collation, summary and analysis process to support the business in their work towards meeting WRAP 2025 Plastic Pact obligations

Assist the management team in generating reports, monitoring the progress of target versus actual cost reduction, and highlight best performing sites directly from dashboard.

Equip the team with inbuilt report and map features that assist with illustrating forward and backward linkages, the flow of plastics recycled, revenue generated from sales and costs incurred in disposal of waste. The DSS brings together the different datasets that are required to streamline systems and standardises them, providing an easy way to input information and aggregate it. This invaluable assistance in mapping data could have a profound, positive impact for retailers struggling with the operational challenges of delivering on their environmental aspirations and commitments, offering a solution that is capable of tracking their whole supply chain.











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This tool can be configured in the future to manage plastics for any retailer. Professor Amar Ramudhin, Researcher

It was challenging to get the level of detailed data we needed against the backdrop of Covid, working with multiple sites, but we got there in the end! Dr Roland Y Getor, Researcher

Sometimes the message to consumers is a complicated. We need to keep it simple to facilitate change. Professor Nishikant Mishra, Researcher

I see the DSS allowing us to capture data for not only plastic waste, but also other waste types like food waste. In addition, the report and visualisation functions will enable us to easily extract, export and circulate the type of information (such as month on month changes; total disposal, transport and site costs and plastic revenue) needed for management briefings and decision making.

David Archer, Procurement Manager, Morrisons



Converting waste plastics into liquid fuel

In 2017, the UK produced 2.4 Mt of plastic packaging, of which 37% was polyethylene terephthalate (PET) film, bottles and trays. Chemical recycling of waste plastics is a crucial technique to transform them into valuable products, such as oligomers and monomers as feedstock for new fuels or bulk petrochemicals.

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If this technology were to be scaled up and applied across the world, it could change the future of packaging plastics. Dr Xuebin Ke, Researcher



Several key technologies enhance the processing efficiency in terms of photocatalysis, electrocatalysis and membrane separation. The low energy depolymerisation process is used to produce liquid products of terephthalic acid (BDC) and ethylene glycol (EG) driven by light irradiation with bias potential and integrated membrane. Through this complex process, all PET waste can be efficiently recycled and used to generate new fuels, which can be particularly used to create products of ethylene glycol that resist freezing but have many other purposes, too.

Experiments were initially carried out in our laboratories on campus until strong results were achieved with gram-scale samples. To enable demonstrations of these findings to partners and stakeholders, we have now developed an integrated rig to support our ambitions to drive further collaborations that will enable us to scale trials up to a commercial/pilot level.



Converting waste plastics into energy

This project sought to address the core challenge that many plastics do not degrade easily and take many years to degrade completely. This innovative, scientific approach saw the team develop a method of growing bacterial cultures to 'eat' waste PET plastic. Clean gas is then produced as a by-product of this process, which can be converted into electricity.

One key aspect of this area of research is that the process in development can be applied to waste plastic that already exists. This is of particular importance when considering developing countries, where no formal recycling processes currently exist. Innovative technical and scientific solutions such as this, alongside effective engagement and implementation, could present a viable solution that could change the environmental outlook for communities around the world.

Longer-term outputs from this study hope to address this through the development of a range of products emanating from plastic waste to serve the communities from which they are collected. In particular, the creation of community biogas as a form of renewable energy, a useful fertilizer for our soil, fuel and value-added chemicals are viable for development as a future focus of this work.

We anticipate that further refinement is required to look at different types of bacteria to improve the process. Another key consideration is the need to consider the challenge of "digesting" different types of plastics, or even mixes of plastics, which would be more representative of the domestic mixed recycling bin that is typical of most local authorities. If we can solve this issue, and produce more and more energy, our vision is looking to different plastics and cultures of bacteria to create solutions that can change the world.

Waste plastic is a human created issue, so it is up to us to develop solutions.

If this is successfully scaled up, globally, it will not only create energy, but, in the long run, it could also save lives. Dr Sharif Zein, Researcher

The presence of PET plastic containers littered across Africa, where collection and recycling is largely absent. provides a ready source of retained dirty water to harbour harmful disease vectoring mosquitoes. The work of the University of Hull on the use of the otherwise benign bacteria Ideonella Sakiensis to consume this PET plastic and at the same time produce off-grid energy, has the potential to save countless and especially young lives in Africa. The **ECPE** project can thus potentially contribute to saving hundreds of thousands of young children's lives on the continent of Africa by reducing the activity of mosquitoes as Malaria vectors. Well done to the researchers and supporting ECPE staff at the University of Hull.

The Global Biotech Foundation



Voice of young people

Professor Kevin Burden, Professor Rudi Wurzel and Dr Charlotte Dean have been developing an innovative derivative of Citizen Science methodology known as Citizen Inquiry (Herodotou et al. 2018) to encourage young people to explore and activate their role in the circular plastics economy, as well as exploring what they understood by the term and what it meant to them.

The <u>"Plastic Citizen"</u> project has worked with over 200 young people in informal and formal education settings, including schools, youth projects and alternative education settings with each group identifying an area relating to the Circular Plastics Economy, which they then explored further using a critical citizen inquiry approach.

The Plastic Citizen project has also developed a strong link with schools and youth groups in Bremerhaven, Germany. During a research visit in early 2020, several workshops with primary and secondary schools took place as well as meetings with the Bremerhaven

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We are genuinely pioneering the use of citizen inquiry with young people and the role it can play in academic outputs. Dr Charlotte Dean, Researcher



Council for Climate Change and the Youth Climate Council (Jugundklimarat) in which young people's approaches to the circular plastics economy were shared and discussed.

A MAPping tool has been developed, which measures the Motivation, Attitude and Participation of young people and how involvement in Citizen Inquiry has impacted on these areas. This tool is supported by a rubric (scoring system), which correlates to ascertain levels of agency and efficacy fostered in young people through project involvement.

Key outcomes of the project include:

Rap video App Podcast Paper Educational resources BBC short film nQuire survey

One of the encouraging messages is that young people are highly motivated to do something about plastics pollution and to get engaged not only in formal school settings but also as 'plastic citizens' outside formal educational institutions.



The question of how best to engage with people and effectively communicate the key issues around plastics is a challenging one. This project had the central aim of taking this important body of work as a collective and finding a way to communicate this to the wider world in a way that was artistically inspiring and arresting.



When listening to the podcast, I want listeners to put themselves in the position of 'the consumer' and to think about the choices they can make as an individual that can have a huge impact on what is happening globally.

We wanted to grab people with their minds and their emotions, rather than through their guilty consciences about plastics pollution... to try and use beauty as a way of switching on their minds to thinking about the issues. Dr Christian Billing, Researcher

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This project brought together political science and education, which gave us all a fresh perspective and led to a strong, collaborative approach. Professor Rudi Wurzel, Researcher

It's a mistake to underestimate young people when they often have the most sophisticated, unfettered views on the world.

Dr Charlotte Dean, Researcher



Whilst the eventual outcomes of the project were adversely affected by Covid-19, arts and music students at University of Hull were engaged and empowered to use their talents to repackage and creatively present the anecdotal research that had been gathered through the ECPE project. The eventual result of this work is a new podcast, 'Links in the Chain'.

The podcast has one narrative, structural motif to give it cohesion, with one central character of a consumer as the narrator. This allowed us to bring together all of the different stakeholder viewpoints, thoughts, concerns and opinions we had gathered – thereby giving multiple voices a platform.

The project brought together specialists such as playwrights, electronic musicians, composers, performers with podcast designer and University of Hull alumna, Hannah Walker-Brown, to deliver the final 30-45-minute podcast, which is set for universal release later this year.

In time, it is hoped that the outcomes from the ECPE Project can be brought to life through more creative outputs as a part of this project, from immersive theatre and dance elements to new compositions and further podcasts.



Looking to the future

The University of Hull has an impressive track record in the area of plastics research. Our Plastics Collaboratory, based at the University's Energy & Environment Institute, brings together a diverse team of researchers across a range of disciplines. We are working alongside other research institutions, businesses and consumers from every level of the plastic value chain to increase our understanding of the pathways and interactions of plastics in the environment. In particular, we are identifying the gaps and leaks in a plastics circular economy and exploring and developing new pathways to an enhanced circularity in plastics use.

The University of Hull's holistic approach is continuing to create a broad range of impacts on disparate areas of the plastics problem. Our Plastics Collaboratory facilitates the exchange of information, expertise and skills across a range of disciplines to help drive the strategic direction of future plastic related research and programmes of activity across the University and beyond. We are committed to playing our part in reducing the negative impact of plastics on the environment, in a number of ways:

Ongoing research

As previously stated, work on these important issues continues and members of the project team are currently supervising four PhD students in their research. Find out more about each <u>project</u>. We will continue to support an environment that facilitates the transformation from linear to circular economy and reduces the harmful effects of microplastics. This includes ongoing outreach work to heighten awareness and action among the wider business and public community.



Our Plastics in the Environment Research Group, comprising experienced and early career researchers, focuses on the issue of plastics pollution and its impacts. Research currently ranges from the transportdeposition of microplastic particles in sediments, rivers and estuaries, through the breakdown of both plastics and bioplastics in different environments (from tropical to Antarctic), to the effects of microplastics ingestion on marine species, and how human rights are affected by plastics pollution.





The <u>Plastic Citizen</u> project, based within the University's School of Education, is helping young people to develop a critical inquiry approach to how plastics are viewed, used and disposed of in our society, encouraging others to use at least one of the 4 Rs when it comes to plastic: Repurpose, Reduce, Reuse and Recycle.

We will continue to identify and overcome potential barriers to a circular economy by understanding the wider issues around the production, use, disposal and/or reuse of plastic. One example is our Plastic Waste Management Tool, developed by the University's Logistics Institute in partnership with Morrison's supermarket group.



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We will continue to develop new biodegradable polymeric materials for customized use by controlling strength, via introduction of alternative monomers and/or additives/ cross-linkers and by manipulation of catalyst structure, and other properties such as rate of biodegradation.

We will continue to work with our partners to identify pathways for new practices helping to shape future policies and frameworks that clear the way for a new circular plastics economy.



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The University of Hull researchers for this project were:

Prof Amar Ramudhin Dr Anne Kildunne Dr Campbell Edinborough Prof Carl Redshaw Dr Chandrasekar Kambhampati Dr Charlotte Dean Dr Christian Billing Dr Christian Billing Dr Chris Skinner Claire Lea Prof Daniel Parsons Dr Felix Why Prof Graham Ferrier

Jana Busch

Dr Jenny SpearJoanne PopplewellProf Jonathan AtkinsJosine OpmeerDr Karen RogersProf Kevin BurdenMicheal FarrellyProf Nishikant MishraDr Orlando SantoroProf Pauline DeutzDr Raghava R Vanga

Dr Roland Getor <u>Prof Rudi Wurzel</u> Shamini Howshigan <u>Dr Sharif Zein</u> <u>Dr Vicky Skoulou</u> <u>Dr Will Mayes</u> Xin Zhang <u>Dr Xuebin Ke</u> <u>Dr Yongqiang Cheng</u> Yangyimin Xue



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This is an interesting report and it was good to see elements of the project grounded in the real world with good amounts of external engagement, including with businesses and local authorities. Andrew Woodend, DEFRA



Project reflections

New, affordable bioplastics are being developed which have more favourable environmental properties than current plastics.





We are improving the cost effectiveness of processes for converting used (petrochemical) plastic into high value outputs using low energy chemical and biological processes.

We have developed a decision support system for improving the sustainability of plastics use in a supply chain of larger retailers.





We are experimenting with arts to inspire and inform people about issues with plastics via an innovative podcast.

Innovations in this project support progress towards the United Nations Sustainable Development Goals, in particular SDG 9 (Resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation); SDG 12 (Sustainable consumption and production).



We are pioneering the use of interactive online approaches to engage with young people through Citizen Inquiry.



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We are helping to reveal the challenges of replacing plastic.

Greater clarity is needed in the legal definition of bioplastic and biodegradable plastic.

Plastic is not just cheap, it has many useful properties and might genuinely be the best option for a given task - using something else might involve redefining the task.

Waste infrastructure needs to match plastics in use.

A strong regulatory drive will be needed to bring about change, including guidance and incentives as well as enforceable requirements.

We are paving the way for a more circular economy for plastics.

Professor Pauline Deutz







Contact us

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