

ARLI Progress Update

The ARLI collaborative research programme has now been running for 18 months. During this time we have assisted over 70 SMEs in the GBSLEP area to develop or improve new products and helped to bring several new products to market, creating additional new jobs.

A flavour of the sort of assistance we have been providing is given below.

Building Systems

We have worked with a number of SMEs who are developing innovative solutions to systems and products related to buildings. Together we have conducted investigations into the performance of potential insulation materials which are more environmentally friendly or which use waste materials, such as composite glass fibre reinforced poly-isocyanides with cardboard honeycomb layers, shredded plastic bottles and other shredded materials. A number of companies are also looking at coatings to provide insulation or fire resistance. In addition, we have tested the thermal properties and durability of various polymer coatings. Several insulation boards and available fire retardants have also been reviewed for clients.

We have also built a brick cavity wall testing facility with variable cavity wall widths, which we fully instrumented to provide full scale testing.

A number of companies have brought us innovative ideas for developing various building system components, from lightweight concrete lintels to patterned acrylic ceiling panels that provide a more restful indoor workplace



ambiance. We have researched the possibility of recovering thermosets and thermoplastics to enable the development of a joist made from recycled plastic and reinforced with glass fibre.

We have collaborated with a client to investigate the possibility of eliminating the need for fire retardant in an innovative insulating concrete form for house-building, which has recycled plastic as its core material.

A number of organisations nationally are developing off-site construction systems for house-building. We have connected a local entrepreneur with plans for a modular concrete house to another of our businesses involved in housing, and helped secure £50,000 funding for further development of the system.



Construction

Innovative uses for waste materials in construction have been a large part of our research collaborations. The reinforcement of soil and concrete has become an important area of our investigations. There are potential applications for the use of waste glass reinforced plastic, carpet waste, crumbed rubber and other non-construction wastes in both geotechnical and construction applications. We have also looked at the geotechnical and construction applications for crushed eggshells, of which there is a significant volume of eggshells available.

We are currently undertaking soil/structure analysis for a new rapid mini-piling system for temporary structures which should be fully recoverable and reusable.

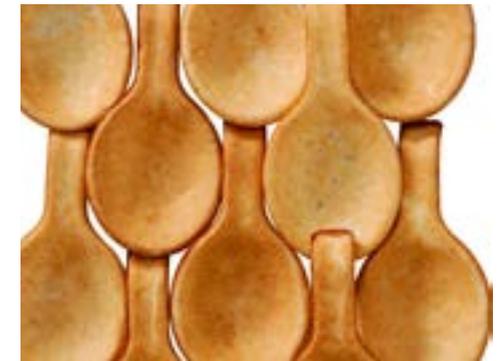
Construction waste management remains an issue within the industry. We have analysed the sources and disposal routes for key waste streams from two major developments to help the client understand where efficiencies and changes need to be made to reduce the volume of waste produced and improve the performance of waste management companies.

Food

A number of SMEs involved in the growing and production of food have contacted us for assistance. We have designed a flexible and adjustable polytunnel, which can be erected and moved without machinery and could be used in a variety of site conditions. The proposed polytunnel adapts to a range of sizes, is lightweight and flexible, allowing ease of use.

Cleaning waste plastic bottles was a challenge in the recycling procedure used by one SME, who were shredding plastic bottles to reform into food containers. We carried out research into a number of cleaning procedures which could be used to clean the plastic, and provided the advantages and disadvantages of each system, including whether there is the need for skilled operators.

Based on the results of desktop research, one SME has concluded that there is a high customer demand for edible spoons, however the environmental impact of the spoon production needs to be assessed. We undertook laboratory analysis on a range of recipes for the



dough to determine the optimum mix in terms of workability, strength and dissolution in cold and hot water.

We have also collaborated with two SMEs looking to innovate systems for growing crops hydroponically and aeroponically. Our research included investigating the most sustainable materials for supporting the growing medium and the design of this.



Materials

We have worked with a number of organisations researching into alternative or more economic and environmentally friendly materials for a wide range of applications. These include assessing different metallic and non-metallic materials which could be used in pipes for high-temperature high-salinity brine applications.

Some of the more unusual materials we have worked with include expired fire extinguisher powder, for which we undertook X-ray diffraction testing to identify the amount of crystalline materials present, particles size, shape and strain.



Plastics

Initial tests on samples of contaminated melamine plastic media has confirmed that it is possible to remove metal wood and the fabric content from the melamine plastic media and enable the SME to use the recycled melamine as a shot-blasting medium. We also identified potential applications for using the particles size fraction of <math><250\mu\text{m}</math>, which would avoid waste and allow added value use for this material.

We are currently collaborating with an SME who is recycling old flip flop sandals into new ones. We are investigating the replacement of glue to bind the shredded waste plastic into a new sole to improve the material properties and make the product more sustainable in terms of performance and material use.

Rubber

While recycled rubber roof tiles are available in the market, we have collaborated with an SME to investigate the use of a variety of waste rubber materials to make roof tiles with up to 100% recycled content. The tiles would be reusable and recyclable for future use.

While there are many uses for recycled vehicle tyres, bicycle tyres are not recycled. With the increase in cycling, waste management is a serious global concern. Working with an SME, we have researched ways of stripping out the circumferential wire reinforcement and of re-using the tyres and inner tubes. We have concluded that bicycle tyre rubber can be used in a substantial number of civil engineering works. The SME confirms that the support received from the University has contributed to further development of its new-to-market product.



Textiles

Carpets are multilayer mixtures of different polymers and inorganic fillers that are difficult and costly to reprocess upon disposal. We have been working with local manufacturers to find innovative recycling uses, which could have a significant positive impact on the environment as well as providing additional income streams to manufacturers. Within the construction industry we have tested the addition of carpet fibres to enhance the loading capacity and stability of soil structures. Geotextile fabrics, drainage and gas venting layers may also be made from carpet waste.

Within the fashion industry, the traditional sources of fabric materials are becoming limited and there is a drive for more sustainable materials. We have assisted two fashion companies in finding alternative natural materials to replace traditional cloths, including innovative textiles such as fabric from oranges, coffee grounds, seaweed, pineapples and hemp fibre. We were able to introduce one of the SMEs to a contact who is assisting them in moving the concept of sustainable clothing even further forward. The SME has found that working with ARLI has *“been an invaluable experience and one for which I would not have been in a position to progress without this assistance. Sincere thanks to all.”*

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