

England's first PP recycling unit proving its worth

Innovative ways to recycle plastics have become a high profile and necessary part of sustainable development. Here James Chadwick, head of Facilities and Capital Developments – Burton Campuses, explains how he and a team at University Hospitals of Derby and Burton NHS Foundation Trust (UHDB) have worked with Thermal Compaction Group (TCG), a Cardiff-based sustainable waste solutions specialist, to implement what is reportedly England's first healthcare sector polypropylene recycling unit.

At the the 2017 Hospital Innovations event in London, Thermal Compaction Group was promoting and showcasing its new machine and technology, Sterimelt, via which it claimed to have resolved the issue of how to sustainably recycle single-use polypropylene wraps in the hospital environment. Recognising the potential for the Sterilmelt technology, and envisaging some significant benefits to the Trust and the NHS in general if it takes off, we decided to explore the new concept from TCG, and invited the company to look at working with us at UHDB to help develop its concept further while the Trust got the benefits of its solution.

Back when it all started, the first used sterilisation wraps were 140 thread count muslin cloth. These ticked all the boxes, as they were easily draped over the instrument trays, inexpensive, reusable, and absorbent. A disadvantage, however, is that with them being a woven cloth, they did not provide complete protection against microbial penetration, and only allowed the sets to be stored for 21-28 days. To help limit any contamination of the instruments and keep them sterile, the double sequential wrapping process was adopted. The next development was a single-use cellulose wrap, but while this addressed the microbial concerns and extended the shelf life acceptance of the sterile set to 12 months, the wrap didn't provide the required durability. Polypropylene thus became the material of choice for instrument wraps, and is still used today.



The Sterimelt machine – developed by the Thermal Compaction Group.

A day-to-day consumer product

Polypropylene is in many of the consumer products we use day to day – for example in straws, yoghurt containers, polymer bank notes, stationery, automotive parts, and textiles, to name just a few. However, if it is not handled properly it can be toxic. It is generally used because it is an extremely durable material that does not wear away over time, rust, or react with water detergents, acids, or chemical solvents like concrete and steel do. Equally, its heat resistance allows it to be used in sterile situations, such as

where it is subject to high heat delivered from the autoclaves in the Sterile Services Department.

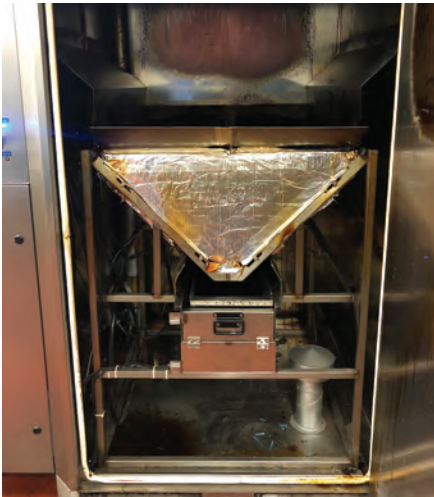
Millions of tonnes of plastic waste are generated annually, of which only about 25 per cent is recycled or upscaled, and indeed each year the UHDB Burton campuses alone use in excess of 59,000 polypropylene wraps, equating to about 16 tonnes of material. These wraps are used by our in-house Sterile Services team to maintain the sterile environment of the instruments during transportation and storage, keeping them surgically sterile until point of use. Once the instruments have been used, they, along with the tray and opened wrap, are then sent back to the Sterile Services unit for cleaning and disposal. Now, instead of these wraps going into the waste streams, they are separated into storage bins, before being collected and sent over to our recycling hub, where they are checked for foreign objects, and the sterile autoclave tape and labels removed, as they are not polypropylene. The wraps are then separated into types ready for reprocessing.

Developed to meet a specific need

The Sterimelt machine was developed after Thermal Compaction Group identified the potential to decrease the amount of single-use disposable plastic used by the NHS. The machine takes costly used surgical wraps and melts them down using a process that converts them into a solid polypropylene material.



The Queen's Hospital, Burton, where the Sterimelt machine was installed on 22 March this year.



The hopper within the Sterimelt machine into which the wraps are fed for processing.

This can then be reused as granulated media for injection moulding or extrusion into pellets to go into processes for creating 3D filaments, which can then potentially go on to become various items both within and outside healthcare, including exoskeletal plaster casts, 3D prosthetic limbs, cutlery, and furniture.

The melting procedure is a very clean process, that uses controlled heat settings up to maximums of 320°C, coupled with Teflon-coated heater plates, thus 'reverse engineering' the sheets. This entails melting the polypropylene (C₃H₆)_n, which has a melting point of 130-171°C, to flow as a molten plastic; thereafter gravity does its job, letting the molten solution drip down into the collection tray. The process simultaneously also gets rid of contaminant molecules. The whole process is controlled by a programmable logic controller with a series of inputs and outputs that allow the PLC to ensure that the plates stay at the optimum temperature during the process, while maintaining a safe working environment for the user/operator.

Other processes

There are other processes that take place in the machine for elements such as



The used surgical wraps are melted down using a process that converts them into a solid polypropylene material.

precise temperature control regulation at the various stages, odour-removing filtration systems, and resin control, which all contribute to the efficiency and purity of the end-product while maintaining safe operating conditions. The resin extracted is 'identification code 5', and is also recyclable. The only real issue we have found with the machine is that if the wraps are not 100% pure polypropylene – as in the case of those from one supplier, which incorporates a viscous layer on the wrap – then the melting process is disrupted, and the block does not form properly. However, with 100% pure polypropylene this is not the case, and perfect results are replicated every time.

The unit was installed on the site at Queen's Hospital, Burton site on 22 March this year – in fact NHS Sustainability Day, making UHDB the second UK Trust to join forces with TCG and becoming its 'beta partner' in England, the first being the Aneurin Bevan University Health Board in Wales at its Nevill Hall Hospital in Abergavenny. Day-to-day operation of the machine is successfully being managed by our Waste and Sustainability officer – Natalie Roddis, who, since the unit went 'live' approximately four months ago, has been able to divert over 5 tonnes of single use plastics from general waste streams.

Just the start

We at UHDB are committed to delivering sustainable solutions wherever possible, and to reducing the amount of non-recyclable plastics we produce, and the adoption of the Sterimelt technology is only the start. We are currently, for instance, looking into both cardboard and plastic baling. It has been a great journey so far working with TCG providing R&D for its machine, and supplying new ideas and data to allow it to develop other uses for the products and identify other polypropylene items to recycle – such as curtains, single-use scrubs, and other polypropylene items. Our constant feedback channels, meanwhile, allow the existing processes to be constantly improved and updated.

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James Chadwick

James A Chadwick BSc (Hons), IEng, MIET, MIHEEM, CBIFM, head of Facilities & Capital Developments – Burton Campuses, at University Hospitals of Derby and Burton NHS Foundation Trust, started out as an apprentice electrician in the private sector, working his way to senior project manager for a local electrical contracting company, covering multiple industries, including breweries, schools, councils, and healthcare.

He subsequently set up on his own as managing director of a successful consultancy and contracting company, which he later sold the client base to on deciding to join the NHS 'for some security and stability while starting a family'. Over the past nine years he has obtained a First Class honours degree in electrical and electronic technology, and registered with the Engineering Council as an Incorporated Engineer. He is a member of the Institute of Engineering and Technology (IET), a certified member of the British Institute of Facilities Management (BIFM), and an active Member of IHEEM, being a committee member on the Institute's East Midlands branch.

During his NHS career he has held roles including Electrical Engineer and HV/LV AP, and various positions in both Estates and Facilities, but for the past four years has headed capital developments for the Burton Campuses at UHDB. He said: "This has been a very interesting period, exposing me to all the environments a healthcare estates role has to offer, from working in HDU/ITU, theatres, and wards, to Pathology, Pharmacy, Residents, and Offices. For the past two years I have added head of Facilities to my portfolio. I am finding the challenge exciting, and am constantly expanding my knowledge of all the patient-facing services that Estates & Facilities offers."