Sustainable Hospital

New circular product designs from recycled dialysis bags

Wittenburg Plastics / Erasmus Medical Center

Assignment

Your assignment is to design a high-end (medical) product based on recycled dialysis bags (including its packaging) which can meet the regulatory and safety demands and technical product requirements. This could be for example a less critical medical product used in the dialysis treatment. You will perform a market assessment, investigate potential volumes (supply-demand), analyse the value chain (waste collector, recyclers, processing companies etc.) and the competitive landscape (including virgin materials). For each product (you may come up with more than 1 design) you will identify a value proposition, determine the adoption barriers and formulate a business case.

In this project parties from the whole supply chain are involved, from the raw material supplier (Wittenburg B.V.) until the hospital (Erasmus MC) and waste collection companies.

If you are interested, contact Prof J.C. Diehl (Inclusive Sustainable Healthcare) j.c.diehl@tudelft.nl

Background

Plastic has become ubiquitous in healthcare, with a dramatic shift towards single-use disposable products or medical consumables, like gloves, syringes, infusion bags, dialysis bags, catheters, video laryngoscopes, surgical staplers, breathing masks, multiple layers of packaging etc. Medical consumables and their packaging require substantial amounts of energy and use of (raw) materials during their production and are often disposed of after single-use, which lead to waste generation. As most of the hospital waste is incinerated, this destroys the value of the materials.

The healthcare sector in the Netherlands is responsible for 13% of total materials extraction, 8% of carbon emissions and 4% of total waste generation[1,2]. In numbers, hospital care results per year in 3.8 kilotons of extracted materials, 17.6 kilotons of CO_2 emissions and 4803 kilotons of waste. The waste consists of 15% hazardous materials (e.g. blood and infected materials) and 85% general hospital waste, of which 55% is plastics.

To support the transition towards a circular economy, it is crucial to respect the waste hierarchy: refuse, reduce, reuse, repair, recycle. For the healthcare sector, this means analysing working practices and identifying opportunities to reduce the use of virgin plastic products through existing solutions and encouraging innovation to design products and services that are reusable or recyclable wherever feasible. To further support the green chemistry approach and to minimise health risks in the healthcare sector (reusable) products should also be free of hazardous substances and not have a negative effect on the health of the patient.

The main plastic types used in disposables are Polypropylene (PP), Polyethylene Terephthalate (PET), High Density Polyethylene (HDPE), Low Density Polyethylene (HDPE), Polyvinyl chloride (PVC), Polystyrene (PS) and Acrylonitril Butadiene Styrene (ABS). Also thermoset materials such as silicon and rubber are frequently used.

Six product categories accounted for over 60% of the total plastic used in hospitals in Europe annually of which roughly 17.5% is disposable gloves, 11.5% is IV solution bags, 10% is disposable protective clothing, 8% is nappies, incontinence wear and bed pads, 8% is syringes and 7% intravenous administration systems. For Erasmus MC alone 12 dialysis bags (5L) are used per patient per day,

leading to roughly 9 Ton of waste (dialysis bags & packaging) per year. In addition, also large volumes of dialysis bags are used in patient homes. Dialysis bags account for a substantial amount of waste, the “used” bags are relatively clean and the films are mostly produced from compatible materials that can be easily reprocessed and recycled.

Company

Wittenburg BV is a designer of customized thermoplastic elastomer (TPE) and plastic compounds for medical, (bio)pharmaceutical, drinking water and food contact applications. Our Cawiton® compounds meet the needs of highly regulated and risk-averse markets. We also supply traditional TPE compounds used in consumer, automotive and industrial applications.

Cawiton® grades are produced in our Wittenburg facility in Zeewolde (the Netherlands) and our Xunfeng facility in Zhuhai (China). Our production sites are ISO13485 and ISO14001 certified and equipped with single and twin screw extruders. The compounds are manufactured under clean conditions as is subscribed for compounds used in medical devices.

Literature

1. Steenmeijer, M. A., Rodrigues, J. F. D., Zijp, M. C., & Waaijers-van der Loop, S. L. (2022). The Environmental Footprint of the Dutch Healthcare Sector: Beyond Climate Impact (SSRN Scholarly Paper No. 4081076). https://doi.org/10.2139/ssrn.4081076
2. Steenmeijer, M. A., Rodrigues, J. F. D., Zijp, M. C., & Loop, S. L. W. der. (2022). The environmental impact of the Dutch health-care sector beyond climate change: An input–output analysis. The Lancet Planetary Health, 6(12), e949–e957. https://doi.org/10.1016/S2542-5196(22)00244-3