

HEALTHCARE PLASTIC WASTE

ANALYSIS OF OLVG HOSPITAL PLASTIC WASTE STREAMS

Introduction

As part of the Nederland Circulair initiative by the Dutch Ministry of Infrastructure and Environment, a variety of organisations within the healthcare industry gathered to jointly identify ways to make hospitals more circular. To pursue this, a series of pilots were identified for further exploration. One of the pilot projects aims to create a mono-stream flow of plastic within the healthcare space.

In order to contribute to the overall objective of creating a mono-stream of plastic packaging within hospitals, Circle Economy engaged in an analysis of typical plastic waste streams from OLVG hospital.

Overview

The analysis of the plastic bags was conducted at the facilities of ICOVA. The 9 bags of plastic waste from OLVG were sorted, as shown in the image above, into nearly 65 different categories and then weighed.

This data was then analysed to answer questions regarding the composition and types of waste.



Objectives

The objectives of the analysis were to sort through 9 bags of plastic waste from OLVG's operating room and identify the contents to determine:

- Types of plastic products in the waste stream
- Composition and diversity of plastic types
- Most common plastic types

Types of Plastic Products

The types of plastic products found within the plastic waste streams are shown in Figure 1. The figure provides a breakdown of the different products based on their weights.

The largest category of plastic products found in the waste bags from OLVG hospital is disposables packaging – making up over 50% of the total plastic waste. Within disposables packaging, Figure 1 provides a deeper analysis of the nearly 15 different types of plastic used within disposables packaging. Although there were no markings to be found on the packaging that would indicate the types of plastic used, Circle Economy conducted additional research to try and determine the plastic types of the packaging.

The largest estimated plastic type used in disposables packaging based on weight are Polypropylene (PP), followed by Polyethylene Terephthalate (PET), Mixed High Density Polyethylene (HDPE) with Coated Medical Grade Paper, and Polyvinyl chloride (PVC).

Of these plastics, PET and HDPE are the most recyclable as they are the most commonly used and most commonly recycled plastics within society¹. While LDPE, PP, and PVC are also recyclable, they typically are not recycled or are down-cycled. Mixtures of different plastics and other materials such as paper are not possible to recycle and are typically disposed of or incinerated (**see Appendix A**).

Bubble wrap from shipments and deliveries is the second biggest plastic product by weight – making up 25% of the total plastic waste - and is the biggest single mono-plastic product - composed of only one material, Low Density Polyethylene (LDPE). This type of plastic when recycled is also typically down-cycled.

The remainder of plastic products within the OLVG waste stream are medical equipment – Trays, Plastic Medical Bottles, Plastic Cups, Gloves, Syringe and Accessories, Sterile Liquid Containers, Tubing and Accessories, Medical Bags, Eyeshields, etc.

¹ [Plastics by the numbers](#)

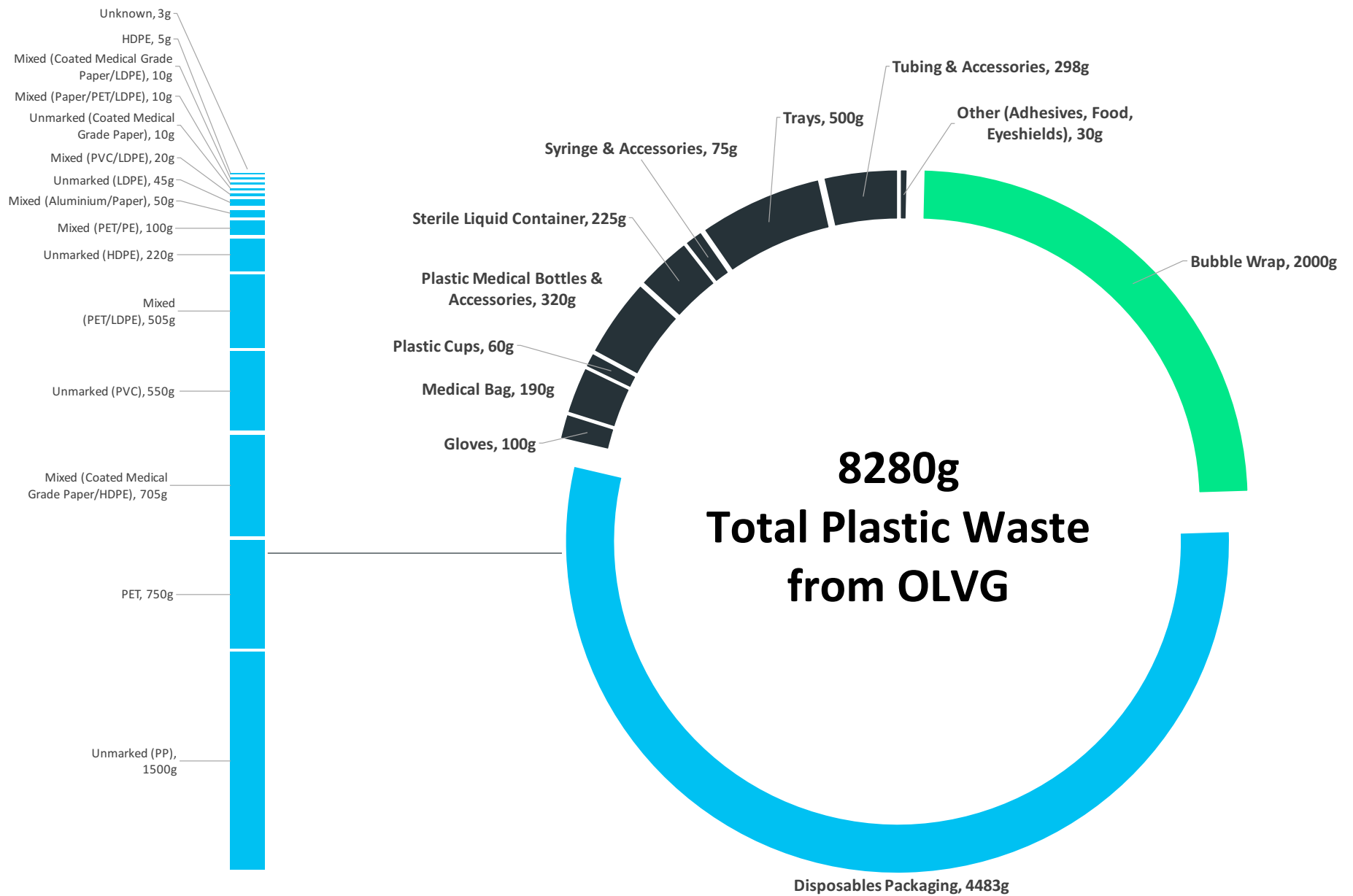


Figure 1. Plastic Waste Streams from OLVG

Composition and Diversity of Plastic Types

The composition of plastic types found within the OLVG plastic waste stream were identified based on the SPI: Plastics Industry Trade Association's Resin Identification Code (RIC) system², shown in Figure 2 below.



Figure 2. Resin Identification Code (RIC) System

Out of the plastics that were marked using these codes, and were able to be identified, Low Density Polyethylene (LDPE) makes up nearly 25% of the total plastic waste stream and PET makes up nearly 10% of the total. Figure 3 provides a breakdown of the plastic types that were identified.

However, as Figure 3 also shows, nearly 45% of the plastics were unmarked – this is due to the fact that there is no

² [Plastics Industry Trade Association](#)

mandatory requirement for marking plastics, particularly for non-containers such as films, bags, etc.³

For these unmarked plastics, Circle Economy analysed the type of plastic that the products could be made out of based on physical characteristics and identification techniques. The breakdown of the potential plastic types for the unmarked plastics is also shown in Figure 3.

It is also worth noting that the set of gloves that was disposed as plastic waste is actually made from nitrile rubber, adding to the lack of transparency regarding the specific types of plastic used in medical products and packaging.

In addition, nearly 20% of the plastic waste was composed of mixed materials – either different kinds of plastic or plastic combined with other materials such as paper and aluminium.

³ [British Plastics Federation](#), [NatureWorks](#)

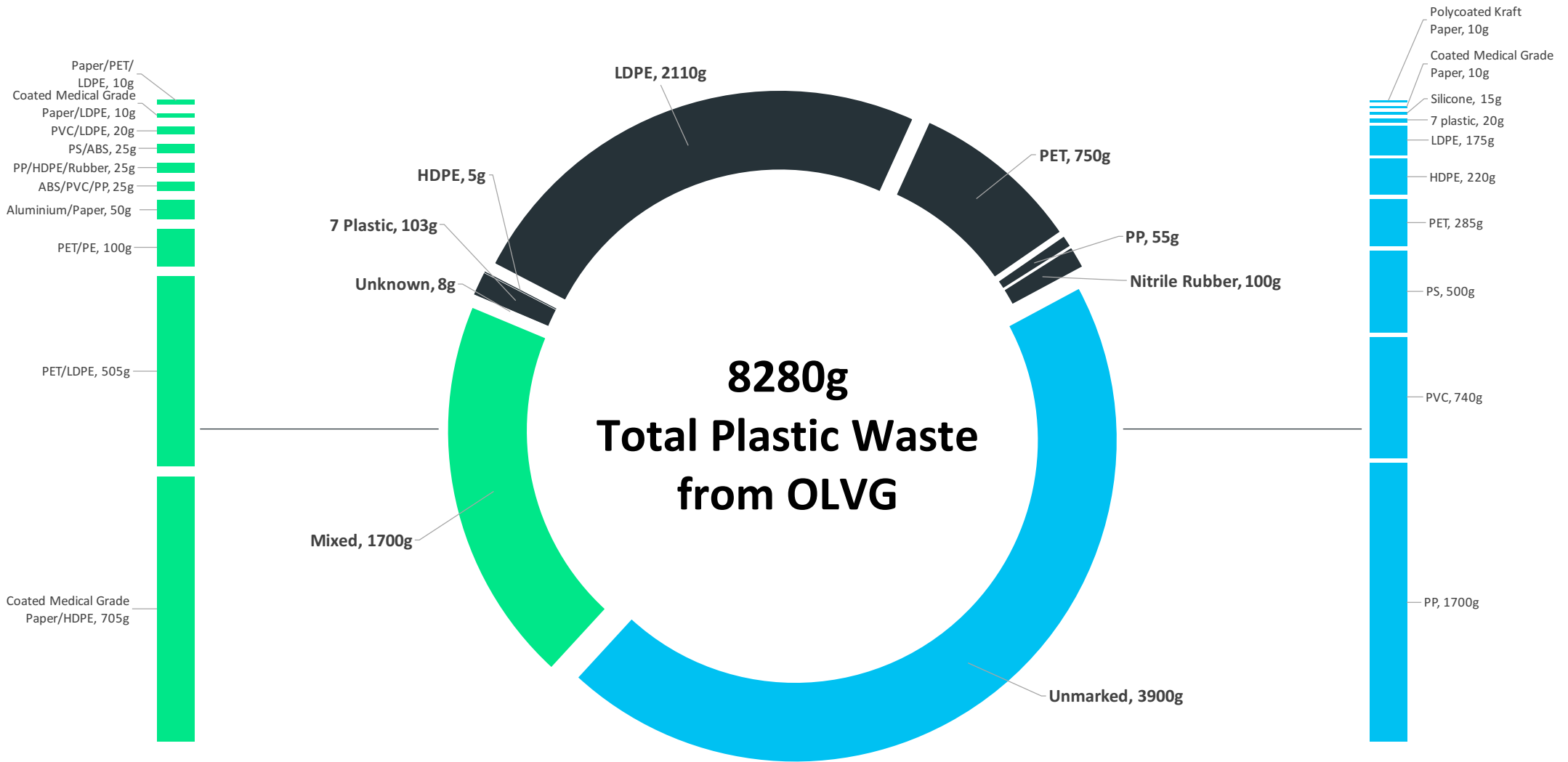


Figure 3. Breakdown of Plastic Types

Conclusion

From the analysis of 9 bags of plastic waste from OLVG, there are important insights based on the most common plastic products that are currently disposed as well as the composition of plastic types within those products

First, focusing on the types of plastic used in packaging of medical disposables presents the greatest opportunity for impact. Disposables packaging makes up over 50% of plastic waste, and is composed of nearly 15 different types of plastic materials. Shifting towards the use of a single plastic type is essential to enable greater recovery and recycling of disposables packaging.

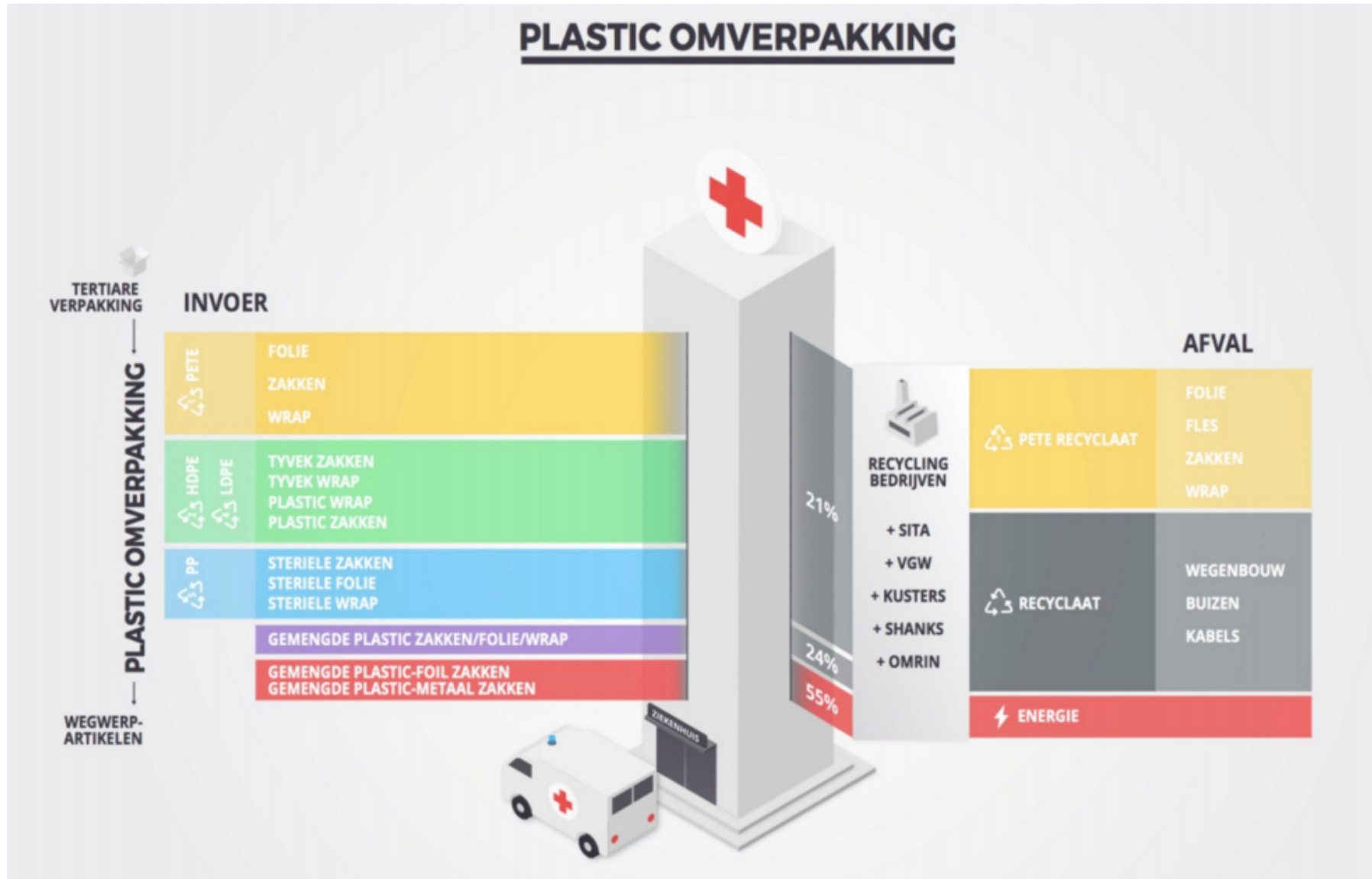
PET and HDPE are the most suitable candidates for this shift towards singular plastic types, as they are the most commonly used and most commonly recycled plastics in society. PET is best suited for single-use applications such as disposables packaging, while HDPE is known for being one of the safest types of plastic.

Further analysis needs to be conducted to determine if PET and HDPE plastics meet the requirements for sterilisation, safety, preservation, etc. of medical equipment used in the healthcare industry. This will require a joint effort between the packaging manufacturers, manufacturers of medical equipment, hospitals, and recyclers to ensure that the ideal plastic type is identified.

Second, to make the plastics used within hospitals easier to recover and recycle at the end of life, it is important to require the printing of plastic codes for products and packaging. Greater transparency regarding the types of plastic being used will ensure that recyclers can more easily process and recycle plastic waste.

Lastly, there is a need to work with manufacturers of plastic products to minimise the amount of mixed plastic used. Products that combine different types of plastic or combine plastic with other materials make it more difficult to separate and recycle plastic waste.

APPENDIX A



APPENDIX B



APPENDIX C

Category	Detailed Description	Plastic Type	Estimated Number	Estimated Weight (g)
Adhesive	White Adhesive Backing Sheet	Unmarked (Polycoated Kraft Paper)	15	5
Adhesive	Yellow Adhesive Backing Sheet	Unmarked (Polycoated Kraft Paper)	25	5
Bubble Wrap	Bubble Wrap	LDPE	100	2000
Disposables Packaging	Surgical Glove Packaging	Unmarked (Coated Medical Grade Paper)	3	10
Disposables Packaging	Steri-Drape Packaging	Unmarked (LDPE)	2	10
Disposables Packaging	Transparent Plastic Bags	Unmarked (LDPE)	10	25
Disposables Packaging	Catheter Packaging	Mixed (Paper/PET/LDPE)	3	10
Disposables Packaging	Chloorhexidine Digluconaat Packaging	Unmarked (HDPE)	1	5
Disposables Packaging	Colour Sterile Film	Mixed (PET/PE)	20	100
Disposables Packaging	Translucent Sterile Bag	Unmarked (PP)	50	1500
Disposables Packaging	Biogel Brand Gloves Pack	Mixed (PET/LDPE)	100	500
Disposables Packaging	Paper Backed Plastic Bags	Mixed (Coated Medical Grade Paper/HDPE)	30	700
Disposables Packaging	Large Adhesive Translucent Plastic Bag	Unmarked (HDPE)	20	175
Disposables Packaging	Big Case Back Table Cover Packaging	Mixed (Coated Medical Grade Paper/LDPE)	2	10

Disposables Packaging	3M Tegaderm Film Packaging	Mixed (Coated Medical Grade Paper/HDPE)	1	5
Disposables Packaging	Klinion Soft Nitrile Examination Glove Packaging	Mixed (PET/LDPE)	1	5
Disposables Packaging	Hard Plastic Packaging	Unmarked (PVC)	6	550
Disposables Packaging	Hard Plastic Blister Packaging	Mixed (PVC/LDPE)	4	20
Disposables Packaging	Vicryl Polyglactin 910 Packaging	Mixed (Aluminium/Paper)	6	50
Disposables Packaging	Needle Overwrap	Unmarked (LDPE)	6	10
Disposables Packaging	Plastic Packaging Material	Unknown	1	3
Disposables Packaging	Flexible Plastic Blister Packaging	Unmarked (HDPE)	3	10
Disposables Packaging	Transparent Plastic Overwrap	Unmarked (HDPE)	3	10
Disposables Packaging	Transparent Plastic Bags	Unmarked (HDPE)	5	20
Disposables Packaging	Hard Plastic Blister Packaging	PET	5	750
Disposables Packaging	Plastic Packaging Material	HDPE	1	5
Eyeshield & Lenses	Euroguard Eyeshield	Unmarked (PET)	3	10
Food Packaging	Food Plastic	Unknown	3	5
Food Packaging	Becel Margarine Portion Packaging	Unmarked (7 plastic)	2	5
Gloves	Klinion Soft Nitrile Examination Gloves	Nitrile Rubber	2	100
Medical Bag	Perforated Plastic Bag	Unmarked (LDPE)	15	100

Medical Bag	Ziplock Bags	LDPE	3	10
Medical Bag	Adhesive Lab Bag	Unmarked (PP)	5	20
Medical Bag	Translucent Plastic Bags	Unmarked (LDPE)	20	25
Medical Bag	Blue Lab Bag	Unmarked (PP)	15	25
Medical Bag	Small Specimen Bags	Unmarked (PP)	3	10
Plastic Cups	White Disposable Plastic Cup	Unmarked (PP)	5	50
Plastic Cups	Plastic Cups	PP	2	10
Plastic Medical Bottles & Accessories	Assorted Plastic Caps	Unmarked (PP)	6	20
Plastic Medical Bottles & Accessories	Plastic Lids	Unmarked (PVC)	4	10
Plastic Medical Bottles & Accessories	Plastic Bottles	Unmarked (PET)	6	275
Plastic Medical Bottles & Accessories	Plastic Container Holder	PP	1	15
Sterile Liquid Container	Sterile Inhalation Water Pack	Unmarked (PP)	1	25
Sterile Liquid Container	Ringerlactaat Flexible Bag	7 Plastic	6	100
Sterile Liquid Container	Sterile Water for Injection Mini-Plasco	LDPE	6	50
Sterile Liquid Container	Caps for Mini-Plasco	LDPE	17	50
Syringe & Accessories	Syringe	Mixed (PP/HDPE/Rubber)	3	25

Syringe & Accessories	Needle Caps	Unmarked (PP)	9	50
Tray	Plastic Tray	Unmarked (PS)	1	100
Tray	Blue Plastic Tray	Unmarked (PS)	4	400
Tubing & Accessories	Dialysis Tubing	Unmarked (PVC)	10	100
Tubing & Accessories	Dialysis Tubing Connectors	Mixed (PS/ABS)	5	25
Tubing & Accessories	Plastic Tube Clamps	Unmarked (7 Plastic)	2	10
Tubing & Accessories	Plastic Tube Clamps	Unmarked (7 Plastic)	2	5
Tubing & Accessories	Hard Plastic Tube	Unmarked (PVC)	2	10
Tubing & Accessories	Plastic Tube Spiral Luer Adapters	Mixed (ABS/PVC/PP)	10	25
Tubing & Accessories	Plastic Connector Tubes	Unmarked (PVC)	2	10
Tubing & Accessories	Corrugated Tubing	Unmarked (LDPE)	1	5
Tubing & Accessories	Pipe Fittings	Unmarked (PVC)	5	25
Tubing & Accessories	Plastic Tab	7 Plastic	1	3
Tubing & Accessories	Venoject Luer Adapter	PP	7	30
Tubing & Accessories	Yellow Plastic Tubes	Unmarked (PVC)	9	20
Tubing & Accessories	Parts of Clear Plastic Tubes	Unmarked (PVC)	8	15
Tubing & Accessories	Parts of Translucent Plastic Tubes	Unmarked (Silicone)	3	15