Nordic Council of Ministers

PLASTIC PACKAGING RECYCLABILITY

IN A NORDIC CONTEXT

Plastic packaging recyclability in a Nordic context

Rebecca Briedis and Frode Syversen

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Summary

The Circular Economy Package demands an increase in recycling targets for municipal waste. If the Nordic countries are to meet the new proposed target, more efficient recycling must be enabled. By designing packaging for recyclability, higher recycling rates may be reached. The main aim of this project was to contribute to higher recycling rates of plastic packaging by supporting Nordic producers in implementing validated design for recyclability principles when designing their packaging. The project was a collaboration between Producer Responsibility organisations in Norway, Finland, Sweden, Iceland and Estonia.

Fact sheets were developed for HDPE, PP, LDPE, and bio-based and biodegradable plastics. These fact sheets have collated all available recommendations on how to design plastic packaging for sortability and recyclability. The guidelines relate to colouring, label material, closure system, additives and barrier materials etc. The fact sheets have Norway-specific information in terms of downstream solutions for the management of these materials. The producers now have easy access to relevant information on design guidelines, allowing them to understand where changes are required.

Tests of plastic packaging from households were undertaken in Norway and Finland. These tests were based on taking samples from the different outgoing streams from the sorting plant during normal operation. The aim of the test was to identify common products/product groups that were lost through the sorting plant. Together with the fact sheets, the results were distributed to producers to increase awareness of the challenges surrounding the sorting and recyclability of various plastic packaging products.

Over the year, producers in Norway have worked towards making changes to packaging products that prove difficult to either sort or recycle. Some producers have however started to produce new versions of their products.

Plastic packaging waste has similar compositions in several Nordic countries and there are many common challenges. The work carried out in this project has assisted in harmonising the guidelines across the regions so that producers are able to implement best practices in an efficient manner. The advancement in Norway has given insight to the other countries on how increased communication at all levels has enabled producers in achieving packaging products that are fully sortable and recyclable. This project is well on its way to leading to higher recycling rates and better access to recycled material on the European market.

1. Introduction

The Circular Economy Package demands a shift in knowledge and practice in the Member States of the European Union. One key element is the drastically increased recycling targets for municipal waste. Specifically, plastic packaging may see targets increasing from 30% up to 55%.

However, not all plastic packaging is well suited for recycling, for reasons that are both technical and related to market conditions. If the Nordic countries are to meet the new proposed target in the circular economy package, the value chain of plastic packaging must engage in a collaborative process to enable more efficient recycling. By designing packaging for recyclability, higher recycling targets may be reached, and the cost of doing so will decrease.

To design for recyclability requires an understanding of the current technology for sorting and recycling. It is therefore important that this knowledge is communicated and implemented among producers in the Nordic countries. Preliminary work was carried out with selected Norwegian producers, such as Tine, Bama, Mills, Orkla Home and Personal Care, Orkla Foods and Fjordland. Sorting of selected packaging solutions from mixed plastics to the correct monomaterial stream, has increased from near 0% to more than 80% using the Near Infrared (NIR) technology which is standard all over the world.

This project has been a collaboration between Producer Responsibility organisations in Norway, Finland, Iceland and Estonia.

1.1 Aims and Objectives

There are bottlenecks preventing recycling both in the sorting, washing, further processing and marketing of recycled materials. The main aim of this project was to contribute to higher recycling rates of plastic packaging by supporting Nordic producers in implementing validated design for recyclability principles when designing their packaging.

The main activities tied to the project are:

- An analysis of the output at sorting facilities for plastic packaging currently used by Producer Responsibility Organisations in the Nordic countries;
  - This resulted in a report where problematic packaging solutions are presented.
- An updated literature review of design for recyclability practices;
  - Built on previous work carried out by Grønt Punkt Norge AS.

- A workshop with producers where results from the analysis of the sorting facilities will be presented, challenges will be identified and prioritised;
- Test redesigned packaging at TOMRA's test facility;
  - Develop improved testing methodology for recyclability.
- Compile test results and develop general guidelines for distribution among producers;
- Communication activities to reach target groups in relevant industries and their supplier's chain.

During this project we intended to investigate the status of recyclability of plastic packaging in the partners' respective countries. Although the current sorting technology was the focus of the study, the market for recycled materials in question was also taken into account. This demands general, validated knowledge of how design choices influence recyclability, and success stories showing how this can be converted into practice. Circular economy calls for solutions that are both technologically feasible and produces recycled materials that are in demand. By meeting these criteria, designing for recyclability will facilitate higher levels of recycling at a reasonable cost.

This project will bring the value chain of plastic packaging together, to learn and find solutions that enable more efficient recycling. Bio-based and biodegradable plastics have been a hot topic over the last year and producers are interested in this type of material. These materials and their downstream solutions in Norway were researched in order to produce a fact sheet with information for producers.

2. Methodology

2.1 Progress

With several partners in 4 countries, this was a challenging project to organise. Establishing good cooperation and communication with companies in other countries and executing the tests took time. This was due to a number of reasons, one of them being that Iceland was starting a new contract with a new sorting centre. This meant that the plastic packaging was going to be shipped elsewhere, and at a new sorting centre, it takes time to create normal sorting conditions. The plastic packaging must undergo tests to optimise the sorting. Tests of the Icelandic packaging were therefore postponed, and, in the end, it was not possible to complete a test within the time frame given.

2.2 Updated Guidelines on Design for Recycling

In 2017, Green Dot Norway, in collaboration with FTI Sweden, published guide on design for recycling.[1] The information in this report was assessed and a literature review was undertaken to gather any new information on the sortability of different material types and their properties. Correspondence with experts within sorting and recycling were consulted to gather new and correct information to update the existing knowledge on guidelines for recycling.

2.3 Test of Plastic Packaging

Tests of plastic packaging from households were undertaken in Norway and Finland. These tests were based on taking samples from the different outgoing streams from the sorting plant during normal operation. The aim of the test was to obtain an overall view of the outgoing flows, quality, and yield for different materials. The specific objectives of the test were:

- to document the quality on sellable quantities;
- identify several products that are mainly lost in the plant, either in mixed plastic or in combustible over 60 mm.

[1] Green Dot Norway (2017). *Basic Facts Report on Design for Plastic Packaging Recyclability.* Available at: https://www.grontpunkt.no/media/2777/report-gpn-design-for-recycling-0704174.pdf (Last accessed: 28 January 2019).

Samples were taken from each outgoing flow and from the reject (remaining waste fraction). The 20 most common products/products groups that were lost through the sorting plant were identified. Specific focus was on these types of products:

- Black plastic packaging
- Products with sleeves
- Products with large labels
- Packaging products with mixed materials.

All contaminations were removed from each fraction and the quality was characterised according to the specifications made in the requirements by Der Grüene Punkt.[2] All plastic packaging that falls into the categories listed above were separated from the plastic fractions to calculate the number of products per material type, both in the reject and in the sellable quantities. This way, a rough estimation of the separation rate can be obtained.

[2] Der Grüene Punkt (2014). *Product specification sheets*. Information for suppliers, specifications. Available at: https://www.gruener-punkt.de/en/downloads.html (Last accessed: 28 January 2019).

3. Results

3.1 Fact sheets

Fact sheets have been developed for the main plastic material types: HDPE, PP and LDPE. These fact sheets have collated all available recommendations on how to design plastic packaging for sortability and recyclability.

An information sheet on bio-based and biodegradable plastics was also developed. This fact sheet included definitions, knowledge of the different bio-based and biodegradable material types, which certification schemes exist, and downstream solutions for the management of these materials in Norway. The existing waste management systems in place in a country will determine how these types of plastics are handled, and it was important to gather Norway-specific information on this for producers of packaging products.

The fact sheets can be found in the attached appendices.

3.1.1 Main Recommendations

There are many elements tied to design for recycling and the fact sheets try to incorporate all. The guidelines relate to the colour of a product, the material of the label and the closure system etc. There are also requirements regarding the volume of additives and barrier materials used.

Having performed multiple tests of plastic packaging, and through communication with experts within sorting and recycling, certain main messages can be communicated:

- Carbon black is not visible to the sorting machines, and products with this pigment will not be separated for recycling;
- Sleeves and large labels can impact the correct separation of a plastic product. Ideally, the material of the sleeve or label should be the same as the product it is covering;
- PVC, metal, aluminium and paper barriers create challenges during recycling and should be avoided;
- Ink directly on the packaging product can contaminate the recycled material;
- Monomaterials are easier to recycle than products made from a range of materials.

3.2 Analysis Plastic Packaging – Norway

In March of 2018, a test of Norwegian household plastic packaging was conducted at the ROAF sorting plant for residual waste. The outgoing plastic fractions were analysed for quality and interesting products were set aside. The results are shown in the tables below. The quality specification number refers to the requirements set out by Der Gruene Punkt. There were multiple samples taken from each fraction and the yellow columns of each table show the weighted average of these.

Table 1: PP: Quality specification 324

		Sorted 13 March 2018		Sorted 14 March 2018		Weighted average	
	Kg	27.5		33.5		61	
	Max (%)	**kg**	**%**	**kg**	**%**	**kg**	**%**
PP		23.9	89.8%	27.8	87.0%	51.7	88.3%
PP-film		1.38	5.2%	1.7	5.3%	3.08	5.3%
PP with sleeves		0.73	2.7%	1.15	3.6%	1.88	3.2%
Total purity		*26.01*	*97.7%*	*30.65*	*96.0%*	*56.66*	*96.8%*
Metallic and mineral Items over 100 g	0						
Cartridges for sealants	0						
Other metal items	0.5	0.03	0.1%	0.09	0.3%	0.12	0.2%
Rigid PE items	1			0.07	0.2%	0.07	0.1%
Foamed plastics, inkl EPS	0.5						
Plastic films	2						
Other residues/impurities*	3	0.57	2.1%	1.13	3.5%	1.7	2.9%
Total amount impurities	*6*	*0.6*	*2.3%*	*1.29*	*4.0%*	*1.89*	*3.2%*
Total amount sorted		*26.61*	*100.0%*	*31.94*	*100.0%*	*58.55*	*100.0%*

Note: * glass, paper, cardboard, liquid packaging boards, aluminised plastic, rubber, wood, textiles, nappies, food, garden waste, stones.

Table 2: HDPE: Quality specification 329

		Sorted 9 March 2018		Sorted 13 March 2018		Weighted average	
	Kg	45		32.6		77.6	
	Max (%)	**kg**	**%**	**kg**	**%**	**kg**	**%**
HDPE		32.6	76.1%	26.2	82.5%	58.8	78.8%
HDPE with sleeves		5.56	13.0%	3.01	9.5%	8.57	11.5%
PET		0.56	1.3%	0.31	1.0%	0.87	1.2%
Total purity		*38.7*	*90.4%*	*29.52*	*92.9%*	*68.24*	*91.5%*
Metallic and mineral Items over 100 g	0						
Cartridges for sealants	0						
Other metal items	0.5	0.18	0.4%	0.03	0.1%	0.21	0.3%
Rigid PP items	3	0.56	1.3%	0.25	0.8%	0.81	1.1%
Foamed plastics, inkl EPS	0.5						
Plastic films	5	1.72	4.0%	1.78	5.6%	3.5	4.7%
Other residues/impurities*	3	1.66	3.9%	0.18	0.6%	1.84	2.5%
Total amount impurities	*6*	*4.12*	*9.6%*	*2.24*	*7.1%*	*6.36*	*8.5%*
Total amount sorted		*42.8*	*100.0%*	*31.76*	*100.0%*	*74.6*	*100.0%*
Unopened bags		1.34		0.15		1.49	2.0%
Total		*44.2*		*31.91*		*76.09*	

Note: * glass, paper, cardboard, liquid packaging boards, aluminised plastic, rubber, wood, textiles, nappies, food, garden waste, stones.

Table 3: LDPE: Quality specification 310-1

		Sorted 13 March 2018		Sorted 14 March 2018		Weighted average	
	Kg	25.0		15.0		40	
	Max (%)	**kg**	**%**	**kg**	**%**	**kg**	**%**
Paper, cardboard	1	0.29	1.3%	0.23	1.9%	0.52	1.5%
Metallic and mineral Items over 100 g	0					0	
Other metal items	0.5	0.06	0.3%	0.1	0.8%	0.16	0.5%
Other plastic items	4	0.23	1.0%	0.1	0.8%	0.33	1.0%
Other residues/impurities*	4	0.39	1.8%	0.11	0.9%	0.5	1.5%
Total amount impurities	*8*	*0.97*	*4.4%*	*0.54*	*4.6%*	*1.51*	*4.4%*
Split film:							
PE-film transparent		5.7	25.6%	2.61	22.1%	8.31	24.4%
PE-film coloured		14.59	65.6%	7.94	67.2%	22.53	66.2%
PE-laminated plastic film		0.91	4.1%	0.66	5.6%	1.57	4.6%
PP-film		0.06	0.3%	0.06	0.5%	0.12	0.4%
Other film							
Total purity		*21.26*	*95.6%*	*11.27*	*95.4%*	*32.53*	*95.6%*
Total amount sorted		*22.23*	*100.0%*	*11.81*	*100.0%*	*34.04*	*100.0%*
Unopened bags		2.64		2.28		4.92	12.6%
Total		*24.87*		*14.09*		*38.96*	

Note: * glass, liquid packaging boards, aluminised plastic, rubber, wood, textiles, nappies, food, garden waste, stones.

Table 4: Mixed PET 90/10: Quality specification 328-1

		Sorted 13 March 2018		Sorted 13 March 2018		Weighted average	
	Kg	35.3		32.3		67.6	
	Max (%)	**kg**	**%**	**kg**	**%**	**kg**	**%**
PET trays, clear		6.62	19.1%	7.61	25.0%	14.23	21.9%
PET trays, coloured		1.1	3.2%	1.14	3.7%	2.24	3.4%
PET bottles, coloured		3.85	11.1%	3.36	11.0%	7.21	11.1%
PET bottles, clear		13.4	38.7%	10.17	33.4%	23.57	36.2%
PET bottles, with sleeve		2.34	6.8%	1.77	5.8%	4.11	6.3%
Pant, Swedish		1.3	3.8%	0.94	3.1%	2.24	3.4%
Pant, Norwegian		4.6	13.3%	4.45	14.6%	9.05	13.9%
Total purity		*33.21*	*96.0%*	*29.44*	*96.7%*	*62.65*	*96.3%*
Metallic and mineral Items over 100 g	0						
Other metal items	0.5			0.08	0.3%	0.08	0.1%
Other plastic items	2	0.14	0.4%	0.49	1.6%	0.63	1.0%
PVC items	0.1						
Other residues/impurities*	2	1.24	3.6%	0.43	1.4%	1.67	2.6%
Total amount impurities	*2*	*1.38*	*4.0%*	*1*	*3.3%*	*2.38*	*3.7%*
Total amount sorted		*34.59*	*100.0%*	*30.44*	*100.0%*	*65.03*	*100.0%*

Note: * glass, paper, cardboard, liquid packaging boards, aluminised plastic, rubber, wood, textiles, nappies, food, garden waste, stones.

Table 5: Mixed Plastics: Quality specification 350

		Sorted 9 March 2018		Sorted 13 March 2018		Sorted 14 March 2018		Weighted average	
	Kg	30		27.6		34.6		92.2	
	Max (%)	**kg**	**%**	**kg**	**%**	**kg**	**%**	**kg**	**%**
Paper, cardboard	5	1.33	5.2%	0.28	2.6%	0.59	3.0%	2.2	3.9%
Metallic and mineral Items over 100 g	0							0	0.0%
Other metal items	2	1.5	5.8%	0.15	1.4%	0.44	2.2%	2.09	3.7%
PET-bottles transparent	4	1.95	7.6%	0.34	3.2%	1.06	5.4%	3.35	6.0%
PVC items other than packaging	0.5			0.02	0.2%			0.02	0.0%
Other residues/impurities*	3	6.7	26.1%	1.57	14.7%	5.1	26.0%	13.37	23.9%
Total amount impurities	*10*	*11.48*	*44.7%*	*2.36*	*22.1%*	*7.19*	*36.6%*	*21.03*	*37.6%*
Split mixed plastic:									
PP		1.79	7.0%	0.61	5.7%	1.14	5.8%	3.54	6.3%
PP film		0.48	1.9%	1.62	15.2%	0.78	4.0%	2.88	5.1%
Sleeves – mixed material						0.25	1.3%	0.25	0.4%
PET trays		6.65	25.9%	3.05	28.6%	5.33	27.1%	15.03	26.8%
PS		0.31	1.2%	0.035	0.3%	0.13	0.7%	0.475	0.8%
HDPE		2.06	8.0%	0.17	1.6%	1.54	7.8%	3.77	6.7%
PE film						1.39	7.1%	1.39	2.5%
PE laminated film		2.9	11.3%	2.83	26.5%	1.9	9.7%	7.63	13.6%
Total		*14.19*	*55.3%*	*8.315*	*77.9%*	*12.46*	*63.4%*	*34.965*	*62.4%*
Total amount sorted		*25.67*	*100%*	*10.675*	*100%*	*19.65*	*100%*	*55.995*	*100%*
Unopened bags		3.61	12%	16.5	61%	14.3	42%	34.41	38.1%
Total		*29.3*		*27.175*		*33.95*		*90.405*	

Note: *glass, liquid packaging boards, aluminised plastic, rubber, wood, textiles, nappies, food, garden waste, stones.

The waste fraction was not sorted during the test at the ROAF sorting plant. A sample was taken, and the waste was sorted, but no specific products were found so this fraction was not analysed and recorded in detail.

The table below refers to specific products that were separated from each fraction. Some were problematic and ended up in different plastic fractions, while others were correctly sorted.

Table 6: Output of certain Norwegian products in each material fraction

Product	Material	Sleeve	Total	PP	PET	HDPE	Mix	Film
Mills Delikat	PET	-	98		50		48	
Idun ketchup/mustard	PP		75	72			3	
Ice cream tubs	PP	-	85	81			4	
Salad bags	PP film	-	26	17			9	
PET trays - white	PET	-	47		36		11	
PET trays - clear	PET	-	11				11	
Comfort	PET	PET	36		34		2	
Softlan fabric softner	PET	PP	14		9	1	4	
Drinkable yoghurt	HDPE	PET	30			28	2	
Milo fabric softner	HDPE	PET	30			29	1	
Domestos detergent	HDPE	PET	11			11		
Jif detergent	HDPE	PET	8			8		
Krystal detergent	HDPE		6			6		
Propud shake	HDPE	PS	11			11		
Jif cream detergent	HDPE	PET	7			7		
Jif spray	HDPE	PET	11			11		
Blenda fabric softner	HDPE	PET	6			6		
Ajax spray, detergent	PET	PET	6		6			
Mills Melange/Vita	PP		29	29				
Raisin tubs	PP	?	9	9				
Chocolate spread	PP		31	31				

There has been a lot of work on the ROAF sorting plant over the years to improve the yield of each product. The NIR machines have been adjusted to recognise certain products that have characteristics which make them difficult to sort, but that are fully recyclable. Many of the products listed in the table above have been correctly sorted, while other products end up in different plastic fractions. It is difficult to understand whether these products are incorrectly sorted by chance, or because the products are difficult to read. The results from this test have been used by Green Dot Norway in the communication and work with producers in Norway.

3.3 Product Improvements

Over the year, producers in Norway have been working towards making changes to certain packaging products that prove difficult to either sort or recycle. A lot of work takes place behind the scenes, between the producer of a plastic packaging product, and their supplier, and this work is time consuming. In many cases a specific material, sleeve material or covering film is chosen for reasons tied to the durability of the content of the packaging product, or the properties of the packaging. Making changes is not necessarily easy. Using different materials will alter the properties of the

packaging product and more changes may have to be made to ensure the packaging product and its contents obtain the required quality.

Several producers in Norway have spent lots of time testing new packaging solutions. However, these tests take time. Storage tests take several months, and if part of the packaging doesn't behave as expected at this time, new tests must be undertaken with a different alternative. Some producers have however started to produce new versions of their products. Mills is an example of a producer that changed the sleeve material on their PP bottle from PET to PP.[3] It took a while, though after many tests, the new packaging product could enter production on a large scale and replace the previous PP bottle with the PET sleeve that was difficult to sort correctly.

Orkla's ketchup bottle is another example of a product where the recycling rate has increased by up to 70%.[4] The PP bottle originally had a PE-sleeve, which made it difficult to sort in some sorting centres (see picture below). By changing the sleeve to PP, the bottle can easily be identified by the NIR sorting technology and separated into the PP fraction.

Figure 1: Orkla's ketchup bottle (PP) with a PE-label (left) and PP-label (right)

The examples given above are some of the few concrete changes that have been made in relation to design for recycling. However, one of the most important impacts this project has had, is the increased awareness of challenges related to recycling, and that it is in large up to producers whether they wish to follow the guidelines given to make

[3] Packnews (2018). *Nytt Foliematerial gjør Mills-Emballasjen Gjenvinnbar.* Online article. Available at: http://www.packnews.no/default.asp?id=14200&show=more (Last accessed: 29 January 2019).
[4] Teknisk Ukeblad (2018). *Flasken til Høyre kan gi 70 Prosent mer Gjenbruk*. Website article. Available at: https://www.tu.no/artikler/flasken-til-hoyre-kan-gi-70-prosent-mer-gjenbruk/435986

their products sortable and recyclable. Black plastic packaging is a good example of how a change often comes down to the willpower of the producer of the packaging product. Black plastic is sometimes used as a light barrier, however in most cases, black is a design choice used solely to marketing reasons. The dark colour creates a contrast to the food that the consumer can find appealing. A fear many producers have had is that a change in colour could impact the sale volumes. However, several producers have started the process of changing their packaging colour to a transparent, clear colour. Other producers have vowed that carbon black (the pigment used) will not be an available choice for any new products. This progress shows that producers are aware of the challenges related to carbon black and are willing to adapt to increase the level of recyclability of their products.

3.3.1 Guideline Challenges

During the creation of the guidelines on design for recycling, several elements have been discussed where there is no clear guideline on what is right and wrong. PET trays are one example of this. PET trays are not recycled at large today, however there are companies that do recycle these trays (their recyclability is linked to whether they are lined with a PE-film or not). There are technologies that are becoming more available, and PET trays could potentially be fully recyclable within a few years. PET trays do also often contain recycled bottles, and this is good for the circular economy. So even though PET trays are not recycled at large today, there are positive advantages with using this material.

The issue of PP versus PS is another topic of question. PS is a very lightweight material and PS products can weigh half of what the same product would weigh if it were PP. PS is possible to recycle, although due to such small volumes, not all sorting centres will separate PS. However, it is possible that more sorting centres will separate PS for recycling in the future.

There are many examples where the consideration for recyclability and climate footprint point in different directions. In these cases, it is difficult to know which solution is best and what to recommend to producers.

3.4 Analysis Plastic Packaging – Finland

A test of Finnish plastic packaging was conducted at the Fortum sorting plant in Riihimaki, Finland, in January 2018. This sorting plant accepts source separated plastic packaging from households. The outgoing plastic fractions were analysed for quality and interesting products were set aside. The results are shown in the tables below. The quality specification number refers to the requirements set out by Der Gruene Punkt.

Due to limitations at the plant, only small samples were collected, and for most fractions, only one sample of each material. Unfortunately, this limits the reliability of the test and the outcome. Analyses performed regularly at the Fortum sorting plant are

different from the ones performed in this project and are not directly comparable. We were therefore not able to check whether our results are representative or not.

The small samples also lower the reliability of the product specific information. When only 1 or 2 products are found, whether they were sorted into the right or wrong fraction, it is uncertain whether they ended up there by chance, or whether they were purposefully sorted there.

Table 7: PP: Quality specification 324

		Sorted 16 January 2019		Weighted average	
	Kg	15.13		15.13	
	Max (%)	**kg**	**%**	**kg**	**%**
PP		11.175	79.2%	11.175	79.2%
PP, black		0.055	0.4%	0.055	0.4%
PP-folie		0.44	3.1%	0.44	3.1%
PP with sleeves		0.04	0.3%	0.04	0.3%
Other PP items (non-packaging)		0.61	4.3%	0.61	4.3%
Total purity		*12.32*	*87.3%*	*12.32*	*87.3%*
Metallic and mineral Items over 100 g	0				
Cartridges for sealants	0				
Other metal items	0.5				
Rigid PE items	1	0.14	1.0%	0.14	1.0%
Black items, non-PP		0.055	0.4%	0.055	0.4%
Foamed plastics, inkl EPS	0.5	0.025	0.2%	0.025	0.2%
Plastic films	2	0.465	3.3%	0.465	3.3%
Crumpled products		0.77	5.5%	0.77	5.5%
Other residues/impurities*	3	0.335	2.4%	0.335	2.4%
Total amount impurities	*6*	*1.79*	*12.7%*	*1.79*	*12.7%*
Total amount sorted		*14.11*	*100.0%*	*14.11*	*100.0%*
Unopened bags		0.94	6.7%	0.94	6.7%
Total		*15.05*		*15.05*	

Note: * glass, paper, cardboard, liquid packaging boards, aluminised plastic, rubber, wood, textiles, nappies, food, garden waste, stones.

Table 8: HDPE: Quality specification 329

		Sorted 15 January 2019		Weighted average	
	Kg	14.21		14.21	
	Max (%)	**kg**	**%**	**kg**	**%**
HDPE		11.25	79.4%	11.25	79.4%
HDPE with sleeves		0.605	4.3%	0.605	4.3%
PET		0.495	3.5%	0.495	3.5%
Total purity		*12.4*	*87.2%*	*12.35*	*87.2%*
Metallic and mineral Items over 100 g	0				
Cartridges for sealants	0				
Other metal items	0.5				
Black items		0.14	1.0%	0.14	1.0%
Rigid PP items	3	0.255	1.8%	0.255	1.8%
HDPE products		0.445	3.1%	0.445	3.1%
Foamed plastics, inkl EPS	0.5				
Plastic films	5	0.6	4.2%	0.6	4.2%
Other residues/impurities*	3	0.38	2.7%	0.38	2.7%
Total amount impurities	*6*	*1.82*	*12.8%*	*1.82*	*12.8%*
Total amount sorted		*14.2*	*100.0%*	*14.2*	*100.0%*
Unopened bags		0		0.0	0.0%
Total		*14.2*		*14.2*	

Note: * glass, paper, cardboard, liquid packaging boards, aluminised plastic, rubber, wood, textiles, nappies, food, garden waste, stones.

Table 9: LDPE: Quality specification 310-1

		Sorted 13 March 2019		Weighted average	
	Kg	6.5		6.49	
	Max (%)	**kg**	**%**	**kg**	**%**
Paper, cardboard	1	0.005	0.1%	0.005	0.1%
Metallic and mineral Items over 100 g	0				
Other metal items	0.5				
Black rigid items		0.067	1.0%	0.067	1.0%
Foamed plastics, incl. EPS		0.065	1.0%	0.065	1.0%
Other plastic items	4	0.695	10.7%	0.695	10.7%
Other residues/impurities*	4	0.015	0.2%	0.015	0.2%
Total amount impurities	*8*	*0.847*	*13.1%*	*0.847*	*13.1%*
Split film:					
PE-film transparent		2.225	34.3%	2.225	34.3%
PE-film coloured		2.955	45.6%	2.955	45.6%
PE-laminated		0.365	5.6%	0.365	5.6%
PP-film		0.09	1.4%	0.09	1.4%
Other film					
Total purity		*5.635*	*86.9%*	*5.635*	*86.9%*
Total amount sorted		*6.482*	*100.0%*	*6.482*	*100.0%*
Unopened bags		0		0	0.0%
Total		*6.482*		*6.482*	

Note: * glass, liquid packaging boards, aluminised plastic, rubber, wood, textiles, nappies, food, garden waste, stones.

Table 10: Mixed Plastics: Quality specification 350

		Sorted 15 January 2019		Sorted 15 January 2019		Weighted average	
	Kg	12.32		14.73		27.05	
	Max (%)	**kg**	**%**	**kg**	**%**	**kg**	**%**
Paper, cardboard	5	0.075	0.7%	0.155	1.2%	0.23	0.9%
Metallic and mineral Items over 100 g	0						
Other plastic items		0.655	5.7%	0.305	2.3%	0.96	3.9%
Other metal items	2						
Foamed plastics incl. EPS		0.175	1.5%	0.265	2.0%	0.44	1.8%
Textiles		0.03	0.3%			0.03	0.1%
PET-bottles, transparent	4	1.055	9.2%	1.2	9.0%	2.255	9.1%
PVC items other than packaging	0.5						
Other residues/impurities*	3	0.56	4.9%	0.435	3.3%	0.995	4.0%
Total amount impurities	*10*	*2.55*	*22.3%*	*2.36*	*17.7%*	*4.91*	*19.8%*
Split mixed plastic:							
PP		1.625	14.2%	1.89	14.2%	3.515	14.2%
PP film		0.47	4.1%	0.925	7.0%	1.395	5.6%
Sleeves – mixed material		0.215	1.9%	0.835	6.3%	1.05	4.2%
PET trays		0.735	6.4%	0.68	5.1%	1.415	5.7%
PS		2.005	17.5%	1.87	14.1%	3.875	15.6%
Black plastic trays		0.445	3.9%	0.61	4.6%	1.055	4.3%
HDPE		1.24	10.8%	0.865	6.5%	2.105	8.5%
PE film		1.34	11.7%	2.65	19.9%	3.99	16.1%
PE laminated film		0.835	7.3%	0.62	4.7%	1.455	5.9%
Total amount		*8.91*	*77.7%*	*10.945*	*82.3%*	*19.855*	*80.2%*
Total amount sorted		*11.46*	*100.0%*	*13.305*	*100.0%*	*24.765*	*100.0%*
Unopened bags		0.665	5%	1.315	9%	1.98	7.4%
Total		*12.1*		*14.62*		*26.7*	

Note: * glass, liquid packaging boards, aluminised plastic, rubber, wood, nappies, food, garden waste, stones.

Table 11: Waste/Reject

		Sorted 16 January 2019		Weighted average	
	Kg	10.995		10.995	
	Max (%)	**kg**	**%**	**kg**	**%**
Paper, cardboard	5				
Metallic and mineral Items over 100 g	0				
Other metal items		0.308	3.0%	0.308	3.0%
PP		1.58	15.4%	1.58	15.4%
HDPE	2	0.13	1.3%	0.13	1.3%
Film		2.415	23.5%	2.415	23.5%
Black items		0.22	2.1%	0.22	2.1%
Other hard plastic		0.91	8.8%	0.91	8.8%
PET-bottles, transparent		0.06	0.6%	0.06	0.6%
Textiles	4				
Sleeved products	0.5	0.015	0.1%	0.015	0.1%
Other waste/residues	3	4.655	45.2%	4.655	45.2%
Total amount waste	*10*	*10.293*	*100.0%*	*10.293*	*100.0%*
Total amount sorted		*10.293*	*100.0%*	*10.293*	*100.0%*
Unopened bags		0.675	6%	0.675	6.6%
Total		*11.0*		*11.0*	

According to Fortum, the waste fraction usually contains a lot of paper and textiles. There was a lack of these items in this sample which could indicate that the sample did not contain a representative picture of the waste fraction.

The table below refers to specific products that were separated from each fraction. Some were problematic and ended up in different plastic fractions, while others were correctly sorted. As the sample sizes were so small, few items were found for each product. It is therefore difficult to reach any conclusion on whether the product design is problematic for sorting or not.

Table 12: Output of certain Finnish products in each material fraction

Product	Body	Sleeve	Total	PP	HDPE	Mixed	Film	Waste
Solevita Orange juice	PET	PP	10			10		
Kesan lumous	HDPE	-	1			1		
Milbona yogurt drink	PET	PS	2			1		1
Nutricia cubitan	HDPE	PS	2			2		
Rainbow Jogurttijuoma	PET	PS	2			2		
Vegan majoneesi	PP	PS	2			2		
Nutricia souvenaid	HDPE	ABS	3	1		2		
Benecol	PP	ABS	6	1		5	2	
Danone Actimel	HDPE	PETG	6			1		3
Valio Turkkilainen	PS	Paper	2			2		
Nutridrink	HDPE	PS	1			1		
Tolu	PET	ABS	1			1		
Klorin	HDPE	PP	1			1		
Rainbow mango yogurt drink	PET	PS	1			1		
Flora culinesse laktoositon	PET	PET	1			1		
Cif power and shine	HDPE	ABS	2		1	1		
Skyr drink	PET	PS	1			1		
Krekkalainen Jogurtti	PS	PS	2			2		
Makea chilikastike	PET	Paper	2			2		
Juhla Coffee	PE laminat		8	2		3		3
Valio, Bulgarian Jogurtti	PS	Paper	2			2		
Eila jogurtti	PS	PS	3			3		
Skyr	PP	ABS	1			1		
Maitokolmio ProFit	PS	PS	2			2		
Pirkka jogurttijouma	PET	PS	1					1
Soda Cola	PET	Paper	1	1				
Milbona cream pudding	PP	Paper	1	1				
Seven original hummus	PP	PVC	1	1				
Serto	HDPE	PET	1		1			
Sunlight expert	HDPE	ABS	2		2			
Domestos	HDPE	PET	1		1			
Danup	HDPE	PETG	2		2			
Sonett foam soap	HDPE	Paper	1		1			
Comfort	PET	ABS	1		1			
Finish power gel	HDPE	-	1		1			
Actimel	HDPE		5		2			3
Fair trade shampoo	HDPE	PE	1		1			
Erisan	HDPE	PET	1		1			
Java house	HDPE	-	1		1			
Monivitamini	HDPE	-	1		1			
Kirkastettu voi	PET		1		1			
Vitalinea	HDPE	PETG	1				1	

3.5 Incomplete Project Elements

At the start of this project Iceland was in the process of signing a new contract with the sorting plant Tönsmeier in Germany. The plan was so start sending their household plastic packaging waste there during summer 2018. This was delayed, and the first tests were performed in early fall. Du to this change, it has not been possible to arrange a test of their plastic packaging.

Making changes to plastic packaging already on the market takes time. Our communication with producers of plastic packaging that has a low yield during sorting has revealed that there are many actors involved and many processes that must take place to change the design of a packaging product. Many changes are difficult to execute due to high costs or manufacturing challenges. Due to this, the development of new products to test at TOMRA's test facility has been limited.

4. Concluding Remarks

Plastic packaging waste has similar compositions in several Nordic countries and there are many common challenges. The work carried out in this project has assisted in harmonising the guidelines across the regions so that producers are able to implement best practices in an efficient manner. The waste streams are very similar, so it makes sense to work together instead of trying to solve the same problem separately. Although there are no concrete changes that can be demonstrated in the other countries already, the work achieved in Norway has given insight to the other countries on how we have communicated with producers and worked with them to assist them in achieving packaging products that are fully sortable and recyclable.

The project has contributed to increased awareness of the difficulties surrounding the recyclability of various plastic packaging products. It has contributed to a change in awareness and been an important practical measure in the work on waste prevention in Norway.

There are many companies with similar challenges related to recyclability of their plastic packaging. The fact sheets developed in this project will make it easier for them to have access to relevant information on recommendations. This will allow them to introduce changes in design more easily.

This project is well on its way to leading to higher recycling rates and better recycled material on the European market. It has contributed to the European Union's work towards a circular economy, and the role that Norwegian industries have played should be a role model for other European countries.

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Sammenfatning

Nye krav fra EU krever en økning i materialgjenvinning av husholdningsavfall. For at de nordiske landene skal imøtekomme kravene, må materialgjenvinningen av plast økes. Ved å designe plastemballasje for materialgjenvinning kan man oppnå de nye kravene. Målet med dette prosjektet var å bidra til høyere materialgjenvinning av plastemballasje ved å støtte nordiske produsenter i å implementere designprinsipper i utviklingen av emballasjen sin. Prosjektet ble utført sammen med produsentansvarsorganisasjoner i Norge, Finland, Sverige, Island og Estland.

Faktaark ble utviklet for HDPE, PP, LDPE og for biobasert og bionedbrytbar plast. Disse faktaarkene samlet all informasjon om anbefalinger om hvordan man kan designe plastemballasje for sortering og materialgjenvinning. Guidene inneholder anbefalinger for farger, etikettmaterialer, lukkesystemer, additiver, barrierematerialer og annet. Faktaarkene har spesifikk informasjon om Norge og nedstrømsløsningene som finnes her for de ulike plastmaterialene. Produsenter av plastemballasje har nå enkel tilgang til fakta om design for gjenvinning hvilket gjør det enklere for dem å forstå hvilke endringer som er nødvendige.

Tester av plastemballasje fra husholdninger ble utført i Norge og Finland. Disse testene baserer seg på prøveuttak av plastfraksjoner fra sorteringsanleggene. Hensikten med disse testene var å identifisere vanlige produkter/produktgrupper som går tapt i sorteringsprosessen. Sammen med faktaarkene, ble resultatene distribuert til produsenter for å øke bevisstheten rundt utfordringer ved sortering og gjenvinning av noen plastprodukter.

I løpet av året har produsenter i Norge jobbet med å endre emballasjen sin som hadde elementer som gjorde den vanskelig å sortere eller gjenvinne. Noen produsenter har lykkes i å produsere nye versjoner av sine produkter.

Plastemballasje har lik sammensetning i flere av de nordiske landene og det er mange felles utfordringer. Arbeidet utført i forbindelse med dette prosjektet has bidratt til å bygge opp felles anbefalinger slik at produsenter kan implementere beste praksis på en hensiktsmessig måte. Utviklingen i Norge viser andre land hvordan økt kommunikasjon mellom alle ledd har hjulpet produsenter i å oppnå emballasje som kan både sorteres og gjenvinnes. Dette prosjektet er på god vei til å bidra til økt materialgjenvinning og mer tilgang til gjenvunnet plast på det europeiske markedet.

Appendix

Fact sheets:

- Design for recycling: Bio-based and biodegradable plastic
- Design for recycling: Packaging material: HDPE (rigid)
- Design for recycling: Packaging material: PP (rigid)
- Design for recycling: Packaging material: LDPE (flexible packaging)

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PLASTIC PACKAGING RECYCLABILITY IN A NORDIC CONTEXT

Tests of plastic packaging in Finland and Norway exposed products that are lost in the sorting process and are not recycled. Products that proved challenging to sort or recycle were then presented to their producers. To assist producers in making favourable decisions, fact sheets with design guidelines were developed for common plastics, HDPE, PP, LDPE and bio-based and biodegradable plastics, to highlight which design choices best help improve recyclability. These also include Norway-specific information on the downstream value chain for plastics.

Producers have shown a willingness to improve their products to increase the level of recyclability. These developments show how higher recycling rates of plastic packaging can be achieved by supporting Nordic producers in implementing design for recyclability principles when designing their packaging.

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