From PET bottles to Clothing: Does it have a future in fashion?

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Final thesis

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Since I started as a student at the Amsterdam Fashion Institute my preference concerning subjects were the lessons about fabrics. It didn’t matter if it was in the laboratory or during regular classes, as long as it was about fabrics. When I started to look for a subject for my thesis I knew I wanted to do something with fabrics. In my first thesis proposal I focused more on the corporate fashion industry but this proposal was rejected. This I don’t mind anymore, because I ended up with a subject I was much more interested in and made the thesis more fun to work on. Nonetheless after the first rejection I still had to find a new subject. After some research on the internet I found there was a lot to do about fashion and the environment. But how to combine this with the subject of fabrics? Then I found an article about the upcoming use of PET bottles in fashion and if it really could help the environment. The article didn’t come to a definitive conclusion so I thought maybe I could perform my own research to see if I can get to a clearer conclusion.

So now after I finally figured out my research question I could start the research. Very soon after starting the research I realized this thesis would be going a different direction than I had anticipated. This was because the differences between virgin polyester and recycled polyester weren’t that big. The focus of this thesis quickly shifted to the recycling part. The biggest problem with this research was to find current information because most of the information is from 2008. I tried to obtain current information, but with most of the companies this information wasn’t even available yet. Annual reports are from the year before and the very latest annual report isn’t there yet. Another problem had to do with the companies I approached. Many of them took a long time to respond and even if they did it was hard to get an appointment. Many of my interviews took place over the telephone or by email. Also the decision to write this report in English gave me some trouble. At the end it was a good very good exercise in improving my English writing.

This report wouldn’t exist in this form without the help of several persons. I would like to thank Bijou Boom and Sven Noordhoek from Nedvang, Debbie Wester from Kuyichi, Koos van Nes from AMFI, the customer service from Patagonia and Greenpeace for all their time and the information they have given me. Also I would like to thank my coach Jan de Vries for all his advice and time.

Marion Weinans
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ABSTRACT

This report looks if it is possible to replacing virgin polyester with polyester made out of PET bottles in fashion. To find out if this is possible you have to look at the different ways of collecting and recycling of plastics. Important questions needing to be answered are if there can be enough plastics collected in the entire world to make the use of PET bottles a feasible alternative for virgin polyester and whether the properties of recycled polyester are the same as virgin polyester and if this has to lead to differences in the production method.

In Europe the European Union dictates the targets for recycling for all of its member states. These targets can be found in the EEG directive concerning waste products. The European Union decided that their members have to collect 22,5 percent or more of their plastics, to be separated from the rest of the total amount of trash. From this amount 55 to 80 percent has to be reused or recycled instead of being burnt or ending up at a landfill. In 2008 there should have been a new directive but this hasn’t been issued to date. This is because the members of the EU cannot agree on some issues. Some of the new members states want more time to fulfill the old targets before new targets are to be set. The Netherlands has also obligated their producers and importers to pay a tax and help collect all the plastic they put on to the Dutch market, although so far here it has taken longer for these plans to take effect.

The Netherlands is working hard to fulfill their targets and is even trying to exceed them. In 2006 the decree of packaging, paper and cardboard was approved which states that in 2009 32% of all plastics had to be recycled but if this target has been reached is still unknown. This figure is expected to be announced at the end of 2010. The target for 2010 is to recycle 42% of all plastic. From 2007 until 2009 most of the plastics where collected, and recycled, by post-separation facilities in some parts of the Netherlands. Unfortunately these facilities do not have the capacity to cover the whole of the country at this point. This is one of the reasons why the government and a company called Nedvang started a campaign (named plastic heroes) to promote the pre-separation of plastics. All the municipals are obligated to join the efforts of the recycling of plastics, but every municipal can decide for them in what way the plastic should be recycled. Most have chosen for pre-separation but around 20% have chosen for post-separation. This is because the early mentioned facilities are close to these municipals and they see no reason why not to use these facilities. Another drawback is that some municipals have chosen pre-separation but now say it is a logistical nightmare to create an extra pickup day because the cities are already too crowded. One example of this is Amsterdam where the plastic is only collected separately from companies whereas the trash from consumers ends up at the incinerator.

One of the problems with recycling is that it is a luxury problem. It is only addressed when all basic living needs in a country are met and there are resources left for such a luxury project. Because of this there are great differences in different parts of the world concerning recycling. The effort of a country to recycle is often linked to the degree of general prosperity of a country. All of the first world countries are at this moment making an effort to improve and promote recycling. America is one of the biggest users of plastics with 30,5 million tons in 2008 alone. America doesn’t have a legislation which obligated its citizens to recycle their garbage, but does try to stimulate recycling. Every state or municipal in America can decide for themselves if they want to make recycling mandatory.

Most newly industrialized world countries do not see it as a necessity but as another way to earn money. In some of these countries people collect plastics from the streets to sell them for some extra money to factories that reuse the plastic for their products; such is the case in China, India and Taiwan. But this is getting less is some countries because producers buy larger amounts of plastic from first world countries for an even cheaper price. In India you have to collect more than 900 bottles for one US dollar. These countries see that they could earn a lot of money with recycling. But the strange thing is that they all struggle with their own trash, especially plastics. You can find plastic everywhere from cities to the countryside just laying around, clogging pips and causing floods or polluting the beaches or other tourist attractions.
Most of the third world countries are already such politically unstable that recycling is the one of the last issues they have on their minds. On the one hand they don’t use a lot of plastic, because most of the plastics we use are luxury products by definition, examples include bottled water, packed meat, and washed and sliced vegetables. Most third world countries are in conflict or suffer from regular natural disasters and to help them we send food and water. Yet the trash generated from these rescue efforts is often left behind, and it does not always end up at a landfill. After looking at almost all the countries in Africa I couldn’t find one that had even made an effort to recycle.

There are three methods of separating trash: Pre-separation, post-separation and PDM separation. With all three methods a separation rate of 100% is impossible to achieve. This is because some parts are too small to filter out.

With pre separation the responsibility of correct separation is with the person who uses the plastics. This is a drawback because the chance of reaching a very high separation rate is almost impossible: people forget, are too quick and throw the plastic in with the rest of the trash or don’t care about recycling. One of the benefits is that people are made aware of the negative effects of plastic by campaigns to promote the pre separation. To pick up the separated plastic an extra pickup-day is needed which means extra fuel and extra emissions of CO₂. After the pickup the garbage the plastic is sorted by types of plastic, cleaned, compressed and grounded up into chips.

With post separation the responsibility of correct separation is with the facilities that carry out the separation. So all the trash is send to these facilities and with the use of special sieves they separate the plastics from the rest of the trash. The plastics are then scanned by a laser to see what kind of plastic it is., for instance PET, PPF or HDPE. One of the advantages of this method is that there is no extra pickup needed and the machines used to separate the plastics are more accurate than persons. One of the disadvantages is that the costs to start up are quite high because the facilities have to be built first. Also at one facility in the Netherlands there were problems in the beginning with diapers where they blocked the machines. Now they are separated from all the other trash before the sorting of plastic begins.

The last method is PDM separation. This method does not only separate the plastic from the trash but also metal and drinking cartons, thus making it a combination of pre and post separation. It has the costs of both, because an extra pickup day is needed but also facilities to separate the plastic, metal and drinking cartons. Because of the combination it has the same benefits and drawbacks as pre and post separation. The advantage would be a higher recycling rate using the PDM mix as compared to pre-separation on its own.

To see if PET plastic has a future for fashion one has to look if there are any differences between virgin polyester and polyester made from bottles. The difference between both is that virgin polyester can be created and spun by one machine in a process called continuous polymerisation. The bottles first have to be cut into chips before the machines can melt the chips to go through the spinneret. Yet both types of polyester have the same possibilities for usage. In the end there is one big question that remains when using PET bottles: Are there enough bottles available to replace the virgin polyester? At this time the answer has to be no for the amount of used bottles is not be enough. On the internet rumours are already circulating that some producers buy brand new PET bottles because there are not enough used bottles collected. Using this trick, although one could even speak of fraud, producers can still say that their fabric is made out of PET bottles.

Reality is there are numerous brands starting to work with recycled polyester and the demand keeps growing every day. It is a good alternative for now but for the future the demand of bottles will get too big for the amount that is actually collected.
Chapter 7 is gives the findings and conclusion of a small questionnaire among consumers. It gives some insight in what consumers think about efforts by companies and governments to be greener, their own efforts to recycle and a comparative research about 2 products made out of recycled polyester.

Recycled polyester is useful and could get a place among the other used materials in fashion, but this depends very much on what countries do with their used plastics. If it is collected and recycled there is no problem to make an entire collection out of recycled polyester. But if recycling doesn’t get more priority from governments, companies, there will not be enough PET plastic to replace virgin polyester. This is also due to the fact that there can be a lot of products made out of PET plastic and it is sure that there is enough used plastic to supply all these products. Recycled polyester could have a bright future in fashion depending on a lot of changes that have yet to be implemented.
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CHAPTER 1 INTRODUCTION

Every year thousands of barrels of oil are used to make polyester whilst knowing our oil-supplies will run out in the foreseeable future. One alternative for using new-found oil is to recycle products that are already made out of oil. For polyester the best alternative to use are PET bottles. But are there enough bottles being recycled to supply for the total demand for polyester worldwide? And are the advantages concerning the environment really bigger than with virgin polyester?

More and more brands start using recycled polyester for their collections instead of virgin polyester. But does recycled polyester really makes a difference for the environment? What are the pros and cons? And if the use of recycled polyester keeps growing are there enough bottles to turn in to polyester? These are a couple of the questions you have to find an answer to when you look at recycled polyester. That is why the research question for this thesis is:

What are the possibilities for recycled polyester in fashion and is it a realistic alternative for virgin polyester?

The objective of this report is to find out if recycled polyester really is an answer for the fashion industry to be less depended on natural resources like oil and there for use less virgin polyester. Is it realistic to think that used PET bottles can supply enough polyester or is it just a fairytale to impress customers? To find out there are more questions to be answered such as:

- Which countries are working on recycling their plastics?
- What are the current laws concerning recycling?
- Which brands are already working with recycled polyester, in which amounts and why?
- Which different collection methods are there for plastics?
- What is the total use of PET plastics around the world?
- Which countries are specializing in the production of recycled polyester?

In chapter 2 we talk about the regulation concerning recycling by the European Union and the Netherlands. The Netherlands is added to this chapter because they just started their program for recycling plastic and it is interesting to see how this is developing and to see the legislation set by the European Union being implemented. Also the legislation is import to know because even if the fashion industry decides to only use recycled polyester, the bottles have to be collected. In most countries this is the responsibility of the government. There is no information about the regulation on worldwide-level because there is no regulation for the recycling of plastic set by the United Nations, merely facts on how much trash countries are producing. That why I also included some information about legislation in America, Canada, China, India and South Africa to show the differences between countries. From this data the amount of plastics we use every year can be distilled. Chapter 3 is about the different ways of separating the plastic from the trash. This is important because there are different costs and pros and cons involved through collecting the plastic. The purpose of using recycled PET for polyester is to help the environment and to be less dependent on natural resources. Nonetheless these positive effects should be looked at in perspective when the separation methods themselves are having a negative impact on the environment, this way creating a dilemma.

Chapter 4 gives an impression about the recycling efforts made by first world, third world and newly industrialized countries. What are the differences and how are they caused? The focus here is with countries that represent these worlds and the status of recycling. These countries are America, India and ....

Chapter 5 is about the differences between virgin and recycled polyester. Does recycled polyester have the same properties as virgin polyester? And what are the differences between the production methods for both
polyesters? The quantities of bottles needed for producing several pieces of clothing is also useful information when deciding if recycled polyester should be used.

Chapter 6 names the brands who are already working with recycled polyester. Why have they chosen for recycled polyester and how many products are made of recycled polyester? Do they promote it to their customers or not, and why?

Chapter 7 talks about the countries that produce the recycled polyester. These are China, Taiwan and America. They are already the biggest producers of virgin polyester so the transition is easy for them.

Chapter 8 contains the conclusion of the previous chapters.

The methods of research used were desk research and interviews. The interviews were used to support and confirm the information found by the qualitative and quantitative desk research. For this report a number of scientific reports were used for information. These reports were made by organizations such as TNO and different universities.
CHAPTER 2 GOVERNMENTS AND RECYCLING

The most important organisations for making recycling mandatory are the governments of countries and of course organisations like the European Union and the United Nations. These last two set guidelines for countries to follow but leave it up to the countries themselves to actually implement the guidelines that are set by the EU and UN.

2.1 EUROPEAN UNION

Every 10 years the European Union makes a new legislation concerning waste management and recycling. In this legislation the minimum amounts for recycling are mentioned. The latest update for this was in 2004. There should be a new legislation introduced in the beginning of 2008 but this has not happened. The standard of the European Union for the separate collection of plastic is at this time 22.5% with a rate for reuse and recycling of 55 to 80%.

The European Union sets the minimum standard for recycling and all members should at least reach these standards. But for every government there is still room to make any changes which lends them a rather large amount of freedom in the way they execute the standards of the European Union. Some European countries wanted to enforce a container deposit law, which means that when you buy a bottle you pay a little bit extra which you get back when you hand it in at a designated location. But the European Union thought that that would create an unfair competition between producers. So it wasn’t aloud.

The European Union promotes the use of the green dot system. This green dot can be found on every article of a producer who is linked to the green dot organization. Through this label the consumer can see in one instant that the producer is contributing to help the collecting and recycling of packaging. It does not mean the package is completely recyclable. Still a lot of consumers have this assumption because the logo of the green dot looks very similar to the official logo for recycling as you can see in figure 2.1.

In most of the countries that use the green dot the producers and importers are obligated by law to help collect and recycle the packaging and plastic they use in and for their products and put on the market. Most companies join up under an umbrella company that organizes everything the companies have to do, this way making it easier than working alone. Every country can set their own rates that companies have to pay for helping to recycle their plastics and packaging.

Europe started a company to give out the green dot license and support each country or company. This company gathers and shares information with all their members. In figure 2.2 you can see all the countries that are a member of Green Button.

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2.2 DUTCH GOVERNMENT

In 2006 the Dutch legislature approved the decree for packaging, paper and cardboard, which contained targets for the recycling of these three products. This decree follows the guidelines set by the European Union. In 2007 25.9% of all plastics used in the Netherlands was recycled. This figure is due to several facilities in the Netherlands who already separate the trash after it is picked up. These facilities cannot support the whole of the Netherlands at this time. That is why the Dutch government started a campaign to promote the pre separation of plastic from the trash. In 2008 only 13 thousand of a total of 75 thousand tons was collected in this way, thus making up a mere 1.7%. One of the targets was that in 2009 32% of the total amount of plastic in the Netherlands has to be recycled, at the writing of this thesis the results of this target were not yet known. For 2010 the target percentage will be 42%.

In 2006 some of the producers and importers founded a company that would coordinate the collecting and recycling for them called Nedvang. They did so because according to the new decree producers and imports are responsible for the accumulation and recycling of their packaging waste. They could do this on their own, or they could join a company who helps them reaching the targets. Nedvang is linked to the green dot system that is most used in Europe as explained in 1.1. Nedvang also works together with the Dutch government for all their campaigns to make consumers more aware of what is happening with garbage, commercial and industrial, and is stimulating the separate pickup of packaging.

Another method to get producers and importers to decrease their use of packaging and plastics was the introduction of a tax on packaging and plastic. This tax is paid by companies who produce or use plastic in their products and sell it on the Dutch market. All the companies using plastics have to mention the amount used in their tax return. If the amount exceeds more than 15,000 kg the company has to submit a tax report which states the kind of plastics the company used and for what purpose. In 2010 the tariff on plastic is € 0.4705 a kilo. The tax is, in most cases, added to the price for which the companies sell their products.

For the collecting of plastic by consumers Nedvang works together with all the municipals in the Netherlands. Every municipal is responsible for the collecting of plastic in their region and can choose their way of collecting. This can happen in 3 ways: Separating before collecting the trash, separating after collecting and PDM collecting. These three methods will be discussed in chapter 2. Nedvang advises municipals to choose for pre separation and most of the municipals have followed this advice. Only in the north of the Netherlands most municipals have chosen for post separation. This is because in 2005 a facility opened that is able to separate all the trash after it is collected and later a second facility followed soon after. In this way the municipals don’t have to bother their residents with instructions for separation and no collecting points have to be added or an extra pickup day for the separated plastic. Also the province and some municipals have invested in these facilities and see no reason why to switch. To promote the citizens to separate their plastics from their trash the Dutch government and Nedvang started a campaign called Plastic Heroes.

Even though the European and Dutch government try their best to promote recycling, it will take time to get everyone to join and make an effort. Also if there are different methods of separation used in different parts of the country this can make it confusing. One other problem is that most of the big cities in the Netherlands say that they made the decision for pre separation but then they say it is a logistical nightmare to pick up the plastics because of narrow streets or there are too few trucks for an extra pick up day. Only the plastic from companies is picked up separately there. In the appendices you can find 2 graphics about the trash from households and the industry. The one about the industries also shows the amount that is recycled at this moment.

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CHAPTER 3 METHODS OF COLLECTING

Even if all the plastic is collected, there is still a part that will be burnt in the incinerator for energy retrieval or will simply end up at the waste yard. This has to do with some of the parts being too small to recycle. It is not clear which kinds of plastic these are. These parts are called fragments. All the garbage mentioned in this part does not consist of any green waste, which is already collected separately in the Netherlands. Also if green waste is still included the methods are still possible to be applied.

3.1 PRE SEPARATION

With this method the consumer is responsible for the correct separation of the packages, bottles and other plastic materials from the garbage. The consumer receives a special garbage container or bag to put the separated plastic in and when full the plastic can be picked up in different ways. The most common is to put the bags/containers alongside the road on a certain day and the bags/containers will be picked up by garbage men. Another possibility is for the consumer to bring their full bags of waste to a central location near their home where the bags of the entire neighbourhood are collected and when full picked up. This is then collected by a company who will process the plastic and make it suitable for recycling or incineration.

3.1.1 ADVANTAGES AND DISADVANTAGES

With this method the responsibility of separating the trash the correct way lies with the consumer. But not all the consumers see the reasoning behind separating their trash and will still throw it away altogether where even if they do separate the plastic it can still happen that something ends up in the trash that should have been separated by accident. So the biggest disadvantage is that the recycle rate will, probably, never reach a 100 percent because this system works on the support and accurate separation of humans. On the other hand this method makes people aware of the necessity of recycling.

3.2 POST SEPARATION

Using this method nothing changes for the consumer. They have to collect their trash like they always do, and after the garbage is collected it will be separated at a special facility. At this facility there are two processes to separate the plastic from the rest of the garbage. The first is an automated process which filters out the big bottles and packages. The second works with two or more drum sieves. These filter out the parts of a specific size and separate the different kinds of plastic and packages using infrared lights. These lights can recognize the different characteristics of the plastics after which an air blower makes sure the plastic lands on the right transport belt.

The products that can be separated through this way of recycling are:

- PPF fraction
- Ferro fractions with packaging’s
- Pet bottles
- HDPE bottles
- And two extra products are:
  - Drinking cartons
  - Aluminium

All of these products can be used for recycling, some for material recycling and some as a combustible material. The remainder of trash is going to the incinerator. The process of this method can be seen in the figure underneath.
3.2.1 ADVANTAGES AND DISADVANTAGES

One of the biggest advantages of this method is that there is no extra use of trucks to collect the trash. Because of this the CO₂ emission is much lower than with the other two methods. But this rule only applies when a country has enough facilities to process the trash. If this is not the case the trash could be transported to neighbouring countries that are able to process the trash. This would neutralize the advantage of the use of no extra trucks. Another advantage is also that the percentage of collected is quite high because it is not dependable of separation by a person.

3.3 PDM SEPARATION

This method is a combination of both methods mentioned earlier, but this method does not only collect plastic but also drinking cartons and metal. These three products are collected in a special bag and collected at a designated time and place, set by the municipals. After the collecting of the bags they are taken to a facility for further separating and preparation for recycling. There the plastic, cardboard and metal go through an automated machine that works with magnets and air blowers to separate most of the PDM. All that is left will go through the same drum sieves as mentioned at the separation after collecting method.

3.3.1 ADVANTAGES AND DISADVANTAGES

This method is not used frequently because it’s a combination of the other two methods. This method requires the consumers to separate the trash and also an extra pickup day is needed. And because the plastic, metal and drinking cartons are mixed it also needs facilities to separate the trash again after pickup. The separated PDM mix on its own has a high separation rate but because one still depends on the consumers to separate first there could still be a PDM mix left in the remainder of the trash. ³

³ (9) (22) (18)
If in 2008 the amounts of plastic present in the Netherlands was 750 million kg, and then imagine what the total tonnage in the whole world would be. What is happening with all this plastic? Is it burnt? Collected? Dumped on a waste yard? Or is it dumped everywhere you look? This depends on the country you look at. In Europe and America recycling is becoming a bigger issue every year, but in third world countries (Africa) and developing countries (China and India) a lot can be done too. In this chapter you can read about the differences between continents. For the first world countries I will be talking about America. This is because they have a different legislation that the European Union which is already discussed in chapter 2.

4.1 FIRST WORLD COUNTRIES/ AMERICA

In most first world countries efforts are made to recycle the waste the countries generate. America is one of the biggest producers of waste in the world, maybe only surpassed by the republic of China. In 2008 the Americans produced a total of 250 million tons. Plastics make up for 30,05 million tons.

Recycling in America is not regulated by the national government. They are trying to stimulate the Americans but none of the suggestions are mandatory. For waste management there is legislation but this only concerns laws about how to build and operate landfills and the incineration facilities. But every state and municipal can decide to make more of an effort for recycling and can come with their own legislation. But how many of the states and municipals are really doing this, is unknown. What is known, are the effects of the recycling efforts. These are published every year by EPA (environmental protection agency). In 2008 33.2% of all the trash was recycled. And with plastics it was 7.1%, which already makes up for 2,12 billion kg. EPA also indicated how high the percentage of recycled PET bottles and jars was. This was 27,7% which made up for 1,7 billion kg.

4.2 NEWLY INDUSTRIALIZED COUNTRIES/INDIA

Newly industrialized countries are countries which have a strong growing economy and where the standard of living is improving. All these countries were at one time considered developing nations.

All these countries have attracted more industrial activities and have changed from producing products of low quality to higher quality products. Also all these countries are relatively politically stable compared to developing countries.

Because of this the government is able to make new laws that improve the living standards of the citizens. Still, the environment is an issue that comes last in most countries. And this is quit logical. Countries are able to change quicker when they can profit from it. In China, Taiwan and India people collect plastics from the streets and sell them to factories that process them further to new products. Governments are busy with installing systems for collecting and processing the trash but this takes time and they don’t want do this to the expense of the new and growing economy.

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A substantial amount of plastic used in Europe and America is sold to China, who is the biggest producer of plastics in the world at this time. Back in China the plastic is melted again and reused in a variety of products. Also India buys a lot of plastics from Europe and America. India itself is struggling with all the plastic that the Indians use. In the cities, on the countryside you can find plastic everywhere. They cause floods because they block drainage or sewer pipes. Some cities have a ban on plastic bags. There is no national legislation concerning recycling yet. They are thinking about legislation only there are some obstacles that have be overcome before that. One of them is how to implement and control any new legislation without an army of officials and a lot of money. Until there is a solution for this, there will be no legislation. But still India is one of the biggest recyclers of waste like plastic and electronic waste. Most of this is not India’s own waste but imported from Europe and America. Recycling is becoming a big business and manufactures in India can get more material if they buy it somewhere else. In India a lot of the poor people made a little extra money with collecting plastic bottles and selling them to the factories, but to get one US dollar they have to collect, at this time, 900 bottles. And this number is rising because first world countries sell their plastics for a smaller amount, because we see it most of all as trash and don’t always see the opportunities of recycling the plastic.

4.3 DEVELOPING COUNTRIES

In third world countries trash is a big problem. Because most third world countries struggle with so many issues making trash not a priority for them. A lot of countries are politically unstable and are therefore not concerned about their trash policy. Even in the countries that are politically stable there are more urgent problems to address than pollution, take for example natural disasters. For them this is not a life threatening problem. But the trash can affect and pollute the water supplies which can cause sickness among the people who drink from this water.

Third world countries are flooded with plastic. Think of the following problem: there is a civil war and there are several refugee camps. All these people are being supplied water by organisations like UNICEF. This water is contained in big plastic bottles. But what happens with these bottles after they are empty? Does UNICEF takes them back or do they end up at a landfill or just on the ground next to the tents? Most probably a combination of all three is the result. In this situation the people are all together in one place but what happens after a natural disaster and the people are scattered over a larger area. Off course the organisations try to keep the trash left behind to a minimum but this is not their first priority.

There are some non profit organisations who want to help. They not only want to help collecting and processing of the trash but if possible also helps the people to earn some extra money. In some third world countries plastic can be collected by citizens and delivered to a factory that can process the plastic. The citizens get a small amount for the plastic they collected. This already happens in countries that are more developed like China and India.
This report is about the use of PET plastic as polyester in the fashion industry. And one of the most important things to know is what the possibilities are of polyester and if these are the same for recycled polyester. And what are the differences concerning production. The total production of polyester fibres was 32.5 million tons in 2008. The prediction is that this amount will only increase the coming years.

5.1 VIRGIN POLYESTER

Virgin polyester is made out of terephthalic acid and ethylene glycol. When this is mixed it forms dihydroxyethyl terephthaleate. After a process that combines high temperature and vacuum, which starts the condensation polymerization, polyethylene terephthalete (PET) is formed (figure 4.1). This is then cast and cut into chips.

Polyethylene terephthalete is a member of the thermoplastics. This means that if heated the polyethylene terephthalete will become liquid and can be used for different purposes. Thermoplastics have the quality to be used over and over again. The structure does not deteriorate when melted but stays as strong as the virgin product. At a temperature of 75˚C the characteristics of Polyethylene terephthalete change and it becomes elastic. This stage is called glass transition and it is possible to form or texture the plastic. When the plastic is heated to 260˚C it becomes liquid and at this time it can be used to produce yarn.

After melting the chips the spinning process can start. The chips are melted at a temperature of 280˚C and extruded to the spinneret. When the chips are liquid a number of additives can be added to enhance or change the characteristics of the yarns. Delustrants can be added to make the yarns look more similar to natural fibres like wool or cotton. After this stage the flat filaments are usually textured and stretched. This process is showed in figure 5.2

5.1.1 QUALITY AND PROPERTIES

Polyester has several qualities and properties which makes it an attractive fibre for bulk production. The material that is used to make polyester is relatively cheap yet still giving the fibre a high quality. Also the ability to change the properties of the fibre makes it possible for the fibre to be mixed with
different kinds of other fibres like cotton or wool. And because polyester has a high melting point and low sensitivity to moisture it can be used in many situations and with a large range of finishing’s without fear of melting.

One of the other strengths of polyester is that it is wrinkle-resistant. This makes polyester perfect for blends with cotton which creases quickly. And because the fibres are man made it can range from microfibers to coarse fibres which can help give a fabric a curtain appearance. Also for purposes of changing an appearance polyester is perfect for texturing.

In the 80’s polyester fell out of favour with consumers who stopped buying products made out of polyester. This happened because polyester was one of the fastest growing type of fibres used and everybody wanted a piece of this. Following this the market was flooded with cheap polyester that didn’t show the high quality it is capable of generating. Customers began to see polyester as a cheap fabric with a low quality. This image still exists today but is changing slowly. Polyester is nowadays used especially in sports and outdoor wear and work wear, mostly because of all the possibilities polyester offers. It can be made extremely strong, flame resistant, heat resistant, antistatic and profiled fibres allow for extra insulation. Nonetheless in mainstream fashion polyester is almost still a dirty word.

5.2 RECYCLED POLYESTER

Recycled polyester can be made from several products. It can be made from leftover yarns or fabric, old clothing, and PET bottles. With the recycling of yarns, fabric or clothing, the yarns of all the products have to be 100 percent polyester, otherwise recycling is made extremely hard and is not worth the effort. PET bottles only have to be cleaned and are then ready for recycling. The bottles are cut up into granulate and are then melted. After this the process is exactly the same as with virgin polyester where the melted PET bottles go through a spinneret to make filaments.

PET can be used for the production of polyester but also for other products, like new bottles, toothbrushes, carpets, plastic containers and so on. So the collected PET is shared by many producers and will there every enough to replace virgin polyester completely?

Post consumer PET bottles are mostly recycled for textiles, carpets, sheets and injection molded goods like new bottles. The bottle-grade PET is of higher quality and has better performance characteristics relative to other grades of PET. To make it possible that the other grades of PET could also be used it is important to recover the original quality that the PET had when it was produced for the first time.

When the PET bottles are grounded up to flakes, this can be done by purification processes that clean the PET from contaminants. The value of PET can be enhanced by Solid State Polymerization (SSP) which also removes contaminations but also increases the degree of polymerization of the flakes which results in enhanced performance characteristics of the recycled PET. This enhancement is expressed in the intrinsic viscosity of the PET. This enhancement is useful only for fabric purposes in PET that is of a lower quality than that is used for bottles. But after the enhancement this PET can also be used for producing fibers.

5.2.1 QUALITY

The quality of the fibres and fabrics made from recycled PET plastic depends on the quality of the plastic, and also of the production process. But the quality of polyester from PET plastic can be at the same quality level as virgin polyester if the plastic is properly cleaned and all contaminations are removed. \(^7\)

\(^7\) (1) (3) (4) (5) (8) (7) (33)
CHAPTER 6 PRODUCERS AND BRANDS WORKING WITH RECYCLED POLYESTER

To reduce the industrial footprint of products is one of the main reasons for companies to change their modes of operation. The footprint stands for how large the impact on the environment is by making this product. This includes not only the steps the companies make themselves but also what happens before and after their actions. This ranges from which natural resource is used to working conditions in the factories to what is happening with the product after the consumer is no longer using it. All these factors make up the footprint of a product. So where is recycled polyester produced and which brands are working with it?

6.1 PRODUCERS

The producers of recycled polyester can be found all over the world, but they are mostly located in China, Taiwan and America. China is already the biggest producer of garments in the world so it is logical that they also produce them. Taiwan produces a lot of sports clothing like swimwear and surf wear, besides producing a lot of the fabrics used for these products.

6.1.1 CHINA

China is at the time the biggest producer of plastics and garments in the world. They are also one of the biggest producers of polyester at this time. They see the benefits of using recycled plastics for new products. Producers in China buy used plastics to reuse, not only from China itself but also from other countries. This way they save money instead of buying new ground materials like oil. China produces around 20% of all polyester staple fibres and around 35% of all polyester filament fibres which makes up a lot of oil. The idea of buying other countries plastics and recycle them almost sounds too good to be true, and apparently it is. More and more countries are asking for global restrictions on the amounts of used plastic that are bought and sent to China. The idea behind recycling is a very good one but the execution of the actual recycling process should be better. With this they mean the environmental and safety risks at the recycling factories. Also countries want to keep the plastic in their own country to reuse, because it is an extra income to some companies that are active in the countries China buys the used plastic from. Most of the recycled products are not sold on the Chinese market but on the European and American market. There the demand of recycled articles is much higher.

6.1.2 TAIWAN

In the case of Taiwan there are no real objections from other countries for them buying used PET other than the economic aspect mentioned in the part about China. The environmental and safety issues in factories are much smaller and the government of Taiwan tries to increase the safety of all the factories through new legislation. Taiwan is a much smaller country than China so all changes can be implemented at a much faster pace. The quality of the yarns and fabrics are also quite high. Probably this comes from the fact that they produce technical, high quality clothing like surf wear but also corporate fashion.

6.2 BRANDS

There are already quit a lot of brands working with recycled polyester. Some of the brands make the consumer aware of the fact that they are working with recycled polyester and some just use it without promoting it. The brands who don’t promote it use it more in fabrics that are blended with other materials like cotton. The brands who promote it use it more for products that are 100% polyester. Also a trend is noticeable when looking at the brands that are working with recycled polyester. A number of them are focused on outdoor and

8 (32)
sports. These brands sell products for being outdoors in nature so it is quite logical that they want to help the environment by any means they can. They use a lot of synthetic fibres and are therefore dependant on natural resources such as oil. So it is smart to already look for good alternatives now instead of when we run out of oil.

6.2.1 PATAGONIA

Patagonia is a brand active in the outdoor sector. They make clothing for hiking, mountaineering and other outdoor activities. Because Patagonia is an outdoor brand it was for them a logical step to do what they can to help the environment. The consumers who buy Patagonia are going out into nature, so Patagonia wants to do everything they can to preserve the environment.

Patagonia has different ways of helping:

- Using environmentally friendly fabrics like organic cotton, hemp, recycled polyester and chlorine-free wool.
- Promoting recycling of clothing. Customers of Patagonia can return their old Patagonia clothing at the stores for recycling. This is because at this time there is too much clothing that is just thrown away instead of collected for a charity or for recycling.
- 1% of the total revenues are donated to different environmental organizations all over the world.
- Patagonia has also started a non-profit organization to protect the wildlife and biodiversity in Chili and Argentina.

Patagonia uses recycled polyester in a number of products, ranging from jackets to sleeping bags. It was the first brand to use fleece made from recycled PET bottles when they started this product back in 1993. Since then a number of articles have been added to the group recycled polyester. They now make jackets, shirts, trousers and bags from recycled polyester.

Because Patagonia is an outdoor brand it uses a lot of synthetic fabrics which increase the footprint of the article. Synthetic fabrics are a necessity in outdoor wear; natural fabrics don’t provide the same quality as synthetic fabrics combined taking price and weight and other properties into account. Patagonia thinks of the environment every step of the way. It starts with the fabrics chosen for a product and ends up at how the product is packed when sent to the stores. Also with production Patagonia only works with producers that ensures a good and save workplace and who not exploit their employees.

6.2.2 NIKE

Nike is especially known of their sneakers and other sportswear. Nike is one of the biggest suppliers of sportswear to athletes for all kinds of sports. So if Nike changes their sustainability policy it has a tremendous effect. For example all the shirts made for the World Cup in soccer of 2010 are made of PET plastic. This makes up for 13 million plastic bottles that are recycled.

Nike is not only using certain fabrics because of environmental purposes but Nike is also looking at the future. They are changing their use of fabrics because some of the resources are getting scarce and Nike anticipates that there will be more restrictions in the future. At Nike they don’t want to wait until they are obligated to change but want to beat the punch and do it now. Nikes vision on sustainability is:

- We design for recycling
- Consumers bring their products back to us and we recycle them into new products
- Waste that cannot be eliminated is recycled
- The product should be less reliant on oil and water
- We all step lighter, faster into a future low-carbon sustainable economy
- We use healthier chemistry to minimize the impact of products ingredients through lifecycle
Nike does not only work with recycled polyester but also with organic cotton, environmentally preferred rubber, PVC and Phthalates and leather. Underneath you can see the amount of recycled polyester used by Nike over the years.

### 6.1 Nike apparel containing recycled polyester

<table>
<thead>
<tr>
<th></th>
<th>FY04</th>
<th>FY05</th>
<th>FY06</th>
<th>FY07</th>
<th>FY08</th>
<th>FY09</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of polyester garments containing recycled polyester</td>
<td>0.00</td>
<td>0.32</td>
<td>0.75</td>
<td>1.58</td>
<td>1.36</td>
<td>2.74</td>
</tr>
<tr>
<td>Recycled polyester as a % of total polyester</td>
<td>&lt; 1%</td>
<td>&lt; 1%</td>
<td>&lt; 1%</td>
<td>&lt; 1%</td>
<td>&lt; 1%</td>
<td>1.6%</td>
</tr>
<tr>
<td>Recycled polyester (lb)</td>
<td>121,000</td>
<td>215,850</td>
<td>451,500</td>
<td>452,400</td>
<td>1,942,500</td>
<td></td>
</tr>
<tr>
<td>Recycled polyester (kg)</td>
<td>57,600</td>
<td>97,900</td>
<td>204,800</td>
<td>205,200</td>
<td>881,000</td>
<td></td>
</tr>
</tbody>
</table>

#### 6.2.3 KUYICHI

Kuyichi is one of the leaders concerning sustainability. Since Kuyichi started introducing organic cotton in 2000 and also started Kuyichi the brand in 2001, they kept growing and kept adding new product lines with sustainable fabrics as a basis. Kuyichi keeps searching and developing new possibilities for fabrics. Kuyichi does not only want to use “clean” fabrics but also the production and transport should be as sustainable as possible. At this time Kuyichi is working for the third time with recycled polyester in their collection and just added jeans to their collection made out of recycled polyester. Almost half of all the jackets of Kuyichi are made of recycled polyester. Kuyichi buys their fabrics in Taiwan where also all the plastic bottles come from. In Taiwan the local people collect the plastic bottles from all over and then sell them to the factory that processes them into a fabric. Also the production takes place in Taiwan, so Kuyichi tries to keep the transport to a minimum to produce everything in one country until it is transported to the shops.

#### 6.2.4 GEOFFREY BEEN/ PERRY ELLIS

Geoffrey Been is an American brand that sells suits and everything you need next to a suit. It does not use recycled polyester openly but uses it quietly. This is because they already support a lot of charities like cancer and Alzheimer research and they don’t feel they need to openly promote their use of recycled polyester. One other reason why I think they don’t promote it is because they only use it in cotton blends for their suits and shirts and not as a total product. Also it does not fit with the image the brand wants to present to the outside. Geoffrey Been wants to have a luxury image, and they feel that customers don’t care if their products are sustainable or not. Perry Ellis also sells suits and casual wear in America. With Perry Ellis it is quite a similar story as with Geoffrey Been. Perry Ellis wants to be more sustainable but they don’t feel that their customers want to be aware of this fact.  

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10 (15) (28) (29) (36)
REI, Columbia and Marmot are all outdoor brands and are just like Patagonia quite dependent on synthetic fibres for their collection. Because they sell products for outdoor activities they also want to help preserve the environment when able to. So all three brands don’t only work with recycled polyester but also with organic cotton, hemp and other alternatives.
CHAPTER 7 MARKET RESEARCH

All the companies that I approached for this report have indicated that they think recycled polyester has a real future in fashion, but of course half of these companies sell garments made out of recycled polyester and the other half of the companies are working to promote the recycling of plastic. Because of this I cannot use this for a proper interview because they are already biased. But what do the consumers think about recycled polyester and of other efforts to create a better environment?

Consumer questionnaire

The first part of the questionnaire focuses more on general issues, such as what the government and companies should do and if they ever buy “green” products.

When the consumer was asked if companies and governments have to do everything in their power to relieve and save the environment, 85% said yes or absolutely yes. But when asked if they still felt the same if prices went up because of new laws the percentage dropped till 50% and 45% was unsure.

One of the other questions was if the consumer ever buys environmental friendly products. None of the consumers always buys environmental product, 43% buys them sometimes and 50% isn’t aware of what kind of product they bought. When also asked if they have the option, would they buy the “normal” product or the “green” product, the answers could be yes, no or unsure. The percentages for all three answers where all around 30 and 35% percent.

The Netherlands started with separating their plastics, and 74% thinks it is a good idea. But how many people are actually doing this. When asked 20% said yes always, 17% yes but sometimes I forget, 56% said no because their municipal hasn’t started yet and only 5% think it isn’t necessary. With the municipals that haven’t started yet it is possible that this municipal choose the option for post separation. With this option the consumers won’t know that their plastic is separated.

Concerning the fashion industry and if this industry should do everything possible to make their products greener the answer was surprising, 50% said they were unsure and 45% said yes. This result is surprising because when asked earlier in a more general way 85% said yes. Another question about the fashion industry was about the number of collections that brands make every year and that collection change very rapid. 50% said it is handy but not necessary and 25% said they love it because they want a lot to choose from.

The second part of the questionnaire was about recycled polyester and what the consumer thinks of different alternatives for “greener” products. Some of the results were quite surprising. When given several alternatives for conventional fabrics out which they had to pick a favorite, organic cotton got 40%, but the alternative remand fabrics got 27% and recycled polyester only 2,5%. But asked later about the soccer shirts NIKE produced out of plastic bottles for the world cup 56% thought it was a really good idea and 42% thought it was a good idea.

Then I did a small comparative research about two products both made out of recycled polyester but presented in different ways. One of the products was on a mannequin (jacket Kuyichi) and the other one was just showed without any extra’s (jacket Nike). Both pictures are use by the companies in their collection book. When asked which one they think was made out of recycled polyester without knowing the brand, 54% choose the jacket from Nike. The arguments for this were that the product looked less sharp than the jacket from Kuyichi and also that on the picture the jacket from NIKE looked like it was from a lower quality than the jacket from Kuyichi.
But when the consumers knew the names of the brands some changed their answers and said that the jacket from Kuyichi was the one made out of recycled polyester. The percentages for this were the same as the first question, 46% against 54% but now Kuyichi had the 54%. When asked why, almost everybody that said Kuyichi knew the brand and thought is more logical. The consumers who answered NIKE mostly did this because I used NIKE in an earlier question. The last question was about the fact that both products are made out of recycled polyester but only Kuyichi makes this really clear to the consumer by tags on the jacket. The question was if the consumer wants to be aware of the fact that they are buying a product that is green or don’t really care about this fact. 65% said yes they want to be aware of this and only 10% said no

Some of the answers were contradicting but one of the conclusions is that consumers want greener options and that companies and governments could do more for the environment without losing customers. Of course there is always some uncertainty about the honesty of the answers given.
CHAPTER 8 CONCLUSION

This report tries to answer the question if recycled polyester is a realistic alternative for virgin polyester and what the possibilities are for use in the fashion industry. The report looks especially at the angle of recycling since in that area the biggest problems are for the use of recycled polyester.

The answer to the research question is yes there are real possibilities to use recycled polyester in fashion but the chance that recycled polyester will completely replace virgin polyester is, at this time, unrealistic. But for companies who what to work with recycled polyester at this time, it is possible to produce the same quality products as with virgin polyester, and also is saves a significant amount of natural resources. How many companies actually are going to use recycled polyester is something for the future. But the option is here and it is a good start to make the collection greener.

The largest obstacle for recycled polyester is to collect enough PET bottles for the production. And this can only happen with the help of the governments and also the companies that use the PET plastic. If legislation in only at municipal or state level there will never be enough plastic collected. In America alone the amount of PET bottles used yearly (30,5 million tons) is almost enough to supply the producers of polyester with enough plastic (35 million tons). But only 2.1 million tons were actually recycled. With the European countries there is legislation set by the European Union. But this takes time and some countries really make an effort and others still feel it is not really their problem.

One other problem is that the PET bottles are not only recycled for use in garments but in a much larger assortment of products, such as new bottles, toothbrushes, carpets, plastic containers and so on. So even if all the PET plastic is collected for recycling the question will still be if there is enough for garments and all the other products.

The market research shows that consumers do think that companies and governments should do everything in their power to save the environment. But with any questionnaire it is always the question if the consumer act the way they say they do.

Recommendations

For companies who want to operate ‘greener’ this is a good alternative for virgin polyester. If all of a sudden the majority of the fashion company’s start working with recycled polyester there could be a shortage but if it goes in the same pace as now it is possible. It is still polyester, so somewhere in the process oil was needed but with reusing the product footprint will become less.

To make sure that in future there will be enough used PET plastic available, governments have to make legislation to insure and stimulate the collecting and recycling of plastic. If this doesn’t happen the change that people will recycle by their selves is slim.

Also companies who sell plastic products like PET bottles could help with stimulating recycling by, for example, adding a container deposit to their products. This way they get the bottles back and can reuse it there selves or sell to other companies who can use PET plastic.

Also a new research to see what the share of recycled PET in fashion actually is compared to the other industries and products that are also working with recycled PET and see how far along we really are in fashion. And maybe find out if other fashion companies would consider working with recycled polyester. This way it could be possible to make an estimate of the amount of PET needed.


32. Textile Fibre Demand. *Driscoll, Peter.* Hong Kong: - , 2008. -.


35. Patel, Mrs Almitra H. *Status of recycling and ecomark legislation in India.* s.l.: - , -.

Appendicle 1: Amount of trash by different provinces

Gemeentelijke afvalstoffen; hoeveelheden

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Appendicle 2: Post separation process

Appendicle 3: Total investment of companies for environmental management and total environmental costs

Kosten en financiering van het milieubeheer
Totaal milieucompartmenten; Totaal sectoren

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11 (31)
Appendicle 4 recycle rate of companies in the Netherlands in tons

Appendicle 5 Trash management USA
Table 1. Generation and Recovery of Materials in MSW, 2008*
(In millions of tons and percent of generation of each material)

<table>
<thead>
<tr>
<th>Material</th>
<th>Weight Generated</th>
<th>Weight Recovered</th>
<th>Recovery as Percent of Generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper and paperboard</td>
<td>77.42</td>
<td>42.94</td>
<td>55.5%</td>
</tr>
<tr>
<td>Glass</td>
<td>12.15</td>
<td>2.81</td>
<td>23.1%</td>
</tr>
<tr>
<td>Metals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steel</td>
<td>15.58</td>
<td>5.29</td>
<td>33.7%</td>
</tr>
<tr>
<td>Aluminum</td>
<td>3.41</td>
<td>0.72</td>
<td>21.1%</td>
</tr>
<tr>
<td>Other nonferrous metals†</td>
<td>1.76</td>
<td>1.21</td>
<td>68.8%</td>
</tr>
<tr>
<td>Total metals</td>
<td>29.85</td>
<td>7.22</td>
<td>24.6%</td>
</tr>
<tr>
<td>Plastics</td>
<td>30.05</td>
<td>2.12</td>
<td>7.1%</td>
</tr>
<tr>
<td>Rubber and leather</td>
<td>7.41</td>
<td>1.06</td>
<td>14.3%</td>
</tr>
<tr>
<td>Textiles</td>
<td>12.37</td>
<td>1.89</td>
<td>15.3%</td>
</tr>
<tr>
<td>Wood</td>
<td>16.39</td>
<td>1.58</td>
<td>9.5%</td>
</tr>
<tr>
<td>Other materials</td>
<td>4.50</td>
<td>1.15</td>
<td>25.6%</td>
</tr>
<tr>
<td>Total materials in products</td>
<td>181.14</td>
<td>60.77</td>
<td>33.5%</td>
</tr>
<tr>
<td>Other wastes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food, other‡</td>
<td>31.79</td>
<td>0.80</td>
<td>2.5%</td>
</tr>
<tr>
<td>Yard trimmings</td>
<td>32.90</td>
<td>21.30</td>
<td>64.7%</td>
</tr>
<tr>
<td>Miscellaneous inorganic wastes</td>
<td>3.78</td>
<td>Negligible</td>
<td>Negligible</td>
</tr>
<tr>
<td>Total other wastes</td>
<td>68.47</td>
<td>22.10</td>
<td>32.3%</td>
</tr>
<tr>
<td>Total municipal solid waste</td>
<td>249.61</td>
<td>82.87</td>
<td>33.2%</td>
</tr>
</tbody>
</table>

* Includes waste from residential, commercial, and institutional sources.
† Includes lead from lead-acid batteries.
‡ Includes recovery of other MSW organics for composting.
Details might not add to totals due to rounding.
Negligible = Less than 5,000 tons or 0.05 percent.
Appendix 7 Recycling rate PET bottles USA

Figure 3. Recycling Rates of Selected Products, 2008*

*Does not include combustion (with energy recovery).
Appendicile 8 Questionnaire

ThesisTools
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1. Wat is u geslacht?
   - Man
   - Vrouw

2. Wat is u leeftijd?

3. Zou u als consument artikelen laten liggen om het milieu te sparen, zoals het volgen van de viswijzer en bepaalde vis daardoor niet te kopen?
   - Ja
   - Nee
   - Geen mening

4. Milieu is een steeds belangrijker onderwerp voor zowel bedrijven en overheid. Moeten bedrijven volgens u zoveel mogelijk doen om het milieu te ontlasten?
   - Helemaal mee eens
   - Mee eens
   - Onzeker
   - Oneens
   - Zeer oneens
   - Geen mening

5. Moet de overheid bedrijven verplichten om het milieu zoveel mogelijk te ontlasten?
   - Helemaal mee eens
   - Mee eens
   - Onzeker
   - Oneens
   - Zeer oneens
   - Geen mening

6. Stelt u voor de overheid voert een wet in voor de kledingindustrie om het milieu te ontlasten. Door deze wet is zijn de modemenen meer geld kwijt. Dit wordt doorberekend aan u, de klant, waardoor u 5 a 10% meer kwijt bent per kledingstuk. Vindt u dit een goed plan?
   - Helemaal mee eens
   - Mee eens
   - Onzeker
   - Oneens
   - Zeer oneens
   - Geen mening

7. Koop u milieubewuste artikelen?
   - Ja altijd
   - Ja soms
   - Let er niet bewust op
   - Nee nooit
8. **Hoe vaak koopt u milieuvriendelijke artikelen?**

9. **Wat voor artikelen zijn dit?**

10. **Zou u eerder kiezen voor een normaal artikel of een milieubewust artikel?**

   - Het normale artikel
   - Het milieubewuste artikel
   - Geen mening

11. **Nederland is begonnen met het apart inzamelen van plastic. Vindt u dit een goed initiatief?**

   - Ja
   - Nee
   - Geen mening

12. **Bent u al bezig met het apart inzamelen van plastic?**

   - Ja
   - Nee, de gemeente haalt het nog niet op
   - Geen mening

13. **We leven in een consumptiemarkt. Kleding wordt sneller vervangen door consumenten en merken brengen steeds meer collecties op de markt per jaar. Wat vind u ervan dat er steeds meer kleding op de markt komt?**

   - Goed, ik heb graag veel keuze.
   - Sommige kunnen beter.
   - Geen mening
   - Slacht. Hoeveel klering heb je nou nodig

14. **Moet de kledingindustrie volgens u alles doen om kleding milieuvriendelijker te maken?**

   - Ja

15. **Waar let u op bij de aanschaf van een nieuw kledingstuk? (prijs, pasvorm etc.)**

16. **Steeds meer kledingmerken willen groenere kleding verkopen. Hierbij hebben ze de keuze uit verschillende stoffen. Welke van de onderstaande alternatieven lijkt u het aantrekkelijkst om te dragen?**

   - Organisch Katoen
17. **H&M is de laatste jaren bezig met het ontwikkelen van groenere mogelijkheden voor hun collectie zoals organisch katoen en gerecycled polyester. Vindt u dit een goed initiatief?**
- Ja
- Op zich wel
- Geen mening
- Nee

18. **Van 8 plastic cola flessen kan een voetbalshirt voor het WK worden gemaakt. Hiervoor zijn geen extra grondstoffen nodig of andere productiemethodes. Wat vind u van dit idee?**
- Zeer goed
- Goed
- Redelijk
- Geen mening
- Slecht
- Zeer slecht

19. **Van welke van de bovenstaande jassen is volgens u gemaakt van gerecycled polyester?**
- De blauwe jas
- De roze jas

20. **Waarom heeft u voor dit artikel gekozen?**
21. De blauwe jas is van het merk Kuyichi en de roze van Nike. Welke is volgens u nu gemaakt van gerecycled polyester?
   - De blauwe jas van Kuyichi
   - De roze jas van Nike

22. Waarom heeft u voor deze jas gekozen?

23. Hoeveel zou u bereid zijn voor dit artikel te betalen?
   - 0-25
   - 25-50
   - 50-75
   - 75-100
   - 100-125
   - 125-150
   - 150-175
   - 175+  

24. Waarom heeft u voor dit antwoord gekozen?

25. Beide artikelen zijn van gerecycled polyester. Om precies te zijn polyester gemaakt van PET flessen. Bij het ene artikel hangt in de winkel een label aan de jas waarop dit duidelijk wordt gemaakt en bij de ander niet. Wilt u er ook bewust van worden gemaakt bij de aankoop van een artikel zoals bij jas 1?
   - Ja
   - Nee
   - Macht mij niet uit

Mode en milieu