Safe Use of Plastic Products

Raed A. Sabha
MS in Agriculture Economics and Agribusiness
Social and applied sciences department
Home Economics division
Princes Alia University Collage
Al-Balqa Applied University
Amman- Jordan

Basimeh M. Khaleel
BS in Nutrition and Food Technology
Social and applied sciences department
Home Economics division
Princes Alia University Collage
Al-Balqa Applied University
Amman- Jordan

Abstract

The Current research aims to clarify the health of monomers and residual components in plastics, including stabilizers, plasticizers and condensation components; the study is mainly done by reading online materials, such as scientific articles and data from different organizations, that it is important to educate people on this issue to reduce the use and waste of plastic. While we knew about plastics and alternatives at the beginning of the project, we did not understand the seriousness of the problem and the possible solutions. There are alternatives and solutions available to reduce the use of plastics and its negative impacts. However, unless people understand and receive education, it cannot function effectively.

Keywords: plastics, side effects of plastics, plastics` additives, hazardous substances

Introduction

Plastic is a well-known material in everyday life. To define a plastic at the molecular level, plastic is an organic polymer that has a molecule which contains a long carbon chain as its main chain that has repetitive units. The structure and atomic type of these repetitive units play an important role in determining the properties of the plastic. These long carbon chains are well grouped by entanglements between macromolecules and van der Waals forces and form a solid, generally strong and solid material. In addition, additives are typically added during the manufacture of commercial plastics to increase strength, durability or impart specific properties to the plastic (Richard C. Thompson et al. 2009). Usually, there are two commercial plastics, thermoplastics and thermosets. Thermoplastics can be reheated, melted and molded in different ways, while thermosetting plastics degrade and become other substances when they are reheated after formation. As far as we know, hazardous substances in plastics have not been systematically and thoroughly analyzed, so we have chosen to include hazardous materials that are currently used (or used) in the manufacture of plastics. Time is critical for the type of hazardous substances found in the product. For short-term products, such as plastic containers, it can be assumed that the product becomes waste in a few years. Therefore, the replacement of hazardous substances in the manufacture of the lever will have a more or less direct impact on the disposal phase. For long-lasting products, such as PVC floors, for example, we must have multiple generations of additives in a long time (P.Mercea, 2009) (Muncke, Jane, 2011)

Statement of Problem

The plastic can be used conveniently and every day. However, we cannot ignore its negative impact on our health. In the long run, excessive use of plastics and lack of proper recycling can have many adverse effects on our health. Plastics are harmful for manufacturing and use, and at the same time they represent a great challenge for recycling. Therefore, when it comes to plastics, there are many problems and challenges to solve.

Purpose of the Study

Current research aims to clarify the health of monomers and residual components in plastics, including stabilizers, plasticizers and condensation components such as bisphenol A (BPA). Some of these problems are based on research that uses very high intakes; others have no scientific basis. The active form of BPA binds to steroid receptors and can affect the functions of estrogen, thyroid and testosterone (Science Daily Report, 2011). To ensure public safety, national and international regulatory agencies such as the Food and Drug Administration (FDA) and the European Food Safety Authority (EFSA) carefully review and manage the substances used in the manufacture of plastics. Any substance that can reasonably migrate to food is classified as an indirect food additive subject to regulations.

Basic uses of plastic in everyday life

- Consumer goods, including sanitary products, plastic shoes, bags, mattresses, sporting goods, gardening items, pet supplies, clothing prints, tarpaulins, etc.
- Products for children, including diapers, bibs, bottles, toys, changing tables, etc.
- Construction materials include pipes, floors, insulation, wallpaper, adhesives and sealants.
- Electronic products, including tablets, televisions, kitchen appliances, mobile phones, etc.
- Furniture, including textiles and furniture.
- Vehicles include decoration of car seats and accessories. All types of vehicles (airplanes, trains, trucks, cars) are included in the concept car. In reality, however, these large flows are common cars (converted into ELVs). In the report, the focus is on the ELV.
- Food packaging and packaging.
- Recycled plastic.

Methodology

The study is mainly done by reading online materials, such as scientific articles and data from different organizations. Although books contain information on traditional plastics, the concept of biodegradable plastics is relatively new, and it is easier and more convenient to find online resources that are updated regularly. In addition, data on the consumption and recycling of plastics can easily be found on the website of organizations related to the environment and chemicals in the annual report.

Plastics Consumption

In different areas of application, the consumption patterns of the five most commonly used types of plastic appear to be consistent in the developed regions of the world. More than a third of the consumption is made in packaging applications (which use common products such as containers and plastic bags) and more than a third more for construction products, including common products such as plastic pipes or vinyl siding. In developing countries, usage patterns may vary slightly; For example, in India, it is reported that 42% of resin consumption comes from the packaging industry (Mutha et al., 2006). Smaller but rather large amounts of plastic are used in automotive applications and toy / furniture manufacturing. As lower unit costs and improved performance specifications continue to promote alternatives to paper, metal, wood and glass, the use of plastic in developing countries is increasing. Plastics are clearly an important part of the range of materials used in modern society. Almost all aspects of everyday life involve some form of plastic or rubber. These include clothing and footwear, as well as food products and public health applications. More than 40 million tons of plastics worldwide are converted into textile fibers (mainly nylon, polyester and acrylic) for the production of clothing. Polycotton garments contain high levels of PET plastic; high performance garments are almost exclusively plastic: polyester, fluoropolymer and nylon. Wool garments are 100% plastic (PET) and can be made from recycled PET. Most footwear also depends heavily on plastic; the insole and sole are made of polyurethane or other elastic materials, while the upper part can be made of vinyl or other synthetic polymers. Plastics also offer many benefits for public health. They promote the supply of drinking water and provide medical equipment through surgical equipment, drip, sterile medical containers and pill containers. They provide packaging that reduces food waste, such as the use of improved atmospheric packaging (Mullan 2002), which extends the shelf life of meat and vegetables. Due to the light weight of plastics, plastics reduce transport costs and, therefore, reduce carbon dioxide emissions in the atmosphere. Public and private transport vehicles can now contain up to 20% plastic, usually as package shelves, door liners, steering wheels, Electrical and electronic equipment, and recent aircraft such as Boeing Dreamliners, with up to 50% plastic design. Plastics can also be used to improve performance and reduce the cost of building materials; Examples of this include lightweight fasteners, door and window frames, accessories and insulation. Plastics can also save energy and improve the quality of many recreational activities in a variety of other applications. Soccer teams and other standard World Cup teams, such as tennis, squash and golf clubs, use nylon, polyether ketone, PP and polymer rubber compounds.

Plastics offer unmatched design versatility in a wide range of operating temperatures. They have a high weight / strength ratio, stiffness and toughness, ductility, corrosion resistance, bio-inertia, high thermal / electrical insulation, no toxicity and excellent durability, and a relatively low cost of living compared to competing materials ; highly effective. According to Plastics Europe (2008), plastics can be manufactured with any raw material that contains carbon and hydrogen. Currently, fossil fuels are the preferred raw material, but plastics are also made from renewable resources such as sugar and corn. Approximately 4% of world oil and gas production is used as raw material for the production of plastics, and similar quantities are used as energy sources in the process. However, plastics essentially store carbon and retain this energy by reusing and recycling the plastic. **Table 1:** Hazardous substances and product groups For a list of the specific chemicals used in plastics, their function, the type of plastic used, the type of product found and the reference material, see Annex 1. Note that the column "Example of type of plastic "is an example, not an exhaustive list.

Hazardous substance group	**Product examples**	**Plastic type examples**
Antimicrobial substances such as organic tin compounds	Shower curtains and rain wear	
Heavy metal based colorants, stabilisers and catalysts such as cadmium and lead and their compounds	Plastic shoes and bathroom products	
Monomers, cross linkers, hardeners, chain modifiers and catalysts such as Bisphenol A	Mattresses and sports shoes, thermo paper (receipts)	
Organic based colorants such as azo dyes	Clothes and bedding	PES, PA, acrylic
Plasticisers such as different phthalates and short-chained chlorinated paraffins (SCCP)	Bags and cases, garden goods, plastic shoes and articles intended for pets	PVC
Solvents –neutral and reactive, such as N, N-dimethylformamide (DMF)	Office supplies	
Others, such as nonylphenol and perfluorinated alkylated substances (e.g. PFOS and PFOA).	Sports shoes and mattresses (nonylphenol), textiles and non-stick products like pans (perfluorinated compounds	
Antimicrobial substances such as organic tin compounds	Diapers and car seats	
Heavy metal based colorants, stabilisers and catalysts such as cadmium and lead and their compounds	Plastic toys and car seats, electronic toys	
Flame retardants such as BFRs and organo-phosphates	Baby products and toys	PUR foam
Monomers, cross linkers, hardeners, chain modifiers and catalysts such as bisphenol A and formaldehyde	Drinking bottles for children and stuffing in car seats, pacifier holders, CD-disc, stickers	Polycarbonate, epoxi
Organic based colorants such as azo dyes	Toys from textile and car seats	
Plasticizers such as different phtalates and short-chained chlorinated paraffins (SCCP)	Bath toys and masquerade toys	
Others, such as perfluorinated alkylated substances (e.g. PFOS and PFOA)	Children’s clothes	
Antimicrobial substances such as organic tin compounds	PVC-flooring and plastisol roofs	
Heavy metal based colorants, stabilisers and catalysts such as cadmium and lead and their compounds	Floor mats	
Flame retardants such as BFRs (e.g. HBCD)	Insulation material	EPS, XPS
Monomers, cross linkers, hardeners, chain modifiers and catalysts such as Bisphenol A	Vinyl floors	
Plasticisers such as different phtalates and chlorinated paraffins (SCCP)	Plastic floors and buildings	PVC

Others, such as nonylphenol and perfluorinated alkylated substances (e.g. PFOS and PFOA)	PVC floors, lightweight concrete	PVC
Heavy metal based colorants, stabilisers and catalysts such as cadmium and lead and their compounds	Casing for TVs and PCs and consumer electronics, shredder residue	HIPS, ABS, ABS-PC, PPO-PS
Flame retardants such as BFRs (e.g. c-OE,TBDBBPA ja c-DBDE)	Scanners and casings for TVs and video devices	ABS, HIPS, ABS-PC, PPO-PS
Plasticisers such as short-chained chlorinated paraffins (SCCP)	Kitchen appliances and game controllers	(Soft) PVC
Others, such as perfluorinated alkylated substances (e.g. PFOS and PFOA)	Photographic and electronic equipment and components	
Flame retardants such as BFRs, hexabromocyclododecane (HBCDD) and rgano phosphates	Upholstery and filling in bean bags	PUR, EPS, PUR foam
Organic based colorants such as azo dyes	Textiles and upholstery for furniture	
Flame retardants such as BFRs (e.g. c-DBDE)	Car fittings, shredder residue	PUR /PU foam
Monomers, cross linkers, hardeners, chain modifiers and catalysts such as formaldehyde	Stuffing in car seats	
Organic based colorants such as azo dyes	Textiles in ELV	
Plasticisers such as short-chained chlorinated paraffins (SCCP)	Upholstery in ELV	
Heavy metal based colorants, stabilisers and catalysts such as cadmium and lead and their compounds	Soft PVC-packaging for toys	Soft PVC
Flame retardants such as BFRs	Packaging	EPS
Monomers, cross linkers, hardeners, chain modifiers and catalysts such as Bisphenol A	Packaging for cheese	
Plasticisers such as short-chained chlorinated paraffins (SCCP)	Packaging	
Heavy metal based colorants, stabilisers and catalysts such as cadmium and lead and their compounds	Recycled WEEE plastic	Recycled from: PET, PP, ABS PVC, possibly HIPS
Flame retardants such as BFRs	Recycled WEEE plastic	Recycled rom: PET, PP, ABS PVC, possibly HIPS

Reasons for using plastics

Although plastic is not good for the environment and produces a lot of garbage around the world, it still plays a very important role in our daily lives. The director of the movie "Indulge in Plastics," Ian Conak, said in an interview with Grimmez: "I don't think these materials should be blamed. I think this is our abuse of materials as consumers, an inefficient recycling policy and the lack of producers (Greenmuze staff 2008). "In fact, plastic is a very useful material that can give us convenience and make many things possible. One of the well known facts is that the price is cheap. If plastic is not used, consumer packaging costs will be increased by 89% (American Chemistry Council 2007). In addition to some shortcomings, plastics are surprisingly beneficial in different ways. The plastic is very light. Without plastic, the package requires 3.98 times the weight of the material; for every seven trucks needed to supply paper to the grocery store, only one truck can carry the same amount of plastic food bags. This means that a significant amount of oil can be saved during transport while less greenhouse gases are released (American Chemistry Council 2007). Plastics require less energy in the production process. Polystyrene foam containers reduce the total energy required to make cardboard containers by 30%; by using plastics in packaging, European product manufacturers save an equivalent of 101 million barrels of oil per year. Although plastic is not very environmentally friendly, it saves energy and also reduces greenhouse gas emissions (Imhoff 2005). The plastic is also durable and resistant. Plastic wood is made from recycled plastic and holds nails and screws better than wood, which requires little maintenance. Due to the way the plastic molecules are arranged, it can remain intact for a long time and is very strong but not brittle. Plastics are also easy to mold (American Chemistry Council 2007).

Societal Benefits of Plastics

(a) Improving health and consumer safety, Plastics contribute to the health and safety of consumers in food and water packaging applications.
Water has become the focus of urban areas, and plastics provide a mechanism for the supply and storage of drinking water. In addition, plastics are lightweight, easy to manufacture and are installed in a variety of different water control and distribution systems (eg, sewage, rain, land drainage and irrigation).

(b) Plastic food packaging allows safe and time-dependent storage of fresh products and other foods using temperature and atmosphere controls in the package (using gas packaging and oxygen removal technology). In addition, the quality of packaged foods (especially the time and temperature history) can be controlled using the integrated low-cost indicator label (M. A. Neal 1990-1995, personal communication).

(c) Energy Savings, The use of plastics in transport buildings and even packaging applications can always generate significant savings in fossil fuel materials and energy . For example, a comprehensive study published in January 2005, GUA (Gesellschaftfu ̈rumfassendeAnalysen GmbH) confirmed that PET and beverages packaged in glass or metal can reduce energy consumption by 52% (83.2 GJ in Europe only, and twenty-one). Greenhouse gas emissions are also reduced by 55% (2.3 million tons of carbon dioxide equivalents per year in Europe). The use of lighter plastic compounds instead of metals in the design of newer aircraft results in significant fuel cost savings and easier assembly. For example, the new Boeing 787 will have a 100% composite housing and a 50% plastic composite interior that will save 20% on fuel costs. In the automotive sector, the replacement of metal parts with less than 50% by weight of plastic compounds contributes to significant energy savings. Aluminum can also be replaced with plastic parts, with 50% less plastic parts and cost savings of 20-30%. For example, light vehicles have an average plastic content of 110 kg or approximately 12% of their weight (Gehm 2006). In a recent study, it was discovered that the energy consumption to make disposable expanded polystyrene cups is much lower than the energy consumption of ceramic vessels or disposable cups. When considering cleanliness, reusable ceramic cups require hundreds of uses to match a single-use expanded polystyrene cup in terms of energy use (Hocking 2006). A similar study conducted by the Dutch TNO Institute (2007) confirmed Hawking's findings

Manufacturing Plastics and health hazards related to it

The chemicals used to make plastics are highly toxic, mainly carcinogenic. As we all know, they have an effect on the nervous system, blood, kidneys and the like. Plastics are added with many additives, such as plasticizers, which are known to be harmful. Bis (2-ethylhexyl) adipate or commonly called DEHA is a plasticizer for PVC-based plastic containers. For many years, DEHA has been controversial for its possible health risks. It has been shown to be carcinogenic and estrogenic in some experimental animals. The U.S. Environmental Protection Agency(EPA) List DEHA as a human carcinogen. Another common event in the field of plastics manufacturing is lead poisoning. Lead stabilizers such as lead sulfate or lead stearate are commonly used as additives in PVC plastics. These lead compounds are supplied in powder form when used in the manufacturing process, which exposes workers to the risk of poisoning. In 1992, the Texas Department of Health reported on a lead poisoning investigation conducted by a manufacturer of plastic pigments. Seven of the 22 workers had blood lead levels (BLL) greater than 40 μg / dl (Coyle 2005). Lead is a harmful chemical that can cause serious health problems. When it enters the body, it is distributed throughout the body like other minerals. It can destroy red blood cells and affect their ability to deliver oxygen to the organs and tissues that need them. Lead has a tendency to remain in the bone, which has led to the accumulation of bone over the years. Lead interferes with the formation of blood cells and the absorption of calcium by the bones. Long-term lead poisoning has many serious health effects, such as reduced bone growth and muscle development, impaired nervous system, language and language problems, and loss of consciousness.

Leaching of chemicals

Often, high temperatures can cause plastics to leach chemicals. It has been found that hazardous chemicals are filtered from plastic bottles, such as plastic bottles and plastic containers. It was discovered that a harmful chemical bisphenol A, commonly known as BPA, was leached from a plastic bottle made of polycarbonate. This is a common component used in plastic bottles and is also the lining of metal cans. Plastic bottles made for babies contain this chemical, which makes the situation even more dangerous. The wear of bottles that often work with water to wash dishes can lead to leaching of this chemical. In fact, in one study, old and new bottles filled with water at room temperature released the same amount of BPA. When exposed to boiling water, these bottles release BPA by a factor of 55 (Szabo 2008). BPA does not apply to all plastic bottles. It is found in polycarbonate plastics that contain recycling code No. 7. According to animal experiments conducted by scientists, it was discovered that BPA affects brain development and reproductive function. Mainly, it is called an "endocrine disruptor," which means that it mimics the effects of sex hormones in the body. It is known to mimic estrogen binding to the same receptor throughout the human body as a natural estrogen.

This chemical is expected to promote the growth of human breast cancer cells. No exhaustive research on humans has been conducted to draw conclusions that BPA is extremely harmful to humans, but so far animal experiments have raised scientists' concerns about human influence. When BPA was first approved for use in food containers in 1963, its negative effects were unknown. However, studies since 1976 have shown that small doses of bisphenol A can be destructive. In one study, the receptors were stimulated by BPA in the prostate gland of the fetus a thousand times faster than estradiol, a sex hormone that represents the main estrogens in humans. Subsequently, these mice developed cancer and other health problems (Biello 2008). The focus on BPA is also common in other parts of the world. In 1997, when research showed that it was leached from bottles, Japanese manufacturers used natural resins instead of BPA to make coating cans. Although the BPA has the advantages of being cheap, unbreakable and light, there are other alternatives that can use the BPA to avoid possible health risks. Polyethylene and polypropylene plastics are a good alternative to BPA in at least some applications. In addition to polycarbonate, which breaks down seven codes of plastic resins and the hazardous chemicals that it leaches, we can propose the following types of resins:

Polyethylene Terephalate (PETE or PET)

It is commonly used in water, soda, mouthwash and detergent containers. It is well known that leaching of "antimony trioxide" can cause respiratory and skin irritation, a higher incidence of abortions in women and prolonged exposure to other menstrual problems.

Polystyrene:

It is commonly used in egg cartons, styrofoam containers, plastic cutlery and takeaway containers. It is well known that styrene is an endocrine disruptor, such as BPA, which is known to mimic the female hormone estrogen. It has the potential to cause reproductive problems and female development, neurological diseases.

Polyvinyl chloride (PVC)

It is commonly used in toys, compression bottles, shampoo bottles, edible oil bottles and even medical tubes. PVC is described as one of the most dangerous consumer products of all time. It can be leached with phthalate (DEHP) or butyl benzyl phthalate (BBzP). Like BPA, these chemicals act as endocrine disruptors that mimic the estrogens of female hormones. They are also associated with asthma and allergic symptoms in children, effects on the spleen and kidneys, bone formation and body weight. In Europe, since 1999, the use of DEHP or BBzP to manufacture children's toys has been banned (Become Plastic Aware n.d.).

Other health problems

The health risks of plastics come not only from the manufacturing and consumption process, but also from the damage caused by the incineration. Incineration pollutes air, water and land to expose workers to toxic chemicals, including carcinogens. Recycling is a challenge in itself, and the fact that used plastic is thrown to the ground will never reduce the problem. Over the years, they have broken down into smaller pieces that are not biodegraded by bacteria in the soil. Its accumulation over the years has led to an increase in soil toxicity, which has many adverse effects on life dependent on plants and animals.

Risks related to hazardous substances

Most of the chemicals used as additives can migrate and, therefore, do not bind to plastics. Migration depends largely on the physicochemical properties of the substance, depending on the size of the material, its boiling point, its vapor pressure, its solubility in the plastic and the surrounding environment / material. Often, consumers may be exposed to substances with high mobility, but the application of the substance is also important, and the knowledge here is not detailed enough to allow comprehensive exposure assessments for different groups of consumers, such as children and adults. For example, a study by Palm Cousins and Loh Lindholm (2016) could not demonstrate that the normal use of PVC floors or walls that contain DINP / DIDP would pose a health risk. Another study by Ionas et al. however, (2014) found flame retardants in children's toys. They speculate that recycled materials have been used to produce these toys and, in some cases, may pose a danger to children's health. However, the Swedish Environmental Protection Agency said: “The content of particularly dangerous substances, if found in recycled materials, is usually many orders of magnitude smaller than the original material. Therefore, the intentional addition of particularly hazardous substances generally carries a greater risk of harmful exposure to humans and the environment than exposure to recycled materials "(Naturvårdsverket, 2016c). To carry out a real risk assessment, it is necessary to know the chemical composition of the recovered material. Fast screening a complex matrix to obtain an image of the content contained in the matrix can be useful and has been developed by Ballesteros Gómez (2014; 2013). It is also possible to analyze the emissions of materials or articles / products, for example, in a download chamber (Rauert et al., 2014). It can be divided into the following categories:

- Plastic waste generally contains a small amount of hazardous substances: for example, food packaging waste.

• Plastic waste that may contain large amounts of hazardous materials, such as old PVC in building materials.

Environmental risks may also be related to the type of recycling. In the case of chemical cycles (eg thermochemical conversion), hazardous substances in the waste stream are not transferred to new products. The current information on hazardous substances in plastics is about the information that can generally be used to achieve different properties in production. It can also be information about the substances found in plastics when analyzing chemical components. In both cases, does this mean that the plastic product or type of plastic always contains the target substance? The use of recycled materials is also expected to be important due to the producer's regulations and restrictions on the substances allowed. To purify the current and establish acceptable levels of risk for waste recycling, more attention should be given to plastic waste that is produced in large quantities and may contain hazardous materials.

Which plastic products that commonly contain hazardous substances?

Knowledge of which plastic products often contain dangerous substances, such as TV covers and computer screens, has been established. Using XRF scanners in certain brands of different brands, you can generate guidance documents for employees on the amount of hazardous substances in different products, specifying which products should be separated from other products or components, but sent to high temperature combustion. In terms of plastics classification, only plastics containing BFR are currently identified and separated (Bibi 2014). In Denmark, the DPA system of responsibility of the Danish producer is fully responsible for managing WEEE processing. However, for real management, municipalities, transport companies and companies specializing in WEEE dismantling are involved. In general, transport companies are collecting WEEE from municipal recycling stations, retail stores and large companies. The collected WEEE are sent to specialized companies such as DanWEEE Recycling AS, which are dismantling WEEE and collecting these components based on known experience, for example, that can be sold in the market. For example, transparent plastics of larger plastic parts have no harmful substances. While plastics generally represent a significant portion of the waste (about 40% by weight), it is also a rare metal and is the focus of the recycling business. As a result, many plastic parts are sent to foreign incineration or other companies.

SAICM:

SAICM referred to the Strategic Approach to International Chemicals Management and was adopted by the International Conference on Chemicals Management (ICCM) in 2006. The policy framework identifies the production of chemical products and uses objectives to minimize adverse impacts. In the environment and human health by 2020. The Chemical Products Program (CiP) in SAICM and Recycling of Plastics SAICM is a continuous activity on policies and practices to obtain information on chemical products in everyday products. The objective of these activities is to increase the availability and access to information that participants need throughout the product's life cycle so that they can properly manage these products and the chemicals they contain. One of the potential results of CiP is "Strengthen the safe recycling and reuse of materials and products" (SAICM, 2016). The lack of information on the chemical composition of plastics is considered a recycling problem. The Rotterdam Convention "Rotterdam Convention" aims to protect the environment and human health and promote the more environmentally friendly use of certain chemicals by promoting common responsibility and the joint efforts of countries in the trade in certain dangerous substances. This will be achieved by facilitating the exchange of information on the nature of chemical products, implementing national decision-making methods for the import and export of such chemical products (the so-called prior informed consent approach) and communicating the decisions made to the parties. The prior informed consent approach and the exchange of information are the two most important provisions of the Rotterdam Convention. Rotterdam Convention and recycling of plastics if the plastic waste contains any of the chemicals listed in Annex III of the Rotterdam Convention, the Convention may have an impact on the export or import of plastic waste for recycling. Annex III includes, among others, pesticides and some industrial chemicals (related here: specific flame retardants (for example, c-OctaBDE, pentaBDE) and PFOS). The importance of the Rotterdam Convention refers mainly to plastic waste containing specific flame retardants and PFOS. 2.2.4 Toy Safety Directive 2009/48 / EC because toys must be safe, children can play and promote their development and play harmlessly. The Toy Safety Directive aims to ensure a high level of protection against harmful substances in toys. The risks, especially those classified as CMR, allergens and certain metals.

Solutions to the Problems of Plastics

Chemical Decomposing:

Because traditional plastics are cheap and convenient, they are now widely used worldwide, and it seems difficult to replace traditional plastics with more ecological but more expensive biodegradable plastics. Therefore, if a technology is developed to chemically break down the plastic into harmless molecules, it will be a good solution to the problem of plastic contamination. Scientists have discovered several methods of decomposition of products, such as plastic bags made of traditional plastics, but unfortunately, it seems that large-scale decomposition of plastics remains a challenge.

Recently, a Canadian teenager, Daniel Bird, discovered a way to break plastic bags in three months, and plastic bags generally take 20 years or more to break. Since polyethylene (PE) is the main component of conventional plastic bags and decomposes under natural conditions after a long period of time, it assumes that there is a bacterium that can digest and break down plastic bags. If a method is developed to separate such bacteria, it is likely that they can be used to break the plastic bags. Therefore, he designed a series of experiments to identify bacteria in soil samples collected from local landfills in Waterloo, Ontario, and discovered that Sphingomonas and Pseudomonas are two microorganisms that can consume plastic bags (Burd, 2008). Although the experiment was conducted on a small scale, it is possible to develop a technique based on this experiment to decompose PE on an industrial scale because the two bacteria are only obtained from the landfill. However, if the concentration is low, it can be inexpensive and challenging to separate large amounts of bacteria from the soil, and collecting plastic bags can be problematic before embedding the plastic bags in a landfill or eventually entering the ocean. Wheelabrator Technologies Inc., a company that successfully develops technology to extract energy from the burning of municipal solid waste, currently operates a power plant. Its facilities for converting waste into energy not only provide safe municipal solid waste, but also provide clean and renewable electricity to thousands of homes and businesses (Wheelabrator Technologies Inc.). Take the Millbury power plant as an example. It processes up to 1,500 tons of municipal solids per day and provides electricity to more than 57,000 homes in central Massachusetts. The power plant operates in a very simple way.

Garbage transported by truck to the power plant undergoes a complete combustion process in a boiler at 2000 degrees Fahrenheit. The air used in the combustion process is removed from the garbage receiving building so that the pressure in the building can remain negative. This negative pressure prevents odors and dust from escaping outward. The heat generated by combustion is recovered as high pressure steam through the surrounding boiler and then converted into electrical energy. Emission control is critical because toxic gases can come from burning waste. At the Millbury plant, several technologies have been applied to clean the exhaust gases so that harmful by-products such as nitrogen oxides, mercury and organic pollutants are not released into the environment. Today, the Wheelabrator power plant meets all current air quality requirements through exhaust gas control technology. After completely eliminating waste and removing ferrous metals from the waste, the volume of waste can be reduced by 90%, demonstrating that this is a very efficient and ecological way to treat municipal waste (Wheelabrator Technologies Inc.). However, these waste-to-energy plants are designed for urban waste and are not specifically designed for plastics. They saved some landfill space, but did not directly solve the plastic problem. But this is still a very inspiring case, which shows that you can build a power plant like Wheelabrator, but only for plastics.

Biodegradable Plastics:

A list of ingredients for preparing biodegradable plastics Biodegradable plastics is prepared as follows. Starches from renewable resources such as plants (starch) are obtained from corn, wheat or potatoes, which use carbohydrates as a source of energy. However, starch cannot be used directly in the manufacture of plastics because it has the ability to dissolve in water. If the plastic is made directly from starch without any chemical modification, items made of such plastics will swell and deform with exposure to moisture. This is the reason why starch is first modified in different polymers. The process of making this change is very easy to understand. The microorganisms convert the harvested starch from the cultures into monomeric lactic acid. Then, the lactic acid is subjected to a chemical treatment that results in the binding of the lactic acid molecule to the long chain or to the polymer. These chains form a plastic commonly known as polylactide (PLA).

Using bacteria

Over the years, science has progressed tremendously. A fascinating aspect of science is the use of creatures around us to improve the environment and our lives. Another important measure to make biodegradable plastics involves the use of bacteria in the process. They are only grown in the medium and then used to produce plastic particles called poly hydroxyalkanoates (PHA) in the cells. It is important to understand how these bacteria help humans solve one of the biggest problems of the recent period: increase the use of plastics and the environmental hazards associated with them. Many species of bacteria are capable of producing substances called polyhydroxybutyrate or PHB. This substance can be used as an energy source for these bacteria, as well as the storage of fat in the human body. Interestingly, PHB is a biodegradable plastic. Scientists have had great success in this natural process that occurs in bacteria. These bacteria are fed with an adequate amount of sugar to carry out a fermentation process to produce PHB in the required amount. In addition, scientists have also produced PHB by genetically modifying plants by inserting genes from these bacteria into plants such as corn to design PHB.

Oxo-biodegradable plastics

These plastics are made of refining byproducts. One of the reasons why oxidized biodegradable plastics are an option for conventional plastics is that they can be produced by by-products that would otherwise be wasted.

From an environmental point of view, it can be shown that it is very useful to make full use of the by-products instead of wasting them. In addition, these plastics can be manufactured with the same machinery and labor required to manufacture traditional plastics. Therefore, from a financial point of view, the cost of preparing oxygenated biodegradable plastics is less than the cost of making conventional plastics. In addition, these plastics can be programmed to degrade in the time required during manufacturing, which gives them the advantages of traditional plastics. They have the same resistance and other properties as traditional plastics before degrading.

The Market for biodegradable plastics

The biodegradable plastics market depends on many factors, from the expansion of costs to the acceptance of traditional plastics. Any type of change takes time to accept, so accept these plastics. We have grown all our lives and are used to traditional, easy-to-use and inexpensive plastics. Therefore, the idea of introducing costly alternatives is not attractive simply because it is beneficial from an environmental point of view. Breaking down the factors that can play a role in determining these plastics markets may raise the following questions. The terms “disintegration", "decomposition", "degradation" and "biodegradation" of completely biodegradable have different meanings. When we talk about biodegradable plastics, we often think that they are easily degraded by the influence of nature over time. However, we may have to reconsider this problem because the biodegradable plastics that we ideally imagine will be "green plastics." Many biodegradable plastics are made from a mixture of starch derivatives and conventional petroleum-based polymers. Even if the bacteria break down the starch molecules in them when they are exposed to a suitable environment, such as warm, moist soil, they still leave innumerable small pieces of plastic. The quality of these plastic parts is only slightly smaller than that of the original product. In addition, the small pieces of plastic left behind occupy only the space on the floor and accumulate over time. They do not provide nutrients to the soil; sometimes they can cause toxic effects and negatively affect the soil and plant organisms. Therefore, achieving full biodegradability of biodegradable plastics makes them "green" as the first step to guarantee their bright future (Kissell 2005). Many of the so-called biodegradable plastics are only semi-degradable due to cost barriers. Polyhydroxyalkanoate (PHA) biopolymers are completely biodegradable. These products are not produced enough to produce biodegradable plastics. However, it should be borne in mind that there may be many possible mixtures of polymers that make the final product more biodegradable. Scientists have made many interesting recent developments in the field. One of them is the invention of biodegradable plastics that can be thrown into seawater. Every day, a large number of transport materials are disposed of in seawater, which will remain for a long time and will negatively affect marine life. Robson Storey, a polymer scientist at the University of South Mississippi, points out the importance of biodegradable plastics because they are sustainable and useful from an environmental point of view. When exposed to seawater, new plastics can dissolve in just 20 days (Choi 2007). These plastics are modified from polyurethanes and contain a biodegradable compound called PLGA. This is similar to what was used in medical sutures for many years. Therefore, it has been the material tested and examined. These plastics will be denser than seawater and will sink instead of floating, which will prevent discharge on the shores and coastlines. When it comes to additives that can improve the biodegradability of plastics, there are many possible ways to do it (The Solutions For Plastic n.d.).

Modification of existing materials

A thin matrix of conventional polyethylene is filled with starch to make a partially biodegradable plastic bag. When the bag is poured, the microorganisms feed on the starch, leaving a polyethylene film structure that disintegrates rapidly. To develop fully biodegradable plastics, scientists have been involved in the world. In the United States, Warner Lambert is involved in the development of fully biodegradable plastics based on starch. It will consist of 80% starch and additives as plasticizers, which will be used to improve process ability and make it more resistant. A distinctive feature of these newly developed plastics is their versatility. They can be used in disposable items such as cups and trays to make pharmaceutical capsules.

Chemical co-polymerization of known biodegradable materials

The use of known biodegradable materials and additives to improve biodegradability is another objective of scientists involved in the field worldwide. Sekisui Chemical Group is a company with operations in about 20 countries and has more than 200 companies based in Japan. The company has developed a new type of plastic by copolymerizing two different biodegradable chemicals based on aliphatic polyester derivatives. This plastic is based on polyester and is broken down into products such as water and carbon dioxide with the help of enzymes such as lipase, and is no longer contaminated like other biodegradable plastics. It is said that this plastic is stronger than polyethylene with faster biodegradability. It is said that this 100 micron thick plastic film will completely decompose on the ground in just two months (The Solutions For Plastic n.d.). Although these plastics have been highly biodegradable, their biodegradability can always be controlled according to the polymerization conditions. Another advantage of this plastic is that it is a thermoplastic that is easy to recycle.

Another company, Tubiz Plastics, is a subsidiary of Rhone Poulenc in Belgium, which developed a new biodegradable plastic called Bioceta, which is based exclusively on cellulose diacetate. The additives they use not only plasticize but also accelerate the degradation of microorganisms.

Use of biopolymers for making plastics

Scientists have also proposed alternatives, including microbes and genetically modified plants, to produce biodegradable plastic polymers. These plastics are called bioplastics. However, their biodegradability depends on factors such as the microbial activity of the environment and the surface area to which they are exposed. Despite its biodegradability, PHA still has good resistance to water and moisture and is stable during use or storage.

Plastics and the Future

As the futuristic Hammond (2007) recently published, "The World of 2030", the speed of technological development has grown exponentially, so by 2030, it seems worth advancing an entire century on 21. The first thirty years of the century. In many ways, life in 2030 will be unrecognizable compared to life today. During this time, plastic will play an important role in our lives. Plastics have become "intelligent" and can play many important roles in the afterlife, including transplants of human and even organ tissues, key materials used in ultra-low emission light vehicles and airplanes and the collection of insulation in the home based on plastic based photovoltaic technology. Reusable books or magazines with electronic graphic media, smart packaging, sustainable monitoring of food content for signs of corruption and efficient solid-state lighting based on organic plastic diode technology. As oil reserves become more limited, more and more varieties of plastic can be manufactured from renewable biomass. These will contribute to the many mechanical and aesthetic properties that plastics are known for. Therefore, any future situation in which plastics do not play an increasingly important role in human life seems to be unrealistic.

Conclusion

Plastics represent a large part of society, from plastics for furniture and electronic products to small homes, such as containers and grocery bags. Since plastics are available to consumers for the first time, they are widely used because of their advantages, such as their light weight, durability and the ability to mold into any product with chemicals and additives. However, plastics also have a number of deficiencies, including health problems from manufacturing to consumption, as well as the negative environmental impacts caused by the accumulation of plastic waste. No matter how much scientists are involved in the field, unless people are fully aware of the differences between the two plastics and make the right decisions, there will be little success. Therefore, public awareness plays a crucial role in determining the biodegradable plastics market. According to a survey of 500 people conducted in April 2007, 70% of Americans did not realize that the plastic was made of crude oil. 40% also believe that all plastics are biodegradable. With the right information, people are willing to make ecological decisions. Through simple data and information, we can get a perspective that allows people to think and worry more. According to the U.S. Environmental Protection Agency (Enhanced Environmental Awareness 2007), about 2 million barrels of crude oil are produced per day, and only 6% of plastics are recycled. These facts and figures can help people realize why they should choose biodegradable plastics instead of traditional plastics. Not only from an environmental point of view, there is also a significant health risk in the production of plastics. Chemicals released in the production of plastic can cause birth defects and damage the nervous system, blood, kidneys, etc. Even the plastics used in our homes release harmful toxins, especially in case of fire. The health risks of plastics will be discussed more on specific issues.

It is believed that biopolymers were not originally manufactured for use as plastic materials. Instead, they are invented as cellular components with the ability to survive a living organism in a given environment. However, the gradual development of several biopolymers over the years has stimulated the development of the plastics industry. As an informed and concerned customer, the prospect of introducing biodegradable plastics in life is promising and progressive.

- Although the economy of biodegradable plastics is usually the biggest obstacle, it should be recognized that the cost depends on availability and use. If traditional plastics are to be abandoned altogether, the demand and production of biodegradable plastics will increase, making their prices reasonable.
- Currently, it is only an option for traditional plastics, but if you want to completely replace traditional plastics, people have no choice but to use them. Its use not only solves the problem of limited space in landfills, but also solves the problem of rising crude oil prices.
- Adding biodegradable plastics to daily use not only reduces the pressure on fossil fuels, but also encourages agricultural producers interested in exploring and developing natural fiber processing industries. If biodegradable plastics can become the mainstream, they can generate large amounts of agricultural income.

In addition to the obvious economic and environmental benefits, biodegradable plastics are also gradual from a scientific point of view. The genetic engineering of plants mainly deals with the modification of plants to produce the genes that ultimately produce plastics, a furious scientific issue. Many interesting research and developments have been carried out along with this topic. Therefore, biodegradable plastics provide a good space for scientific research and genetic engineering research. The genetic engineering of plants is used for the purpose of full use, in which plants can be used for industrial applications in addition to food. In addition to being used for everyday purposes, biodegradable plastics also have a wide range of applications in the medical field. Therefore, the market for these plastics seems very promising. The biodegradable sutures used in medicine have been approved since the 1960s. When used as an implant, the biodegradable drug device does not require a second surgical procedure for its removal. This makes the procedure safer and reduces the likelihood of infection. If their production can be generalized, they are likely to expand to many areas over the years.

Recommendations

- Adding biodegradable plastics to everyday life is a progressive idea and a way to achieve a greener, healthier and better environment.
- Recalling what was described earlier in the document, the use of biodegradable plastics has greatly reduced dependence on fossil fuels. This is one of the main reasons why we strongly promote these plastic concepts. We are responsible for the future generation, all of which begins with the care of our planet. Even if we currently have access to fossil fuels, we are responsible for the proper use and management of these resources. Biopolymer researchers are considering the fact that alternative materials are soon needed for the manufacture of plastics.
- Last but not least, we have come to the conclusion that it is important to educate people on this issue to reduce the use and waste of plastic. While we knew about plastics and alternatives at the beginning of the project, we did not understand the seriousness of the problem and the possible solutions. There are alternatives and solutions available to reduce the use of plastics and its negative impacts. However, unless people understand and receive education, it cannot function effectively.

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