Committee: Forensics Junior Group Discussion (FJGD)

Topic: Measures to Abolish Single-Use Plastic from the Market

Student Officer: Theofilos Kiakidis and Louai EL Hajj

Position: Deputy Presidents

Personal Introduction

Dear delegates,

My name is Theofilos Kiakidis and I am fifteen years old. I am looking forward to co-chairing the Forensics Junior Group Discussion committee for the first time and attending my fourth MUN conference thus far. Since I started participating in MUN through the past years I found a personal interest in this type of diplomacy which in turn made the experience of learning about severe global issues and how to combat them with theoretical and practical methods, an enjoyable adventure. I hope you can withdraw the same feelings that I have gained with the more MUNs you participate in.

One of this year's topics for this committee is measures to abolish single-use plastics from the market. In the following study guide, you will learn the back story which has led to this modern-day problem, the factors that first spread awareness to plastic pollution, which countries and organisations have been involved in solving the issue and what they have already done to solve it.

Best regards,

Theofilos Kiakidis

Dear delegates,

My name is Louai and I am 15 years old. I am absolutely delighted to be serving as one of the co-chairs in the Forensics Junior Group Discussion. Even though Mun is an extracurricular activity in which you have to devote your time and efforts, it is a key steppingstone to a bright future. In this committee, you will be intrigued to keep up with global affairs without being bored, representing your delegation at a 'global' level whilst feeling a sense of power, control and jubilation. Most importantly, you will have the opportunity to interact with people from different backgrounds, make alliances and come up with diverse and effective solutions manifesting a fruitful conference.

Best of luck,

Louai El Hajj

Please do not hesitate to email us if you have any questions about the topic.

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Topic Introduction

Over the past century, the plastics industry has played a major role in the development of societies around the world, offering a cheap and durable alternative to other synthetic or organic materials we use daily. However, over that period of time, the harmful effect of plastic on ecosystems around the world and the economy were vastly unknown. Only in recent decades have countries and organisations attempted to find solutions to plastic pollution. Due to plastics' high chemical and physical resistance, it is approximated it would need one millennium to naturally decompose in nature after it has been produced. This has caused many organisms in nature to get tangled in these materials or even mistaking them as food and eating them causing them to die from suffocation or plastic poisoning. Countless animal species have become extinct in this

way. Furthermore, many large areas in the world are dedicated to the disposal of waste products produced by humans in which a majority of the trash contained there consists of various sorts of plastics. So, if we do not become more plastic independent, more land which serves as a natural habitat to many animals or land that could be used for useful economic development will become wasted. As the issue of plastic pollution is becoming more apparent over the years many countries and organisations have commenced operation in the creation of more environmentally friendly plastics, for efficient and wide-scale recycling operations and the introduction of law and regulations for the reduction of plastic either with the use of fines or complete bans of the material's purchase as a whole.

Definition of key terms

Plastic

A long chain of synthetic polymers made from carbon-containing compounds. It has a large variety of uses due to it being easily malleable when under heat or pressure.[1]

Polymers

Long repeating chains of chemically bonded molecules which consist of smaller units called monomers.[2]

1 "Plastic | Definition of Plastic by Oxford Dictionary on Lexico ...." https://www.lexico.com/en/definition/plastic. Accessed 21 Jul. 2020.

2 "What Is a Polymer? | Live Science." 14 Oct. 2017, https://www.livescience.com/60682-polymers.html. Accessed 21 Jul. 2020.

Market

The location where individuals buy or sell goods and services to each other or that can buy shares (stocks) or items in a paper form.[3]

Abolish

To stop or to put an end to an action or idea.[4]

Pollution

Making part of essential components for life e.g. water or habitats for animal and plant species unsuitable for use; leading to the waste of natural resources and the destruction of ecosystems.[5]

Enzymes

A biological catalyst that can speed up a natural process in the body or any living organism by lowering the activation energy for molecules to either fuse together or

3 "Market | Definition of Market by Oxford Dictionary on Lexico ...." https://www.lexico.com/en/definition/market. Accessed 21 Jul. 2020.

4 "Abolish | Definition of Abolish by Oxford Dictionary on Lexico ...." https://www.lexico.com/en/definition/abolish. Accessed 21 Jul. 2020.

5 "Pollution | Definition of Pollution by Oxford Dictionary ... - Lexico." https://www.lexico.com/en/definition/pollution. Accessed 21 Jul. 2020.

separate from each other. Enzymes can separate or fuse many different substrate molecules for multiple reactions before not being able to function any more.[6]

Bacteria

Unicellular organisms that have an irregular shape, have a cell wall, have one strand of DNA and have a few organelles inside their cell body.[7]

Microplastics

Pieces of plastic that are less than five millimetres in length.[8]

Single-use plastics

Commercially available materials made from synthetic polymers only intended to be used once by an individual and then discarded in a trash can or disposal location.[9]

6 "enzyme | Definition, Mechanisms ...." https://www.britannica.com/science/enzyme. Accessed 21 Jul. 2020.

7 "Bacterium | Definition of Bacterium by Oxford ... - Lexico." https://www.lexico.com/en/definition/bacterium. Accessed 21 Jul. 2020.

8 "What are microplastics? - NOAA's National Ocean Service." 30 Mar. 2020, https://oceanservice.noaa.gov/facts/microplastics.html. Accessed 21 Jul. 2020.

9 "What Are Single-use Plastics and Should They Be Banned ...." 28 Jan. 2020, https://science.howstuffworks.com/environmental/conservation/issues/single-use-plastics.htm. Accessed 21 Jul. 2020.

Ultra-thin plastics

Any plastic product that has a width length of under 0.025 millimetres.[10]

Phytoplankton

Microscopic organisms most classified as single-celled plants living at the surface of the water in the sea. They act as the producers in the aquatic food chain by carrying out photosynthesis.[11]

Algae

Unicellular plant organisms that live at the surface of sea or freshwater. The chloroplasts that they contain within themselves allows them to make their own food in the form of sugars effectively acting as travelling sea plants.[12]

Background Information

Plastics have changed our modern industry and daily lives but at the cost of the environment suffering and ultimately creating numerous issues around the world that need to be solved. However, to better understand what has led to the modern-day

10 "China set to ban ultra-thin plastic bags - Reuters." 26 May. 2008, https://www.reuters.com/article/us-china-plasticbags/china-set-to-ban-ultra-thin-plastic-bags-idUSPEK16089020080527?sp=true. Accessed 21 Jul. 2020.

11 "What are Phytoplankton? - NASA Earth ...." https://earthobservatory.nasa.gov/features/Phytoplankton. Accessed 21 Jul. 2020.

12 "Alga | Definition of Alga by Oxford Dictionary on Lexico.com ...." https://www.lexico.com/en/definition/alga. Accessed 21 Jul. 2020.

plastic crisis some important historical facts about how plastics were first created and how they got integration into our everyday lives have to be acknowledged first.

What Has Led to Mass Plastic Pollution Around The World?

Plastic was first invented in 1907[13] by a Belgian-American scientist. Plastic is a synthetic material made primarily from non-renewable resources such as petroleum and coal[14]. To create the material, only a small carbon footprint is created per plastic product or part if the manufacturing operation is run on a small scale. Even if it does require energy from burning fossil fuels to make the plastics themselves and to power all the machinery involved it is actuarial more environmentally friendly than creating other materials. A study from the Danish government found that you would need to use a reusable cotton bag around 7,100 total times for its carbon emissions to not outweigh the ones of making only one single-use plastic bag.[15] The issue with plastics is a common misconception. The plastics themselves are extremely useful in our society but what makes them so dangerous is how humans manage them when they have already used them. After the second world war, the number of plastics kept increasing every year and many countries hadn't integrated any recycling system or legal disposal locations for the wastes they kept, resulting in the accumulation of

13 "History of plastics :: PlasticsEurope." https://www.plasticseurope.org/en/about-plastics/what-are-plastics/history. Accessed 28 Jun. 2020.

14 "How plastics are made :: PlasticsEurope." https://www.plasticseurope.org/en/about-plastics/what-are-plastics/how-plastics-are-made. Accessed 28 Jun. 2020.

15 "The Ministry - Ministry of Environment and Food of Denmark." https://en.mfvm.dk/the-ministry/. Accessed 11 Jul. 2020.

plastics in areas where a lot of wildlife was present. In some instances, the governments didn't even bother to collect plastics but instead decided to dump the plastics in the ocean where they would collect in huge masses thanks to the movement of gyres (sea currents) in the ocean.[16]

Integration of plastic into everyday life

As mentioned in the previous paragraph, plastics were introduced to the public as commercially available products only after the second world war ended. This was because plastics were first used to make military-grade weapons for many armies which took part in the two world wars. Plastics usage ranged from components in hand grenades to big parts in aircraft and battleships.[17] In 1945 after the bombings in Japan took place, plastic companies had the ability to produce plastic products and parts at a very large scale, but they didn't know to whom they could sell it to. After planning and making major adjustments to machinery and marketing campaigns, plastic factories altered their focus to civilians.

They would make and sell many home products which make house chores and travelling easier and cheaper. In the mid-1960s, the first plastic furniture item was designed by a man named Joe Colombo. [18] After that many more pieces of plastic furniture were produced and as technology also advanced plastics proved to be material which couldn't conduct heat and electricity making it ideal for the protection of electrical components and to make an object or area not fluctuate in how hot or cold

16 "Great Pacific Garbage Patch | National ...." 5 Jul. 2019, https://www.nationalgeographic.org/encyclopedia/great-pacific-garbage-patch/. Accessed 12 Jul. 2020.

17 "History of Plastics | Plastics Industry Association." https://www.plasticsindustry.org/history-plastics. Accessed 12 Jul. 2020.

18 "Celebrating the Everychair of chairs, in cheap plastic - The ...." 4 Feb. 2007, https://www.nytimes.com/2007/02/04/style/04iht-design5.html. Accessed 12 Jul. 2020.

it is. However, in1976 scientists accidentally discovered a type of plastic that could conduct electricity at such a high level that the flow of electrons per second that could pass through the material could be comparable to that of copper. This discovery created a new field in which plastics could be used in. In some cases they could even replace metal parts because they were much more lightweight than most other metals, they could be used in so many more electronic appliances and they were significantly cheaper to manufacture. [19]

Industrial Manufacturing of Plastics - Blow Moulding

The process of making plastic into almost any shape has varied largely. The most common method of shaping a piece of plastic into any container or object is blow moulding. For factories to get plastic for the blow moulding process they first have to make it themselves. Plastic is made from many different materials, these may include coal, petroleum, cellulose, salts and other organic materials. These substances are mixed and heated into an industrial mixing machine until they harden and form into small plastic pellets. These pellets are then put into a sort of oven which melts them and turns them into a sort of easily moldable sludge. The mixture is then passed through a nozzle piece where it creates a relatively thick cylinder of plastic. That plastic is placed in between two identical half moulds of a specific product that want to be made (look at the

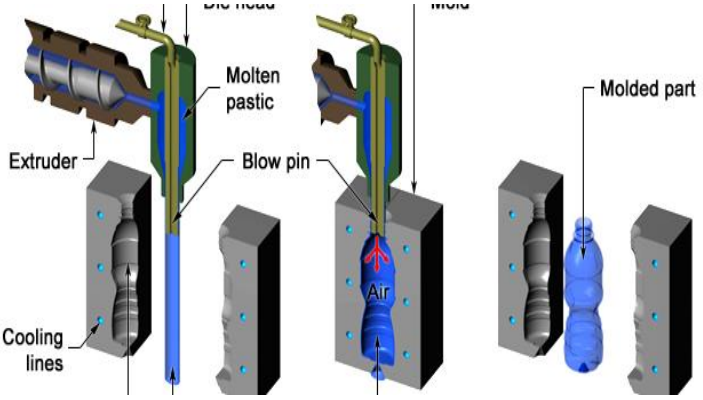

Figure 1 representing the process of blow-moulding

19 "Conductive Polymers - YouTube." 28 Oct. 2013, http://www.youtube.com/attribution_link?a=KcH9RA9i85w&u=/watch%3Fv%3DUjMbwSoLOkU%26feature%3Dshare. Accessed 12 Jul. 2020.

image on the right for visualisation).

As those moulds are facing each other and gradually come closer together they almost completely encase the plastic cylinder. At the top part of the mould, where the plastic was originally squeezed into a tube, a metal pipe moves into place. Its purpose is to blow hot air into the plastic's outer surface push against the mould's lining. Once the plastic has solidified it can be polished, dyed and tested for its durability and resistance to pressure. After that, the plastic can be packaged and delivered.[20]

Major countries and organizations involved

India

India has set multiple goals in reducing its plastic waste as well as the plastics it receives from other nations and its availability of plastic goods of plastics in the general market. When Narendra Modi, most recent Prime Minister of India, took office he set a goal that by 2022 all single-use plastics in the country would be banned.[21] As of March 2019, the government in India collectively decided to stop the importation of plastic waste into its borders. Also, the country has partnered with the United Nations Environmental Programmes (UNEP). The UNEP's new goal, as of February 2017, is to remove as many plastics from the world's ocean as possible with their Clean Sea

[20] "KENT Systems - Plastics are cool! Check out this video on ...." https://upload.latest.facebook.com/KentSystems/photos/a.10150335309570409/10158433010215409/?type=3. Accessed 12 Jul. 2020.

[21] "Taxing plastic production: a solution to India's plastic waste ...." 28 May. 2019, https://www.ids.ac.uk/opinions/taxing-plastic-production-a-solution-to-indias-plastic-waste-crisis/. Accessed 29 Jun. 2020.

Campaign[22] and spread awareness of plastics harmful long-term effects especially in low income countries (LICs). In regards to the committees work with India, one of their sub-sectors focuses on educating children and adults about plastic pollution and how it can affect local ecosystems. For example, the organisation teaches them that by throwing away plastics directly into the environment they can destroy freshwater reservoirs which in some areas of India is utterly devastating due to the lack of drinkable water and filtration systems in general.[23]

China

China is one of the largest plastic producers in the world producing upwards of 60 million tons of plastic annually. However, due to its extremely large population of about 1.4 billion people China generates only one-fifth of the world's plastics while housing almost one-fourth of the world's individuals.[24] To combat its plastic pollution problem China has set up multiple laws to limit the accessibility of the material in the market. For example, in 2008 China banned the use of 'ultra-thin' plastic bags.[25] In 2017, China also disclosed the importation of many plastics for 'recycling'[26]and has furthermore begun preparations in banning single-use plastics, more specifically

22 "The Clean Seas Campaign on Marine Litter." https://wedocs.unep.org/bitstream/handle/20.500.11822/20882/Clean%20Seas%20campaign.pdf?sequence=6&isAllowed=y. Accessed 21 Jul. 2020.

23 "India's youth take on plastic pollution - UNEP." 8 Jul. 2020, https://www.unenvironment.org/news-and-stories/story/indias-youth-take-plastic-pollution. Accessed 11 Jul. 2020.

24 "Plastic Pollution - Our World in Data." https://ourworldindata.org/plastic-pollution. Accessed 9 Jul. 2020.

25 "Single-use plastic: China to ban bags and other items - BBC ...." 20 Jan. 2020, https://www.bbc.com/news/world-asia-china-51171491. Accessed 30 Jun. 2020.

26 "China announces a new ban on single-use plastics - PRI.org." https://www.pri.org/stories/2020-03-19/china-announces-new-ban-single-use-plastics. Accessed 9 Jul. 2020.

plastic that can't easily biodegrade, in many of its large cities. In addition to the previous events, there are also some attempts by the government to reduce the use of small single-use plastics. For instance, by the end of 2020, China has aimed to ban the use of plastic straws in restaurants.[27]

Haiti

Haiti has been heavily impacted by plastic waste at the start of the 21st century. People that have visited the country or have reported their observations stated that walkways and streets are filled with plastic waste. Even after the Haiti government said they would ban the importation of polyethylene and polystyrene in 2012 in an attempt to solve the issue plastics were still accumulating in bigger unmanaged piles as the particular law was not enforced enough by authorities.[28] However, in 2014, Haiti was one of the few countries in the world to implement a system to encourage the trade of plastics for money or phone charging time in their new Plastic-Bank.

Figure 2 representing the concept of the Haiti Plastic Bank

There are more than 32 plastic bank locations throughout the country where individuals can deposit plastic waste of any kind and in exchange have money deposited to their account or get their phone charged. The amount of plastic that they

27 "Single-use plastic: China to ban bags and other items - BBC ...." 20 Jan. 2020, https://www.bbc.com/news/world-asia-china-51171491. Accessed 9 Jul. 2020.

28 "Haiti could solve its drastic plastic problem and help its most ...." 5 Jun. 2014, https://www.theguardian.com/global-development/poverty-matters/2014/jun/05/haiti-drastic-plastic-problem-help-vulnerable. Accessed 21 Jul. 2020.

deposit correlates accordingly to how much money or charge time they receive.29 The Haiti Plastic Bank has also collaborated with Expo 2020. The organisation has agreed to educate children about plastic recycling and pollution. The schools also have organised a specific area in which children can deposit their plastics which helps in raising money for the schools' own funding.30

European Union (EU)

The European Union has introduced a plastic fee which has been enforced by many countries. The seven sent tax on plastic products has helped in reducing plastic consumption by a very large percentage in many countries. For example, in Greece, the mandatory application of the fee in the purchase of a lightweight plastic has reduced the demand for the material by 60% in small commercial stores and up to 80% in large stores. For Denmark the fee has helped reduce the annual consumption of plastic bags in half and in Portugal since 2015 up until 2020 plastic bag usage has dropped by 90%. 31

Italy

Italy has been the country in the European Union that has statistically developed the most, industrial wise, over the past decades explaining why it is the largest producer of plastic in its continent. To combat this, multiple laws have been set up to remove single-use plastics from commercial availability. In 2013, Italy passed a law which

29 "Haiti - Plastic Bank." https://plasticbank.com/haiti/. Accessed 7 Jul. 2020.

30 "Expo 2020 & Plastic Bank - EDUCATING HAITIAN CHILDREN." https://plasticbank.com/expo2020/. Accessed 21 Jul. 2020.

31 "The case for taxing plastic - Europa EU." 20 Nov. 2019, https://europa.eu/taxedu/news/case-taxing-plastic_en. Accessed 29 Jun. 2020.

prohibited the sale of non-biodegradable plastic products.[32] Italy also hopes to increase the percentage of plastics recycled in its borders by 55% until 2030. It has also attempted to regulate the magnitude of its waste, especially plastics, from entering landfills bypassing certain taxes to landfill owners depending on the size of their landfill. For more information about the various plastic laws in Italy look at the link corresponding to the number next to the following full stop.[33]

Germany

Through its more advanced and efficient plastic waste management system, Germany has the highest plastic recycling rate in the world. Compared to its total plastics production and consumption, Germany recycles upwards of 66% of their plastic waste. By having many special recycling bins available to the public and encouraging the separation of all recyclable materials such as plastics, metals, cooking oils and building debris, more plastics end up in recycling plants and not in landfills. [34] Another system set up by the German government is called the crux system. According to the laws, factories that produce plastic packaging for goods and stores that sell products made from plastics have to pay a fee for those items which can increase if they either sell more items or produce more packaging. [35]

32 "European Green Capital." https://ec.europa.eu/environment/europeangreencapital/englandplasticbag/. Accessed 29 Jun. 2020.

33 "Italy - WWF." 6 Jun. 2019, http://awsassets.panda.org/downloads/06062019_wwf_italy_guidebook.pdf. Accessed 7 Jul. 2020.

34 "USAG Ansbach - YouTube." https://www.youtube.com/channel/UCDm-nRfjAps1AsVx073dkKQ. Accessed 9 Jul. 2020.

35 "All About Recycling in Germany - How To Germany." https://www.howtogermany.com/pages/recycling.html. Accessed 9 Jul. 2020.

France

In France, many laws have been passed to limit the availability and use of single-use plastics by individuals. In August 2015, a law was introduced banning the use of single-use glass, plates and cups but not banning these products if they are used in packaging. In October 2018 an extension to the previous law called the Egalium law was announced. This further banned the use of other plastic products such as straws, trays, cutlery and many more. Then in 2019, the decree of 24 of December was passed banning more types of plastics which are non-biodegradable starting from the first day of January 2020. The order also pointed out that the ban will affect the plastic packaging only after July 3 2021. One other bill called the Circular Economy Bill which is still being debated about by the French government will redefine the meaning of 'single-use plastics' and will decrease the number of plastic products allowed to be sold by businesses.[36]

Greece

Greece is a country that heavily relies on tourism for its economic development, especially during the summer season. Many people want to enjoy their time in the country by swimming in the sea or staying on the beach. However, their leisure can be cut short due to the overwhelming amount of plastic in the water. According to the current Energy and Environmental minister Kostis Hatzidakis, more than 85% of all garbage in the ocean consist of plastic.[37] As the tourism industry correlates to about 18% in the entire countries GDP this problem needs to be solved urgently as the cleaner

36 "Summary of Plastic Bans in France – Bioplastics News." 28 Dec. 2019, https://bioplasticsnews.com/2019/12/28/summary-plastic-bans-france/. Accessed 11 Jul. 2020.

37 "Greece To Ban Single-use Plastics As Of July 2021 – Greek ...." https://greekcitytimes.com/2020/05/31/greece-to-ban-single-use-plastics-as-of-july-2021/. Accessed 23 Jul. 2020.

the environment more tourists will be satisfied with their stay and they will keep coming to their desired location.[38] One proposal that was made was to completely ban single-use plastics from the market by July 1st 2021 especially plastic bottles, bags and packaging.[39]

Kenya

The world's harshest plastic ban is in none-other than Kenya where if found using, producing, or selling a plastic bag the punishment is equivalent to a four-year stay in jail or alternatively a simple $38,000.

Vanuatu

The first Pacific country to launch a ban of phasing out plastic bags and bottles occurred on the 30th of July 2017, which was the nation's Independence Day.

UK

The UK took action as of January 2018, where it announced a 25-year plan to "set the global gold standard" on eliminating plastic waste, according to environment minister Michael Gove.

38 "For a Sustainable Tourism Industry - Tourism." https://www.mfa.gr/usa/en/about-greece/tourism/for-sustainable-tourism-industry.html. Accessed 23 Jul. 2020.

39 "Greece Looks To Ban Plastic Bottles, Bags, Packaging in 2021." 31 May. 2020, https://greece.greekreporter.com/2020/05/31/greece-looks-to-ban-plastic-bottles-bags-packaging-in-2021/. Accessed 23 Jul. 2020.

Plastic Ocean

The way this organization goes on about solving the problem of the abolishment of single-use plastic is through their educational/entertaining films. Plastic pollution believes that, "To change the world's attitude towards plastic within a generation."

Plastic Change

This organization is based in Denmark. Working on an international scale with more than 1800 global organisations While they tackle several plastic-related issues, one of their latest campaigns is called Beat the Microbead, an app which informs the microplastic content in cosmetics.

One Green Planet

They are the instigators of the #CrushPlastic Movement. This campaign focuses on reducing single-use plastics including shopping bags, coffee cups, water bottles, take-out containers, and straws.

Friends of the Earth

An international network of environmental organizations in 74 countries, their drive is to achieve a better and healthier environment by 2030. Part of this effort includes reducing plastic pollution.

Algalita

Algalita works to develop influencers in the area and impact decision-making. The organization believes that education and knowledge are key to combat plastic pollution.

5GYRES

This NGO combines science, education, and art to fight plastic use. One of their flagship programs lends trawls (scientific equipment) to citizen scientists in order to collect data on plastic pollution.

Timeline of events

Date	Description of Events
1284	First recorded mention of the Hornes Company of London (firmly linked with the British's plastic federation) with predominant early natural plastics
1872	First plastic injection moulding machine which was patented by Hyatt brothers,

1907	The first synthetic plastic called Bakelite was invented in a factory in New York by a man called Leo Baekeland
1930-1940	Plastic was first introduced to the healthcare industry. Primarily used for bone implants and fillings for cavities
1933	Polyethylene was discovered by Eric Fawcett and Reginald Gibson
1935	Nylon, a form of plastic, was invented by Wallace Carothers which was first used during world war two in the tyres of armoured vehicles and the threads in parachutes and other military-grade equipment
1936	First military plane to have parts made from Perspex which is a type of plastic
1938	First blow mould was created and sold to the Hartford Empire Company
1941	Ford created the first automobile which has several plastic parts in it
1942	The first super glue was discovered by Dr Harry Coover which was made primarily from methyl cyanoacrylate, a type of plastic
1948	Velcro was invented by George de Mestral which was first made from cotton by then re-made by nylon and polyethylene

1953	Polyester fibres (clothing material) are first marketed to the public as non-iron and drip-dry plastics
1968	Plastic storage bags were widely used as food containers
1969	First plastic flag made from plastic was placed on the lunar surface by Neil Armstrong
1980	Low-density polyethylene is first mass-produced in factories
1982	The first artificial human heart was made from plastics and then surgically implanted into an individual's body
1983	First 3D printer was invented with plastic being the main material used to fabricate the models.
1989	Students at the University of Cambridge discovered plastic polymers that have light-emitting properties
1996	Introduction of more environmentally friendly plastic packaging

2003	Recovinyl, a system created by the European Union, was established to recycle PVC pipes
2004	The first computer made entirely of recycled PVC parts
2005	The material RFX1 (polyethylene-based plastic) is being tested by NASA for its potential benefits as a good material for spaceships
2009	Almost half of the Airbus 380 'Plastic Dream' plan was created from plastics compounds
2010	The of University of Sheffield attempts to create haemoglobin, the components in blood cells that allow for the transportation of oxygen around the body, out of plastic
2016	It was predicted that by 2050 that 20% of all the oil extracted by humans on Earth will be used in plastic production and by then estimates show that the number of plastics in the sea, by mass, will outweigh all the fish on earth.

CAUSES FOR MEASURES TO LIMIT PLASTIC POLLUTION

There are many reasons why plastic pollution has become recognised by countries and organisations worldwide and why it is becoming an increasingly alarming issue to the environment and humans. Here are some of the factors that inspired actions to solve plastic pollution.

Destruction of habitats and wildlife

Millions of tons of plastics end up in oceans and other natural environments every year. As they have accumulated over the one-hundred-year period after they were first created, plastics have overwhelmed ocean and land ecosystems either destroying or severely damaging/killing the animals and plants that live there. More specifically, plastics in the sea have collected in a few locations around the world due to the currents' movements of floating plastics. One of these locations includes the great pacific garbage patch which has an equivalent area to the entire country of Mongolia.[40] [41]

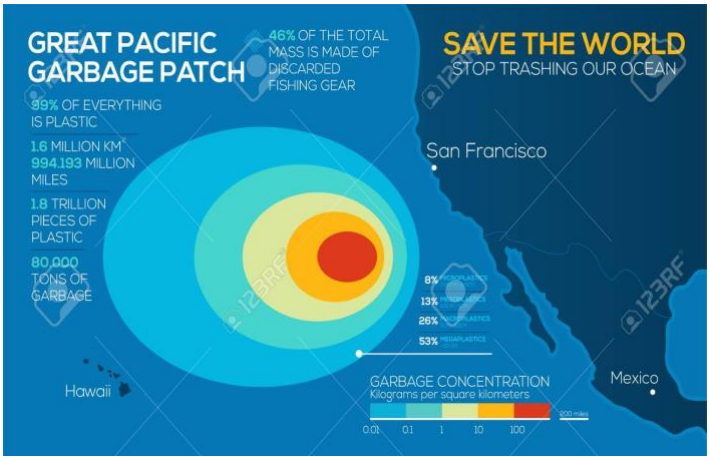

Figure 3 depicting the size of the Great Pacific

Animals have mistaken piles of plastics as food and therefore eat it or get entangled in it. If they do eat it, the plastics will occupy the space of the stomach without decomposing, essentially making animals starve to death as their body thinks they are constantly eating due to something (the plastics) being in them. If animals do get

40 "Great Pacific Garbage Patch now three times the ... - CNN.com." 23 Mar. 2018, https://www.cnn.com/2018/03/23/world/plastic-great-pacific-garbage-patch-intl/index.html. Accessed 4 Jul. 2020.

41 "Countries Compared by Geography > Land area > Sq. km ...." https://www.nationmaster.com/country-info/stats/Geography/Land-area/Sq.-km. Accessed 4 Jul. 2020.

trapped in the plastics, then the material will slowly penetrate their skin and they will be more susceptible to diseases and infection.[42]

As for phytoplankton and plants in general, plastic can pose many harmful threats. For phytoplankton, if plastics retain their buoyancy and float on the surface of the sea, they can prevent the passage of light to the small organisms. This will result in them not being able to photosynthesis and therefore dying from the lack of sugar compounds. This, in turn, will make the distribution of food to other parts of the aquatic food chain uneven. For plants, plastics can become attached and trapped in plants as they grow. This may cause them to have deformed bodies and cells that do not function normally.

Extinction of animal species

As a result of plastic's harmful effects on the environment, many animal species go extinct around the world. It is estimated that around 1000 animal species are either affected or endangered from plastics since its invention.[43] The animals that are most affected by this are mostly sea creatures with sea turtles, whales and dolphins being impacted the most by this. Due to the fact that these specific animals either ranked as top carnivores or secondary consumers in their separate food chains, their decreased numbers or eventually extinction can be devastating to other animal species as well. For example, if the number of sea turtles decreases in an area then jellyfish, the prey of sea turtles, will increase. As a result, the animals that are eaten by jellyfish, usually small fish, will be eaten at an increasingly fast rate until their population ceases to exist

42 "Five Ways That Plastics Harm The Environment (And One ...." 23 Apr. 2018, https://www.forbes.com/sites/grrlscientist/2018/04/23/five-ways-that-plastics-harm-the-environment-and-one-way-they-may-help/. Accessed 4 Jul. 2020.

43 "Plastic pollution affecting wildlife at an all-time high, finds ...." http://www.climateaction.org/news/plastic-pollution-affecting-wildlife-at-an-all-time-high-finds-rspca. Accessed 4 Jul. 2020.

in a particular location. In conclusion, the result of even one animal species going extinct can affect the fate of many other animal species.

Eutrophication

Millions of tons of plastic enter our oceans every year and those plastics have killed wildlife in many unexpected ways. Since most of the plastics produced and not properly disposed of are the ones involved in the packaging of foods, they may contain nutrients from the food that they came in contact with. When those nutrients reach the ocean, algae in the water use those nutrients as food and therefore reproduce at a rapid rate. Since they float on the water's surface, they can sometimes create a barrier which doesn't allow light to penetrate the ocean surface making the plants on the ocean floor unable to photosynthesis. Other than that issue, when those algae die, bacteria in the water start to decompose their bodies and use up all the oxygen in the water. Due to the lack of oxygen in the water aquatic life that has gills to take in oxygen to survive will slowly suffocate and die.[44]

Ocean Acidity

In recent years a higher percentage of products containing a large quantity of plastic get manufactured. To create more of these plastics factories, have to use more electricity, from the burning of fossil fuels, to keep up with the demand. As more fossil fuels are burned more carbon dioxide is released into the atmosphere. This excess carbon dioxide can then dissolve into the ocean water. Although this may seem to be a good phenomenon because there are going to be fewer greenhouse gases in the air, ocean life is majorly affected. As carbon dioxide is slightly acidic in a solution it

44 "What is eutrophication? - NOAA's National Ocean Service." 3 Jun. 2020, https://oceanservice.noaa.gov/facts/eutrophication.html. Accessed 11 Jul. 2020.

decreases the pH of the water. This causes many fish and other plant species such as coral to die and even making many regions of the sea completely inhospitable.[45]

Landfills

The number of landfills around the world are ever-increasing every year. In the US alone almost half of the waste produced per year, equivalent to 250 million tons of trash, ends up in landfills where most of that waste consists of single-use plastics.[46] Even though the number of total landfills in the world is unknown estimates show that the world has around 7,000 landfills.

Figure 4 depicts a poorly managed landfill site

Most of these sites are currently still open and not maintained properly meaning that as plastics and other materials decompose, their chemicals can go into the soil and contaminate water in rivers and aquifers. Estimates show that about 97% of the world's fresh water is contained in underwater rocks and about a collective 1.5 billion people depend on these water sources for their survival. However, when those aquifers do get contaminated with plastic parts many of the water filtration plants that pump and clean that water don't have the special equipment to filter particles that are dissolved

45 "Cambridge IGCSE Chemistry (0620) - Cambridge International." https://www.cambridgeinternational.org/programmes-and-qualifications/cambridge-igcse-chemistry-0620/. Accessed 12 Jul. 2020.

46 "Land of Waste: American Landfills and Waste Production." https://www.saveonenergy.com/land-of-waste/. Accessed 6 Jul. 2020.

in it. This can, therefore, make many people susceptible to synthetic chemicals bringing about sickness and severe distress in their bodies. [47]

Air Pollution

Since the invention of plastic, an estimated 6.3-8.3 billion metric tons of the material was created. Out of all that plastic, only 9% of it has been recycled. That is about 567-747 thousand metric tons of plastic recycled in the entire world. [48] As for the remaining 91% of the plastics, 78% are thrown away in landfills and the remaining 13% are burned by humans.[49] When plastics melt, all the chemical additives that were put on them by manufacturers get released into the atmosphere as well as other hazardous compounds such as hydrochloric acid and sulphur dioxide.[50] The plastic particles (particulates) then travel in the air and may cause respiratory problems when inhaled. Furthermore, the hydrochloric acid released can leach minerals out of the soil and affect the yield of crops and sulphur dioxide can combine with water vapour in the atmosphere and produce acid rain which dissolves limestone buildings and causes plants to grow unnaturally. [51]

47 "Aquifers — Safe Drinking Water Foundation." 19 Jan. 2017, https://www.safewater.org/fact-sheets-1/2017/1/21/aquifers. Accessed 13 Jul. 2020.

48 "A whopping 91% of plastic isn't recycled - National Geographic." 20 Dec. 2018, https://www.nationalgeographic.com/news/2017/07/plastic-produced-recycling-waste-ocean-trash-debris-environment/. Accessed 5 Jul. 2020.

49 "Production, use, and fate of all plastics ever made | Science ...." https://advances.sciencemag.org/content/3/7/e1700782.short. Accessed 5 Jul. 2020.

50 "Can we safely burn used plastic objects in a domestic fireplace?." 12 Mar. 2013, https://engineering.mit.edu/engage/ask-an-engineer/can-we-safely-burn-used-plastic-objects-in-a-domestic-fireplace/. Accessed 6 Jul. 2020.

51 "Cambridge IGCSE Chemistry (0620) - Cambridge International." https://www.cambridgeinternational.org/programmes-and-qualifications/cambridge-igcse-chemistry-0620/. Accessed 6 Jul. 2020.

Plastics In The Body

As mentioned in the previous paragraphs, plastics can majorly affect the population of animals in specific locations and therefore unbalance the local food chains. However, not only fish are affected by this. Microplastics, small pieces of plastic, which float around in the ocean and can get eaten by zooplankton. The zooplankton are eaten by other fish which are eaten by other bigger organisms such as salmon which are overgrazed by humans which eat them. Studies have shown that nearly all adults and a majority of babies have microplastics in their bodies[52] either from eating fish or other commercially available products such as salts and tap water.[53] Even though research on plastics from scientists hasn't conclusively proven the harmful effects of microplastics some speculations have been brought up. One includes that the chemical DEHP, which is added to plastics to make them more malleable, can cause cancer in the body.[54] Also, scientists have monitored that when we ingest microplastics, they can have harmful effects on the body by entering our organs and even interfering with the way our immune system fights diseases.[55]

52 "Phthalates and other additives in plastics: human exposure ...." https://royalsocietypublishing.org/doi/10.1098/rstb.2008.0268. Accessed 5 Jul. 2020.

53 "Anthropogenic contamination of tap water, beer, and ... - PLoS." 11 Apr. 2018, https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0194970. Accessed 5 Jul. 2020.

54 "Water, Sanitation and Hygiene (WASH) and ... - PLoS." 27 Mar. 2017, https://journals.plos.org/plosntds/article?id=10.1371/journal.pntd.0005393. Accessed 5 Jul. 2020.

55 "Plastic Health Coalition: How Plastic Affects & Threatens ...." https://www.plastichealthcoalition.org/. Accessed 5 Jul. 2020.

Previous attempts to solve the issue

Discovery of Bacteria that can Dissolve Plastics

In 2016, in one of the research labs in Germany, scientists accidentally discovered a type of bacterium that can decompose plastics. This organism is able to do this by using a certain enzyme. The scientists have further extended their research and tried to modify the enzymes protein structure to get a better understanding of how it works. In doing so they managed to create a mutant enzyme that is more effective at breaking down plastics than the original one. Instead of the plastic taking centuries or millennia to degrade the enzyme can 'eat' the same amount of plastics in only a few days. It also creates so fine plastic particles, at the end of the procedure, that the material can be more easily recycled.[56]

Environmentally Friendly Plastics

By making organic plastics which can come from tree resin, organic wastes and many other materials will eliminate the need to buy multiple of the same plastic product daily and also worry about the consequences of 'littering' the environment. Due to the reduced intramolecular strength of the particles in organic plastics compared to synthetic plastics, they are less durable over long periods of time making them naturally decompose in weeks or even months as opposed to hundreds of years.[57] Two particular organic materials that can be made into toxin-free plastic are cassava starch

56 "Scientists accidentally produce an enzyme that ... - Engadget." 17 Apr. 2018, https://www.engadget.com/2018-04-17-scientists-accidental-mutant-enzyme-eats-removes-plastic.html. Accessed 6 Jul. 2020.

57 "European Bioplastics." 15 Apr. 2020, https://www.european-bioplastics.org/bioplastics/. Accessed 7 Jul. 2020.

and vegetable oil. By combining them, a type of plastic can be made which is proven to be safe for consumption by animals in nature or even humans.[58]

Bamboo Bottles

Many companies have now started campaigns to replace plastic products, especially packaging such as plastic: bottles, bags and other containers with other materials. One common organic material used by these organisations is bamboo. It is used because it is considered the fastest growing plant in the world, growing at an ever-increasing rate by expanding its root network underground and making bamboo shoots from the original bamboo that was planted.[59]

Figure 5 depicting many reusable bamboo

This feature makes the total amount of bamboo grow at an increasingly fast rate making it a natural material which constantly replenishes itself. At the end of the manufacturing process, the bamboo bottles will have triple or even quadruple the price of a disposable water bottle but can be used thousands of times more by someone compared to any other plastic bottle.[60]

58 "TEDx Talks 'Plastics that marine life can safely eat' - YouTube." https://www.youtube.com/user/TEDxTalks. Accessed 7 Jul. 2020.

59 "How does bamboo grow? - Lewis Bamboo." https://lewisbamboo.com/how-bamboo-grows/. Accessed 6 Jul. 2020.

60 "This man from Assam is making eco-friendly bamboo water ...." 9 Aug. 2019, https://yourstory.com/socialstory/2019/08/bamboo-bottles-organic-plastic-free-assam-man. Accessed 6 Jul. 2020.

Asia

Indonesia

In the year of 2017, the government took action by forming a Memorandum of Understanding or (MOU) in which the governor signed it to phase out plastic bags by January 2018 due to a four-year campaign organized by citizens to get plastic banned in Bali. This was indeed very impactful, and Bali began 2018 plastic bag free.

Additionally, on December 21st, 2018, Bali Governor, Wayan Koster, announced a ban on single-use plastic by June 2019, (with a six-month "warm-up" period to give businesses time to react.) On June 23rd, the plan was officially enacted upon and dreaded Styrofoam, plastic bags and plastic straws are now officially prohibited island wide.

Thailand

A public-private campaign took place in 2009 for 45 days with the collaboration of many supermarket chains, local and other stores to discount customers which brought their own cloth bags. This targeted a cutback of 4.4 million plastic bags which did work flawlessly.

Europe

Austria

In 2016 a public-private agreement levied plastic bags in major supermarkets in Austria. The agreement was signed by the Ministry (BMLFUW) and major trade companies and environmental protection organizations. Its target surpasses that of the EU-Directive (United Nations, 2017a). However, it was very effective as the country's consumption of plastic carrier bags per person per year dropped from 54.3 very lightweight and 3.1 lightweight (15-50 microns) in 2015 to 44 very lightweight and

4.3 lightweights in 2016 (Ministerium für ein Lebenswelten Österreich, 2017). This proved that even the most extraordinary goals can be achieved.

Finland

Furthermore, in 2016 public-private agreement levied a voluntary agreement between the Ministry of Agriculture and Environment and the Federation of Finnish Commerce to undertake measures to reduce the consumption of plastic bags.

These movements were, in fact, effective and gave birth to another agreement ensuring that Finland reaches the reduction targets for the consumption of plastic carrier bags in the EU Directive on packaging and packaging waste and entrusting the each and every citizen of Finland to not use more than 40 bags per year.

Germany

Additionally, in the same year, a Voluntary ban or levy was put in place on plastic bags which was made by the Ministry, the German Retail Federation and participating companies to curb the use of plastic bags (retailers can decide whether to phase out plastic bags or to apply a fee of €0.05 to €0.50 (about $0.06 to $0.60).

After this action, many companies participated without having signed the agreement.

North America

Canada

Moreover, a huge supermarket chain in 2016 announced that it will start charging a small fee for every plastic bag used (CAD 0.04) and for every reusable bag used (CAD 0.25).

As expected, people began to reconsider if it was worth it buying a single-use plastic bag and the amount of reusable bag used increased due to its demand.

Oceania

Australia

Subsequently, some major supermarkets announced that they will phase out lightweight plastic bags or provide bags but charge AUD 0.15 ($0.12) per bag.

The effects of this action were quite similar.

Relevant UN Resolutions, Events, Treaties and Legislation ==

Environmental goals

Along with another fourteen goals, the United Nations (UN) wants to achieve by the end of 2030 one of the goals is dedicated to reducing pollution of any kind in the ocean and land habitats.[61] The UN does not have that much legal power to alter or react to major laws in other countries but it can enforce the limitations to how many plastics can be produced by a country, to a degree. It can also host movements to discourage the usage of single-use plastics and organise campaigns to clear areas from waste materials. However, some treaties have been agreed to be passed by the member countries of the organisation. One treaty that was established, promised to regulate the buying and selling of plastic scraps and waste between nations. This limitation alone has prevented a few single locations on land to be vastly overfilled with plastic

61 "United Nations Environment Assembly of UNEP ...." https://sustainabledevelopment.un.org/index.php?page=view&type=30022&nr=243&men. Accessed 29 Jun. 2020.

waste but instead has partially distributed the number of plastics in each recycling plant and landfill in each country.[62]

Sustainability Goal 14 'Life Below Water'

The UN has aimed to reduce the pollution of any kind from coastal and sea areas. This will be completed by sets of volunteers and UN officials that will clean up large areas or ocean and patrol them to prevent littering of any kind by individuals.

Sustainability Goal 15 'Life on Land'

In regards to the UN operations on land, multiple campaigns have commenced in trying to clean up forests and other natural habitats from plastic and also preventing more plastics from entering them. In some cases, they even set up personnel to protect certain areas from plastic pollution and guarding endangered species from them getting entangled in plastics.

Possible solutions

Democratic Poll or Vote on Plastic Bans

In an effort to reduce single-use plastic availability and manufacturing governments can set up opinion polls either on the internet or on local community municipalities to receive the public's opinion on the matter. This will create a more long-lasting impression that the governments of countries are interested in solving plastic

62 "UN-adopts-global-treaty-limiting-plastic-waste-trade." 10 May. 2019, https://www.plasticsnews.com/article/20190510/NEWS/190519991/un-adopts-global-treaty-limiting-plastic-waste-trade. Accessed 14 Jul. 2020.

pollution and will potentially help in the further discussions and arguments the council's committees of the government may have in combating other issues in their country.

Education

By educating more children about the plastic pollution crisis around the world and teaching them how they can help to solve this issue by learning to correctly use and dispose of the plastic that they have, they and we can live in a waste-free world. For many plastic campaigns and schools, the simple catchphrase 'Reduce Reuse Recycle' has helped children understand the basics of plastic management. Some schools have even dedicated one week in their educational program for the awareness of plastic pollutants through assignments that require research and discussions between class individuals about the harmful effects of single-use plastics and the actions that we can take to solve this issue.

Introductions of Fines for Littering Generally

By introducing a set amount of money that individuals will have to give in when law enforcement officers spot them littering will discourage them to continue polluting the environment and public/private locations. Through the new and advancing technologies of facial recognition and the instalment of cameras in public areas, more people can be detected and fined for littering with higher efficiency than corrections officers although their presence through a settlement for their duties, in general, is necessary for the more accurate and precise identification of who littered a specific location.

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