Research Paper Biological Science

AN OUTLOOK ON UPSHOT OF BIOPLASTICS IN INDIA

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ABSTRACT

As oil runs out and the use of fossil fuels becomes progressively more expensive, it's a necessity to replace the sources of raw material for the manufacture of vital plastics. In addition, the use of carbon-based sources of energy for use in plastics manufacturing evolve greenhouse gases to the atmosphere impeding the world's attempts to avoid CO2 emissions. Currently, solid waste management and global warming are the great challenge to the world. Bioplastics, the plastics derived from renewable biomass sources, are one of the alternatives to avoid more dangerous tribulations. Environment protection and sustainable product development has attracted a lot of attention in the last few years, and there has been extensive research looking at ways to provide material needs using energy efficient, non-toxic and renewable sources. Nowadays many countries are aware of usage and production of bioplastics. This communication is intended to project the status of bioplastics in worldwide market and especially in India.

KEYWORDS Plastics, green house gases, global warming, bioplastics.

INTRODUCTION

Plastics become an essential commodity to enhance the comfort and quality of life. They are the needed part of almost all industries and have influence in medicine too. They are considered to be a bubbly métier for humanity. We should be very grateful to Alexander Parke who presented the major revolutionary contribution to the development of plastics from cellulose nitrate in the 1850's. In the current age, plastics play many more dynamic roles to mankind as they have versatile qualities. But there are lots of hitches associated with the use of synthetic plastics. So they are considered to be the foremost ecological noxious waste. Conventional petrochemical plastics are recalcitrant to microbial degradation. Excessive molecular size might be mainly responsible for the resistance of these chemicals to biodegradation and their persistence in soil for a long time. These non-degradable petrochemical plastics accumulate in environment at a rate of 25 million tons per year. Typically made from petroleum, it is estimated that 7% of the world's annual oil production is used to produce and manufacture plastic. With the mounting concern over global warming due to greenhouse gas emissions the carbon dioxide emissions of the plastics industry require discussion. The plastics industry had the third highest carbon emissions in the chemical sector behind industrial organic chemicals and industrial inorganic chemicals. The total carbon emissions resulting from energy consumption for the chemical industry were 78.3 million metric tons of carbon dioxide (U.S. Department of Energy, 2010).

Mountains of plastic litter our landscapes and oceans. Solutions to plastic waste management include source reduction, incineration, recycling and bio- or photo-degradation. However, most of these have problems associated with them. Incineration of plastics is potentially dangerous and can be expensive. During the combustion of plastic waste, hydrogen cyanide can be formed from acrylonitrile-based plastics and may cause potential health hazards. Recycling can be done but is very tiresome. The sorting of the wide variety of discarded plastic material is also a very time-consuming process. Moreover, the presence of a wide variety of additives such as pigments, coatings, fillers, limits the use of the recycled material.

According to water pollution facts from the National Geographic, the Great Pacific Garbage Patch holds as many as 750,000 bits of plastic per square kilometer. Animals often mistakenly ingested the plastics as feed. The ingested plastics are clogging their intestine which results in death by starvation. Birds, turtles, and fish ingest a variety of plastic items and their digestive systems become clogged. Other animals or birds become entangled in plastic bags and drown or can't fly as a result and finally die Thousands of marine animals and more than 1 million birds die each year as a result of plastic pollution.

The health risks associated with plastics have recently gained media attention. The main health risks of pure plastics involve their monomers. The issues surround the toxicity to human from the single use plastics are primarily due to their use in packing food stuff. Here drinking water bottles are often the most talked about sources of toxicity to humans from plastics. Pthalates and Bisphenol A (BPA) are the two most tarnished toxin which leach from plastics into the contained food or water. Styrene is a possible carcinogen and endocrine disruptor. Department of Health and Human Services in 2007, reported that Bisphenol-A is a hormone disruptor that can mimic estrogen. Vinyl Chloride, the monomer of PVC, is a known carcinogen. Some plastics are more likely to leach monomers than others. The main health risks associated with plastics do not come from plastics themselves but from additives like plasticizers. Phthalates, have been found to deposit in the fatty tissues of the body, where they act as anti-androgens. Dioxin, a highly carcinogenic and toxic by-product of the manufacturing process of plastics, is one of the chemicals believed to be passed on through breast milk of the mother to the nursing infant. Burning of plastics, especially PVC releases this dioxin and also furan into the atmosphere.

The Times of India on Apr 4, 2013 stated the Supreme Court

proclamation as "We are sitting on a plastic time bomb". The Central Pollution Control Board (CPCB) reported that India generates 56 lakh tonnes of plastic waste annually, with Delhi accounting for a staggering 689.5 tonnes a day and "Total plastic waste which is collected and recycled in the country is estimated to be 9,205 tonnes per day (approximately 60% of total plastic waste) and 6,137 tonnes remain uncollected and littered". The four metros are major culprits in generating such waste in which Delhi producing 689.5 tonnes a day, followed by Chennai (429.4 tonnes), Kolkata (425.7 tonnes) and Mumbai (408.3 tonnes). As 40% of plastic waste is not recycled, the daily addition to untreated plastic in Delhi is estimated at 275.6 tonnes, followed by Chennai (171.6 tonnes), Kolkata (170 tonnes) and Mumbai (163.2 tonnes).

Now a day, management of plastic waste is a great mayhem to environment. Although plastic has many advantages its non-biodegradability is a major drawback, which forced us to think upon a material which can replace plastic. In recent years there has been a shift in public opinion, with people becoming more ecologically aware. The shift in public opinion and political influence combined with the increasing price of oil, has driven industries to investigate biodegradable alternatives to plastic, which are not manufactured using petrochemical methods. Materials produced from synthetic polymers are widely used for a diverse range of applications in modern society. The production of biodegradable alternatives with greater compatibility in the environment is necessary if the applications continue to grow. The world needs to find a solution that gives us continued access to plastics but avoids these serious problems. Bioplastics are considered to be an important component of global sustainability.

SOURCES USED FOR BIOPLASTICS

Plastics are used in routine life but due to the glitches allied with plastics, researchers were eyeing for a substitute to exchange plastics. The world needs to find a solution that gives us continued access to plastics but avoids these serious problems. Bioplastics are considered to be an important component for global sustainability. They are defined as biomass based biodegradable plastics which can be derived from corn starch, pea starch, vegetable fats and oils and microorganisms like bacteria, algae etc.,[Fig.1]. Bio-plastics are bio-based, biodegradable plastics with almost similar properties to synthetic plastics. Biodegradation can be explained as a chemical process during which microorganisms that present in the environment convert materials into natural substances such as water, carbon dioxide, and compost.

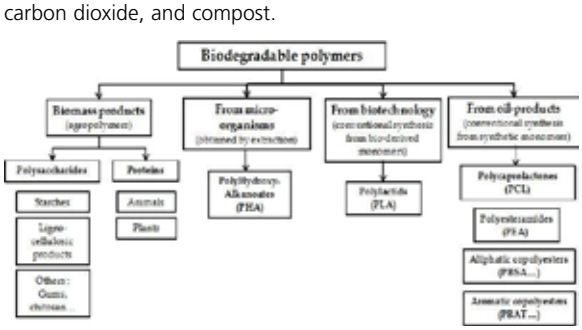


Fig.1: Different sources of Bioplastics

We have identified some major advantages of bioplastics [Fig.2] in this note as follows,

1. Potentially a much lower carbon footprint
2. Lower energy costs in manufacture
3. Do not use scarce crude oil
4. Reduction in litter and improved compostability from using biodegradable bioplastics
5. Improved acceptability to many households.

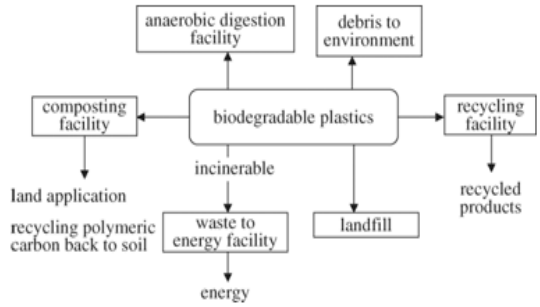


Fig.2: Multiple end life options of bioplastics

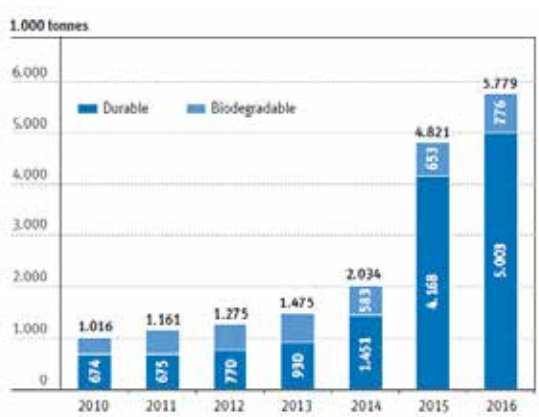
Hence bioplastics are important in helping consumer goods companies present their brands in a favourable light. Recyclable or compostable packaging made from biological materials can be used to make their products more environmentally friendly in the eyes of consumers. Although bioplastics may be more expensive per kilo of packaging, the extra cost is more than outweighed by the benefits seen by purchasers. The client lists of the major bioplastic suppliers include most of the largest and best-known consumer goods companies, ranging from the Shiseido cosmetics brand to Ecover, the Belgian cleaning products company.

MARKET AND PRICE OF BIOPLASTICS

According to European Bio-plastics Association, the global production capacity for bioplastics is projected to grow four times by 2020. The prices of any biopolymer are likely to be high when it is only produced on a small scale. The scale of production is likely to have a greater influence on the price than the costs of the raw material source and of the chemistry involved. According to EBA, Bioplastics consumption is likely to reach two million tons by 2018.

Europe is the biggest market in terms of consumption of bio-plastics whereas Latin America the least. Bioplastics find more place in the food industry as compared to the other markets. According to global market watchers, global Poly Lactic Acid market is expected to reach US$2.6 billion by 2016 at a Compounded Annual Growth Rate (CAGR) of 28%. Region-wise analysis shows that Asia-Pacific is forecasted to record the highest growth rate of 29.3% during the analysis period 2011-201 [Fig.3]. Europe follows Asia-Pacific with a CAGR of 28.9%. The Americas forecasts to drive the global market with a 27.3% increase. Volume based studies reveal that the maximum share of growth rate is expected from Asia-Pacific region. Comparing the end-user industries, textiles and electronics are going to be the major supporters of this market.

GLOBAL PRODUCTION CAPACITY FOR BIOPLASTICS

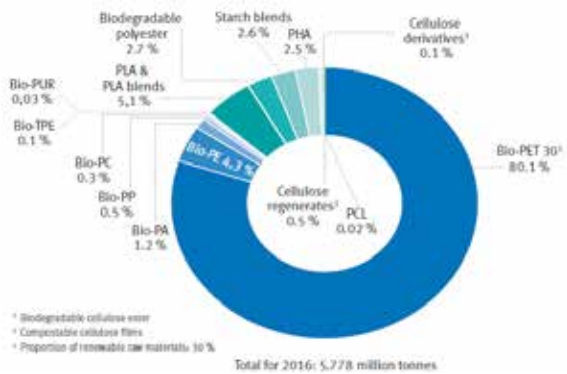


Source: IfBB, University of Applied Sciences and Arts Hanover

Fig. 3: Production capacities for bioplastics broken down by region (estimates for 2016)

Regardless of the high market growth described above bioplastics are still in their infancy. With a total market for plastics estimated to be 330 million tonnes in 2015, [Fig.4] bioplastics in material applications will amount to no more than 2 % in the next two to three years. From a purely technical point of view up to 90 % of all plastics could be switched from fossil fuels to renewable sources. However, in the short and medium term this conversion will not be possible partly due to economic barriers and to this extent insufficient availability of biomass even at short notice.

MARKET SHARE OF DIFFERENT BIOPLASTIC TYPES



Source: IfBB, University of Hanover

Fig. 4: Market shares of different types of bioplastics (estimates for 2016)

Even though the usage of biomaterials trends are being projected, by 2014 durable are expected to account for almost 40% of bioplastic compared with 12% today. But the bioplastics market currently has only a very small volume of less than 1 % of the total plastics market. However, the development in recent years has given this market an enormous boost, so that double-digit growth rates are expected in the near future. Over the last three years this situation has altered significantly. In the meantime the market is subjected by so-called "drop in bioplastics". These are biobased (and partially biobased) standard plastics such as polyethylene (PE), polyamide (PA) or polyethylene terephthalate (PET). This quick change in the market became possible because on the one hand several globally active companies changed their food packaging (and beverage bottles) partially to bioplastics. On the other hand drop-in bioplastics were produced from the start in large scale installations and in suitably large quantities.

Fig.5: Shows IBAW, an international association of the bioplastics and biodegradable polymers industry, Australia exhibited their bioplastics products at the BioFach, 2005.

THE STATUS OF BIOPLASTICS IN INDIA

In India, in particular we have a great scope to develop biodegradable polymers based on natural polymers for a variety of application due to the availability of natural resources in abundance with appropriate backup of research institute, knowledgeable in the field, and business ready to take up a new product. With the proper implementations of the use of bioplastics, no doubt India can play a leadership role in this field, which other countries can emulate. For example India leads in natural polymers based geo-textiles.

In India, bioplastics are still in their nascent stages with very few market players operating in this segments. Currently, the Indian bioplastic market is beset by challengers such as low awareness that are typical to emerging markets especially the markets dealing with eco friendly products, but there is a potential frequencies wishing to enter this market.

Apart from possible government backing and rising greater environmental awareness, bioplastics manufacture can benefits from the easy availability of abundant feedstock in India. This segment has a long way to go in terms of production, raw materials technology. Environmental awareness and promoting the long term benefits of bioplastics in an initial step that needs to take toward bringing this change.

Even for long-term scenarios, if the whole world plastics production capacity were to switch to biobased plastics only 4 % to 7 % of the agricultural land available world-wide would be required if we use plant sources for the production of bioplastics. So it is a time to raise awareness among target groups including general public on the issue of biodegradable plastics. We have to improve technology transfer and knowledge exchange mechanisms with end -user industries. In all educational institutions and R&D should initiate their students to access scientific knowledge and the use of already existing knowledge as well as adapting it to the requirements of biodegradable polymer. In addition to that we have to intensify the application-oriented cooperation between research and industry.

CONCLUSION AND DISCUSSION

With increased environmental awareness and more and more communities/societies becoming environmentally conscious, those who invest in production of bio degradable plastic materials stand to gain as they have a head start. The many advantages of bio-plastics such as - 100% biodegradable, produced from natural renewable resources, able to be recycled, reused, composted or burned without producing toxic byproducts, etc. make it an excellent alternative to traditional plastic products. Biopolymers limit carbon dioxide emissions during creation and degrade to organic matter after disposal. Bio degradable polymers may not be a one stop solution to all environmental problems created by plastics but it's a step in the right direction as time is of essence for biodegradable polymer development as society's current views on environmental responsibility make this an ideal time for further growth of biopolymers.

So bioplastics are a reality and is a practical truth. Our willingness and improvement in technologies will give it a wider success. They are cheaper to produce hence the need of the world to employ more resources in utilizing these technologies. Moreover, the bioplastics industry shows a bright future ahead. Climate protection and intelligent use of natural resources will be essential policies of the 21st century. The road towards sustainable development will be built on innovation. Bioplastics can be a great contributor towards achieving multifaceted usage and ecofriendly earth. Representatives of politics, researchers and private enterprises now have to screen for suitable instruments that will facilitate a dynamic and broad market introduction. It is my hope that this communication will provide a stimulus in taking the initiative.

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