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CONVERSION OF CO_2 INTO PLASTIC

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ABSTRACT

Unrestricted carbon dioxide (CO_2) is may be the single biggest environmental problem facing the world today. Luckily, with a bit of try it can be put to fecund use as a raw material in the chemical industry. Project represents green chemistry in action, taking a knowledge-based proposal to intercept and solving environmental problems. The recovery of CO_2 requires a very high-emission industrial plant. This is new technology a novel way to make plastic from carbon dioxide (CO_2) and uneatable plant materials, such as agricultural wastage and grasses. New technology could provide a low-carbon different to plastic bottles and other items currently made from petroleum.

Keywords: Co_2, Carbon Dioxide O2, Oxygen

I. INTRODUCTION

Multiple plastic legacies today are made from a polymer called Polyethylene terephthalate (PET), also known as polyester. Worldwide, about 50 million tons of PET is manufacture each year for items such as fabrics, electronics, reused beverage containers and familiar care products. The motive of fossil-fuel feedstock, combined with the energy required to manufacture PET, creates more than four tons of CO for every ton of PET that's produced. The plastics industry has yet to find a low-cost way to manufacture it at scale.

The plastics industry has become one of the top manufacturing industries in the United States. Plastics are worn in products ranging from food packaging to automotive parts and have become a necessity of life. The expanding volume of plastics, its manufacture price, heavy use of exhaustible resources, and environmental consequence has caused enough treat. Currently, it takes large amounts of volatile chemicals and fossil fuels to produce fabricated plastics. It is evaluated that plastics production accounts for between 5% - 10% of worldwide oil and gas consumption. The increasing costs of oil and fossil fuel coupled with the introduction of cheap plastic from center Eastern producers is applying pressure on the industry to minor production costs in the near term. A very rising substitute to the fossil fuel concerted method of manufacturing plastics involves the capture of industrial waste CO_2 and its successive conversion into a major component of thedD used to make the final product. The use of CO_2 as a cheap bio renewable wealth could potentially solve a number of problems associated with plastics production. The catalytic bonding of CO_2 and epoxies into create carbonates or polycarbonate has proved to be a very promising technology in the implementation of CO_2 as a major component in a wide variety of plastic products. Due to the low cost and accessibility of CO_2, the attractive belongings of polycarbonates, and significant public interest in producing environmentally friendly plastics.

Fig. 1.1 Evaluation of CO2 from Industries

II. LITERATURE REVIEW

[1] Armstrong, K. & Styring, P. Front. Energy Res.3, 8(2015). Industrial progress has enabled us to imagine a solution in which carbon dioxide (CO2) becomes an increasingly important carbon resource; a world in which we utilize CO2 to create products.

[2] Zhang, Y and J Young Gerentt Chan. 2010. Sustainable chemistry: imidazolium salts in biomass conversion and CO2 fixation. Energy and Environmental Science http://dx.doi.org/10.1039/b914206a.Certain classes of organic molecules can be instrumental in both capturing carbon dioxide from the air and incorporating it into new plastic materials, which could lessen the need for raw petroleum.

[3] Satthawong, R., Koizumi, N., Song, C. & Prasassarakich, P. Catal. Today 251, 34–40(2015).As a source of carbon, skeptics argued, the gas was far more difficult and expensive to obtain than the petroleum, coal and natural gas that now provide the raw material for most chemical manufacturing. And even if CO_2 could be captured cheaply enough, converting such a stable molecule into more-useful chemicals would generally require lots of energy, which might well come from fossil-fuel plants. The conversion could cost a fortune and make more CO_2 than it consumed.

[4] Aresta, M., Dibenedetto, A. & Angelini, A. J. CO2 Util. 3–4, 65–73 (2013). Capture and utilization of CO_2 as alternative carbon feedstock for fuels, chemicals, and materials aims at reducing greenhouse gas emissions and fossil resource use. For capture of CO_2, a large variety of CO_2 sources exists. Since they emit much more CO_2 than the expected demand for CO_2 utilization, the environmentally most favorable CO_2 sources should be selected.

III. THEORY

3.1 On site Study

Over the last decade, the performance and availability of Biodegradable Polymers (BP) has developed strongly driven by increasing interest in sustainable development, desire to reduce dependence upon finite resources and changing policies and attitudes in Waste Management. Most of the BP in the market or in development is based on renewable raw material feedstock from agriculture or forestry. Therefore, information was reviewed to gain an understanding of the following aspects.The Biodegradable Polymers and its manufacturing process available worldwide, major market segments and also the relevant manufacturing companies in India as well as across the globe. Depending on the evolution of synthesis process, different classifications of biodegradable polymers have been proposed. Figure 1 shows an attempt of classification of biodegradable polymers. There are broadly 4 different categories of which only 3 categories (a to c) are obtained from renewable

RESOURCES:

a] Polymers from biomass such as the agro-polymers from agro- resources (e.g., starch, cellulose),

b] Polymers obtained by microbial production, e.g., the polyhydroxy- alkanets,

c] Polymers conventionally and chemically synthesized and whose the monomers are obtained from agro-resources, e.g., the poly (lactic acid),

d] Polymers whose monomers and polymers are obtained conventionally, by chemical synthesis.

3.2 Manufacturing Study

A detailed survey on the various plastics industries manufacturing biodegradable/degradable plastics in India was conducted. The factory sites were visited & samples such as poly bags, master batches etc. were collected.

Cost:

As per the available Market data, the current price trend of Oxo/Photo-degradable plastics (Based on Polyethylene material) and Biodegradable plastics for film applications (co-polyester based) are as follows:

1. Oxo/Photo Degradable plastics film / bags – Rs.90 – 120 per kg (depending upon prices of polyethylene & additive, which are variable and as per the global trend of polymer pricing.)
2. Biodegradable plastics film / bags - Rs.400 – 500 per kg. It is evident from the above that the Oxo/Photo degradable films are cheaper than the biodegradable plastics films bags, which may, perhaps, the reason for spread of Oxo/Photo degradable films and bags in some parts of the country.

3.3 Analysis of sample:

The samples collected from the above plastic manufacturer's sites and other sources were subjected to biodegradation test as per ASTM D5338: Standard Test Method for determining the aerobic bio-degradation of plastic materials under controlled composting conditions.

Significance and Use:

The degree and the rate of aerobic biodegradability of a plastic material in the environment determine the extent to which and time period over which plastic may be mineralized. Disposal is becoming a major issue with the increasing use of plastics, and the results of this test method permit an estimation of the degree of biodegradability and the time period over which plastics will remain in an aerobic soil environment. The test method determines the degree of aerobic biodegradation by measuring evolved carbon dioxide as function of time that the plastic is exposed to soil.

Soil is an extreme species – rich source of inoculums for evaluation of the biodegradability of plastics in the environment. When maintained appropriately with regard to moisture content and oxygen availability, the biological activity is quite considerable, although lower than other biologically active environments, such as activated sewage-sludge of compost.

SCOPE:

The test method determines the degree and rate of biodegradation of plastic materials on exposure to a controlled composting environment under controlled laboratory conditions. The samples were exposed to inoculum that is derived from compost from municipal solid waste.

The aerobic composting takes place in an environment where temperature, aeration and humidity are closely monitored and controlled. The percentage of biodegradability is obtained by determining the percentage of carbon in the test sample that is converted into CO_2 during the duration of the test.

IV. METHODOLOGY

Carbon capture and storage (CCS) is most commonly defined as the capture of CO_2 from an industrial or power-sector point source combined with its transport and its storage in geological formations (see e.g. IEA, 2009). CCS is seen as one of the possible technologies in the portfolio of mitigation options that can contribute to cost-effective emission reductions. In theory, CCS facilitates the continued use of fossil fuels while reducing atmospheric CO_2 emissions. The composting vessels were incubated in diffuse light minimum for a period of 45 days & the temperature of the system was maintained at58C. The CO_2 & O_2 concentrations were checked in the outgoing air daily with a minimum time interval of 6 hrs after the first week. The air flow was adjusted to maintain a CO_2 concentration of at least 2% vol / vol to allow accurate determination of CO_2 level in the exhaust air. Composting vessels were shaken weekly to prevent extensive channeling provide uniform attack on test specimen and provide an even distribution of moisture. The incubation time was fixed to a minimum 45 days in case of the homopolymer samples. In copolymer samples or in the samples in which significant biodegradation of the test sample was persistent even after 45 days duration, the incubation period was extended to 180 days.

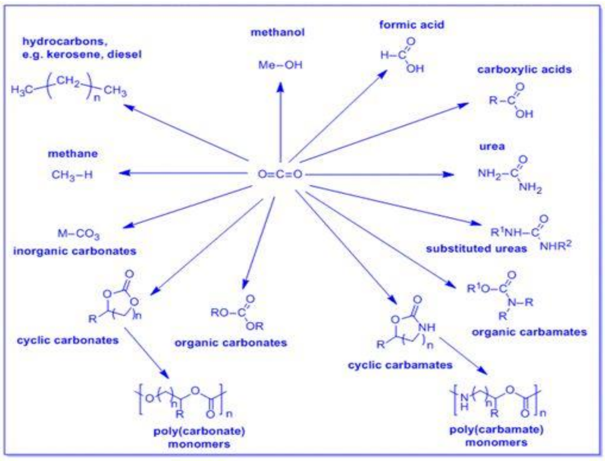

Fig.4.1 A brief overview of chemicals from carbon dioxide

V. CONCLUSION

Hence, we have discussed about how to convert carbon dioxide (CO_2) into plastic. In developing state and local policy relevant to the environmentally profitable uses of degradable plastics, it is to consider the implications of any policy or program on the pretentious waste diversion and destruction systems. Because improvement in one area of a system can sometimes adversely affect another part of the system. In Indian context, considering the local environment, social fabric, culture and wont of public random system of plastics waste management wide spread littering etc, introduction of chemical dissolution of plastics, packaging products would further add to the apathy of plastic waste disposal by adding another dimension / family of plastics.

REFERANCES

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