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NATURAL VERSUS CHEMICAL FIXATION OF CARBON DIOXIDE TOREDUCE GLOBAL WARMING

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ABSTRACT :

Photosynthesis is the only process by which carbondioxide is fixed naturally by green plants with the help of chlorophyll and sunlight into carbohydrates. This is the only source of food production on earth. Hence green plants are also called producers and every food chain starts with producers. In olden times due to less pollution the amount of carbondioxide in the environment was balanced. But with increasing pollution its amount in the air has been increased. Moreover it is a green house gas.

KEYWORDS : *food production , environment , increasing pollution.*

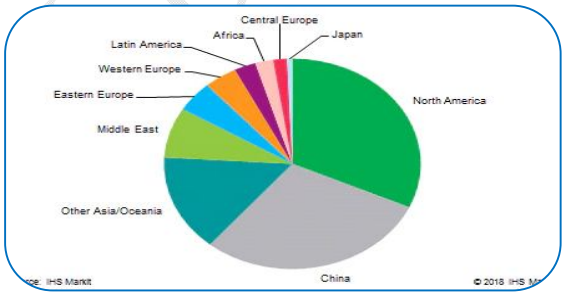
INTRODUCTION:

Chemically it is an inert gas with linear structure and with C=O on both sides. As it is a Green House gas, hence it traps heat of the sun which would otherwise escape from the earth. So this is a major contributor to Global Warming. Due to deforestation green plants are continuously decreasing on the earth hence natural fixation of CO_2 is not a sufficient processto balance the amount of CO_2 in nature and has become a serious concern for many countries of the world. One step in this direction is chemical fixation of$CO_2$to various value added chemicals. Although this process does not uses large amount of CO_2but still provides a greener and cheaper route for the synthesis of various chemicals. Some of the major routes for large volume fixation of CO_2 are in the manufacture of chemicals like polymers, methanol, urea, dimethyl ether, cyclic carbonates etc.

CARBONDIOXIDE TO UREA

CO_2 reacts with ammonia to form ammonium carbamate which further gives urea and water. The reaction is carried out at high temperature and pressure. The unreacted ammonia and carbondioxide are recycled at the end of the reaction. The value added product urea formed at the end of the reaction can be used as fertilizer.

CARBONDIOXIDE TO DIMETHYL ETHER



Dimethyl ether is an expensive chemicalbut still of great importance as it is a clean solvent and does not contain poisonous substances. It is a good fuel and burns without particulate matter. It can be possiblyused as substitute of diesel oil and LPG in the near future.

Synthesis of dimethyl ether fromCO_2 can be done by various possible ways. One way is the dehydration of methanol and the other way is from cyclic carbonates. Methanol and cyclic carbonates can

be synthesized from CO_2as raw material first and then further converting it to dimethyl ether. Now a days, various catalyst systemshas also been developedthat can also directly convertCO_2 to dimethyl ether.

CARBONDIOXIDE TO METHANOL

Synthesis of methanol from CO_2 is feasible commerciallyand this reaction is of great interest since methanol can also act as raw material for the synthesis of chemicals like formaldehyde, acetic acid and biodiesel.

CARBONDIOXIDE TO POLYMERS

Major class of polymers that can be synthesized from CO_2 are polycarbonates. There are many type of carbonates that can be synthesized using this route. The reaction between $CO_2$and different epoxides takes place under controlled conditions i.e suitable temperature and pressure of CO_2. Polymers synthesized by this method will have different types of applications depending upontheir degradation temperature and glass transition temperature. Till date, epoxides like ethylene oxide, propylene oxide, cyclohexane oxide have been reacted with CO_2 to synthesize their respective polycarbonates. This technique has also been used commercially and industries like Novomer(New York USA), Empower materials(NEW CSTLE USA) are synthesizing green polymers by using such techniques. These synthesized polymers are also value added commodities used for various purposes. Polypropylene carbonate(polymer made from propylene oxide and CO_2) is used as binding material in ceramic industries. Polyetylene carbonate(polymer made from ethylene oxide andCO_2) has oxygen barrier properties and is thus inserted in packaging containers.

CARBONDIOXIDE TO CYCLIC CARBONATES

CO_2 can possibly react with epoxidesin the presence of suitable catalystand thus cyclic carbonates can be synthesized[North et al.(2009)]. This technology is widely used commercially and one of the efficient base for cyclic carbonate synthesis. For this a bifunctional nucleophile-electrophile catalyst of tetradentateSchiff's base Aluminium complexes in conjunction with quarternary ammonium salt is used in the absence of any organic solvent.

In this work the catalytic efficiency of ionic liquid cholinechloride/urea supported on molecular sieves for the reaction of CO_2andepoxide was studiedunder different conditions. It was demonstrated that this biodegradable and green catalyst is very active and selective. Choline chloride and urea showed a synthetic effectin promoting these reactions. After the reaction solid catalyst and the product could be separated easily.

Using excessively loaded propylene oxide(PO)as a solvent, the copolymerization of $CO_2$and PO was carried out with zinc glutarate catalyst, consequently producing polypropylene carbonateof high molecular mass in high yield. Both PO and CO_2were fully recoverable, and reusable for their copolymerization indicating that this is a clean, green polymerization process to convert CO_2 to polycarbonates.

Cyclic carbonate is value added commodity with many applications. It can be used as polar aprotic solvent, electrolytic element in lithium ion secondary batteries and as chemical intermediate in the preparation of various agricultural chemicals and medicines.

CONCLUSION

Various ways for the fixation of CO_2 gas chemically have been discussed in this paper. Many value added chemicals like methanol, dimethylether, urea, cyclic carbonates and various types of polymers can be synthesized from this global warming gas,CO_2 as one of the reactant. It is noted that these processes are becoming quite famous commercially due to their significance. Thus it will help us to control environmental pollution and oneday it will lead to the conversion of CO_2 to carbohydrates(as done by green plants) by cheaper routes and food problem arising due to overgrowth of population would be solved effectively.

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