REVIEW ON CONVERSION OF CO_2 INTO NEW VALUABLE FORM

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ABSTRACT

Nature utilizes CO_2 to produce countless substances that are consumed by humans as well as animals. Many industrial procedures aim to accelerate the utilization of CO_2. There are mainly three pathways for using CO_2 and namely they are conversion of CO_2 to fuel, utilization of CO_2 as a feedstock for chemicals and non-conversion use of CO_2. The technologies to moderate CO_2 emissions are essential for the chemical industry to become "greener". An alternative to carbon capture is the use of CO_2 as a feedstock in the production of valuable products such as methanol. by using Electro reduction of carbon dioxide (ERC) which combines captured CO_2 with water to produce high value materials.

Keywords: *Carbon dioxide; Methanol; Electroreduction of carbon dioxide (ERC)*

1 Introduction-1

Carbon dioxide plays a key role in producing the greenhouse effect. It is probable that the atmospheric concentration of CO_2 has significantly increased in the last 60 years. As a result, the problem of global warming has escalated. Therefore, it is extremely important to reduce the level of CO_2 in the atmosphere and if it is possible to convert it into the useful organic molecules. [1] ERC gives an innovative solution to reduce the impact of carbon dioxide (CO_2) on the Earth's environment by converting CO_2 into materials with a broad range of commercial applications. The first example of ERC are 19^{th} century, when there is reduction of carbon dioxide to formic acid using a zinc cathode. [2] The rate of formation of $_{CO2}$ and the rate of reduction of CO_2 in the atmosphere are not proportional. The conversion of CO_2 into new useful natural fuels by means of energy that is not produced from fossil fuels is believed to be one such alternative method. The various souses of CO_2 emmisionin 2015 is shown in fig.

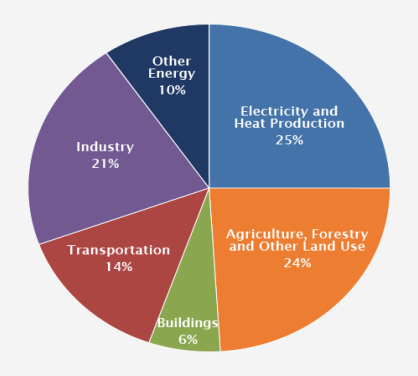

Fig -1: Sources of carbon dioxide emissions in 2015.

2. Effects of carbon dioxide - 2

carbon dioxide is waste byproduct emitted by coal-fired power station or in general by any combustion of fossil fuels it is major contributor to climate change as well as environmental and ocean acidification.

2.1 Effects of carbon dioxide On Human -1

The health of individuals near carbon transport and appropriation sites must be considered in site risk account. The toxic effects of high CO_2 concentrations are well known, but the literature also discloses cause for concern for both the survivors of high-level CO_2 exposure and individuals who experience continued low-level exposure [3]. As human populations continue to increase, simultaneous increases in energy and food will be required The effects of CO_2 in an exact individual depend on the concentration and period of exposure as well as distinct factors, such as age, health, physiologic appearance, physical activity, profession, and lifestyle.

Table - and Symptoms of Survivors Presenting at the Hospital

Signs and Symptoms	% (No. of Survivors)
Cough	31 (226)
Headache	26 (216)
Fever (malaria is endemic)	12 (104)
Weakness/Malaise	11 (95)
Limb swelling	10 (85)
Weakness of arms or legs	6 (51)
Dyspnea or Eye symptoms	5 (45)
Vomiting or Diarrhea	5 (46,44)
Hemoptysis (blood in sputum)	3 (23)

2.2 Effects of carbon dioxide and climate change on ocean acidification-2

We use an earth system model of midway density to show how consideration of climate change affects expected changes in ocean pH and calcium carbonate saturation state. The ocean plays a main role in the interest of anthropogenic CO_2 emitted from fossil fuel burning, helping to reasonable future climate change. However, the addition of CO_2 into the ocean disturbs the carbonate system, posing a danger to marine biota. When CO_2 liquefies in the seawater it increases concentrations of hydrogen ion [H+], lowering ocean pH. This reduction in ocean pH has some direct effect on marine organisms Also, some of this supplementary [H+] reacts with carbonate ions to form [HCO_3]. The decrease in carbonate ion decreases the saturation state of calcium carbonate minerals, making it more difficult for setting marine organisms to form their shells and skeletons The effect of reduction in the existing

carbonate ions has been most studied in coral, which form their skeletons from aragonite, a metastable form of calcium carbonate [4]**.**

2.3 Effects of carbon dioxide on environmental -3

There is no question that growing carbon dioxide stages will differentially kindle the growth and function of plant types on a global basis, thereby touching the flow of energy and carbon through environments. Really, it seems fair to anticipate that, as carbon dioxide increases, environment composition itself will change (e.g., cheatgrass and fires). A number of studies have, in fact, established that both rice and wheat can show a positive response to increasing atmospheric carbon dioxide (Mandersheid and Weigel 1997; Horie, et al. 2000). Since 1960, the amount of carbon dioxide in the atmosphere has increased from 315 to 378 ppm, a growth of approximately 20%. [5]

3. literature review 3

Tobias Mattisson, Juan Adanez et al: Chemical-looping combustion (CLC) is a combustion technology where an oxygen carrier is used to transfer oxygen from the combustion air to the fuel, thus escaping straight contact between air and fuel. The method includes the use of metal oxide particles with the resolve of shifting oxygen from an air reactor to a fuel reactor.

Oluwafunmilola O. Ola et al: CO2 operation by direct catalytic conversion of CO2 driven by solar energy is an attractive method for producing other value added products fit for end-use organization. In order to fully harness the solar spectrum and increase photocatalytic activity and selectivity, Cr-TiO2 based films were put on ceramic honeycomb monoliths with varying concentrations synthesized by sol-gel technique and dip coating route. The better photocatalytic activity of the Cr-TiO2 monoliths in the visible light region compared to pure TiO2 can be attributed to increased visible light absorption and accessible active metal sites arising from the appropriate metal dispersion and loading amount.

Amartya Chakrabarti et al 2011: Burning magnesium metal in dry ice caused in few-layer nanosheets of graphene in high produces. These carbon nanomaterials were considered by Raman spectroscopy, energy-dispersive X-ray analysis, X-ray powder diffraction and transmission electron microscopy. This work provides an innovative route for producing one of the most promising carbon nanostructures by capturing carbon dioxide that is commonly known as the greenhouse gas.

Irshad Ali et al2014: Electrochemical conversion of CO2 into working aqueous-phase organic molecules was examined employing a glassy carbon (GC) electrode patterned with nickel nanoparticles (GC-Ni), in a batch electrochemical reactor operating at constant potential, room temperature and atmospheric pressure. The system was found to efficiently convert CO2 into mostly ethanol (91±1 mol.%), at a very high faradaic efficiency (221± 23% after 8 hours of electrolysis), representing that the CO2 reduction could most maybe be occurring both electrocatalytically and catalytically.

Ibram Ganesh2011: conversion of carbon dioxide, a green house gas into methanol or to any other value added chemical following various routes including catalytic, their-mal, biological, electrochemical and photoelectrochemical (PEC). More importance is given on conversion of carbon dioxide to methanol using solar energy (i.e., artificial photosynthesis) as this process can challenge the human generated two pressing problems, i.e., "global warming" and "energy crisis" today world is facing.

3.1 The summary of above literature

Table- 1: summary of above literature

Sr.no	Method of conversion of CO_2	Products	Catalyst	Author Name
1	Chemical looping combustion	Oxygen carrier	Metal oxide	Anders Lyngfelt (2008)
Remark- The project has demonstrated that production of oxygen carriers which exhibit excellent properties with respect to important parameters for CLC can be produced with commercial materials and production methods.[6]				

2	CO_2 conversion into valuable fuels using chromium base supports	Alcohol	Cr-TiO_2	OlawafunmilotaQ.ola(2014)

Remark-Sol gel derived Cr-TiO_2 immobilized onto monolithic structures threaded with optical fibers were considered under visible light irradiation. The photocatalytic actions of Cr-TiO_2 based monoliths with various fixing concentrations were evaluated for CO_2 reduction after 4 hours of visible light irradiation. The optical properties of TiO_2 were curved towards the visible light with increased Cr concentration when compared to pure TiO_2. [7]				
3	Burning Magnesium metal in dry ice	Graphene	_	Amartya Chakrabarti(2011)
Remark-The carbon nanomaterials were considered by Raman spectroscopy, energy-dispersive X-ray analysis, X-ray powder diffraction and transmission electron microscpy. This work runs an innovative route for producing one of the most capable carbon nanostructures by capturing carbon dioxide that is widely known as the greenhouse gas.[8]				
4	Electro chemical conversion of CO_2 into aqueous phase organic molecule	Methanol, Ethanol	Electroo catalyst	Irshad Ali(2014)
Remark-The conversion of CO_2 into different organic molecules using a GC-Ni electrode in a batch electrochemical reactor operating at room temperature and atmospheric pressure and at a very high faradic efficiency was demonstrated.[1]				
5	Conversion of CO_2 by solar energy	Methanol	Nickel	Ibram Ganesh(2011)
Remark-The conversion of CO_2 into more valuable organic fuels (like methanol) using energy that is not created from fossil fuels is be-lieved to be one such another method. It is also strongly believed that the synthetic photosynthesis has fantastic potential, even though it remains to be successfully established on a profitable basis.[9]				

4. CONCLUSIONS

Now in modern era of 21st century we improve our lifestyle, technology, food, agriculture & so on but side by side we also increase our pollution rate very rapidly so that many dangerous problems are arises one of them is global warming and its main cause is increase in % of CO_2 concentration in the atmosphere so to minimize this problem the simple way is to reuse of CO_2 converting it into valuable form by using various methods like chemical looping combustion, CO_2 conversion into valuable fuels using chromium base supports, burning magnesium metal in dry ice, electro chemical conversion of CO_2 into aqueous phase organic molecule, conversion of CO_2 by solar energy and Electroreduction of carbon dioxide.

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