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Co_2 Scrubbing Concrete Roads

Ankit Jena[1], Harish Kelageri[2]

[1]*Assistant Professor, Department of Civil Engineering, Gandhi Institute For Technology (GIFT), Bhubaneswar*

[2]*Assistant Professor, Department of Civil Engineering, Gandhi Engineering College, Bhubaneswar*

ABSTRACT:

An experimental investigation was carried out to evaluate capacity of concrete roads to absorb carbondioxideusing natural zeolite (NZ). To overcome serious climate change, deep reduction in CO_2 emission will be required in next coming years. Global warming can be control by the CO_2 absorption technique. Global warming is caused by large greenhouse gases(CO_2, NH4 ,etc.) emission by human activities. In construction sector, CO_2 emission dominantly occurs from cement production. Capturing of $CO_2$from source, from polluted air and reducing atmospheric CO_2 concentration by using Zeolite material and Zeolite sand. Concrete roads with Zeolite as coat can absorb large quantity of CO_2.By coating Zeolite material on the concrete roads absorbs CO_2 from the atmosphere hence it will be eco-friendly as well as beneficial to the environment. Absorb CO_2 and reduces the air pollution, Keep environment clean and full of oxygen. Zeolite.This material is easily available.The direct partial replacement of cement by zeolite resulted in the slight decrease of compressive strength, especially the early strength and tensile splitting strength. Study of effect of zeolite on the strength of concrete made in this study by Choosing M30 Grade of Concrete and Replacement of Cement With 25% of zeolite and Also Project Conducted Compressive Test and Acid AttackTest.

Keywords-ExperimentalStudy,Absorption,CO2,M40Concrete,Zeolite

I. INTRODUCTION

Zeolites occur naturally but are also produced industrially on a large scale. As of September 2016, 232 unique zeolite frameworks have been identified, and over 40 naturally occurring zeolite frameworks are known. Every new zeolite structure that is obtained has to be approved by the International Zeolite Association Structure Commission and receives a three letter designation It is also possible to produce zeolite structures that do not appear in nature. Zeolite A is a well-known example. Since the principal raw materials used to manufacture zeolites are silica and alumina, which are among the most abundant mineral components on earth, the potential to supply zeolites is virtually unlimited Zeolites are widely used as ion-exchange beds in domestic and commercial water purification, softening, and other applications. In chemistry, zeolites are used to separate molecules (only molecules of certain sizes and shapes can pass through), and as traps for molecules so they can be analyzed. Zeolites are also widely used as catalysts and sorbents. Their well-defined pore structure and adjustable acidity make them highly active in a large variety of reactions. Zeolites have the potential of providing precise and specific separation of gases, including the removal of H_2O, CO_2 and SO_2 from low-grade natural gas streams. Other separations include noble gases, N_2, O_2, Freon and formaldehyde.

II. HISTORY

On-board oxygen generating systems (OBOGS) and Oxygen concentrators use zeolites in conjunction with pressure swing adsorption to remove nitrogen from compressed air in order to supply oxygen for aircrews at high altitudes, as well as home and portable oxygen supplies Global warming resulted from the emission of greenhouse gases has received widespread attention. Among the greenhouse gases, CO_2 contributes more than 60% to global warming because of its huge emission amount. The CO_2 concentration in atmosphere now is closed to 400 ppm which is significantly higher than the preindustrial level of about 300 ppm. To mitigate global warming, Kyoto Protocal urges 37 industrialized nations and European Union to reduce their greenhouse gas emissions to a level of 5.2% on average lower than those of 1990 during the period of 2008 to 2012. Copenhagen Accord also requests the global temperature increase be limited to 2°C above the pre-industrial level by 2100.International Energy Agency (IEA) pointed out to achieve the ± 2°C goal, CO_2 capture and storage (CCS) technology is required and the contribution would be 19% in 2050. It is therefore essential to develop the CCS technologies to cope with the global demand of CO_2 reduction. Among these technologies, chemical absorption using aqueous alkanolamine solutions is proposed to be the most applicable technology for CO2 capture before2030.

III. MATERIALS ANDTESTING

The increase in the strength of mortars due to the replacement of zeolites 1Carbonation Of Concrete Carbonation is known to improve surface hardness, strength, and durability of cement-based products by porerefinement of the cement paste matrix. Carbonation can be helpful in non-reinforced cement-based products. However,for reinforced cement-based products, as the pH of carbonated cement paste reduces due to carbonation, reinforcingsteel loses its passivity and becomes vulnerable to corrosion. Carbonation in cement-based products can be defined as areaction between the CO_2 dissolved in water and the cement hydration product Ca(OH)2 in the pore water. Thisreaction produces calcium carbonate (CaCO3) and water. Calcium silicate hydrates and calcium aluminate hydrates alsoreact with CO2 in the presence of moisture to produce calcium carbonate and hydrates of silicates and aluminates andwater.CO2 diffuses through the pores depending upon the pore structure and the degree of saturation of the pores in thecement paste matrix. CO_2 in gaseous phase does not react with cement hydration products; it has to dissolve in the porewater first to form carbonic acid (H2CO3). Out of the hydrates in the cement paste, the one which reacts with CO_2mostreadily isCa(OH)2.OtherhydratesalsoreactwithdissolvedCO2,andhydratedsilica,alumina,andferricoxidearepro duced.WhenallCa(OH)2becomescarbonated,thepH valueoftheporesolutionisreducedfrom12.5to8.3

ZEOLITES

Zeolites are framework silicates, with a completely linked framework of tetrahedra, each consisting of 4 O2-surrounding a cation (usually Si4+ or Al3+). The framework contains open cavities in the form of channels and cagesChannels and cages are occupied by H2O molecules and extra-framework cations (K+, Na+, Ca+ and others) thatare commonly exchangeable. Channels are large enough to allow passage of guest species.In the hydrated phases, dehydration occurs at temperatures 400oC and is largely mostly below 400 C reversible Zeolites are porous, hydrated aluminosilicates. They may be natural minerals orsynthetic materials. The general chemical composition of a zeolite is:

Characteristics ofZeolite

High degree ofhydration Low density and large void volume when hydrated. Stability of the crystal structure when dehydrated. Cation exchange properties Uniform molecular-sized channels in dehydrated crystals. Ability to absorb gasses and vapors Catalytic properties

Properties Of Zeolites

The properties of zeolites are closely related to both structure and chemistry.Three main characteristic properties: Adsorption Ion exchange Catalytic activity

IV. PROBLEMSTATEMENT

We hear a lot about carbon dioxide when we talk about climate change, but sometimes it's important to go back and examine why too much CO_2 in the atmosphere is a bad thing.

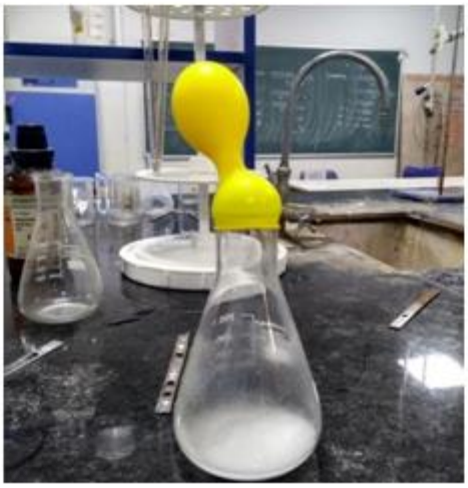
CO_2 a naturally occurring gas that is also emitted at great levels by human activity — is one of several greenhouse gases in our atmosphere. Other greenhouse gases include water vapor, methane, ozone, nitrous oxide and halocarbons. To understand the impact of these gases, we first start with the sun, which sends solar radiation in the form of light to Earth. The atmosphere deflects some of this radiation, while the rest hits the planetary surface and warms the land and oceans. The Earth then radiates its own heat back up in the form of infrared rays. Some of those rays escape the atmosphere, while others are absorbed and then re- emitted by the atmospheric gases. These gases – the greenhouses gases – then help to keep the planet at its normal temperature. For millions of years, the production of greenhouses gases was regulated by the natural systems of the planet. Gases would be absorbed and emitted at a fairly steady rate. Temperatures, meanwhile, were maintained at a level that supported life around the world. The Environmental Protection Agency characterizes this as "a balancing act."

V. EXECUTION METHODOLOGY

Preparation of specimen

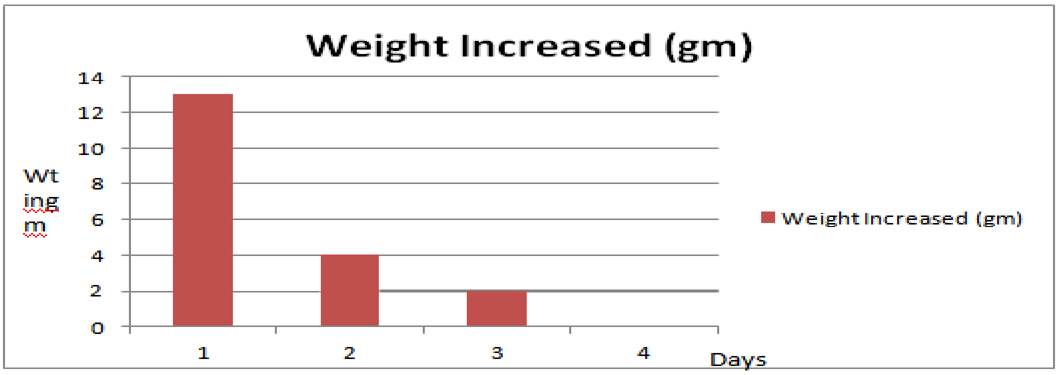
Preparation of mortar (plain concrete) specimen was accomplished following JIS (Japan Industrial Standards) A 1132- 20067): "Method of making and curing concrete specimens," Which is equivalent toISO1920-3:2004. Three identical specimens were prepared at a time. Mortar pieces were chosen in order to simplify the experiment for CO2 absorption observation. Cement mostly used was ordinary Portland cement. Water/cement ratio was 50 %. Porosity of the pieces was prepared at 0, 25 and 50 % void with using a foaming agent (Fine foam707, BASF). For all specimens, the amounts of aggregate and water were 1350 and 225 grams, respectively. Cure was done for 20 days in water at temperature 7±1 C and drying under atmosphere at temperature 20 ± 1 C with relative humidity 65 %. The configuration of the piece was 40mm × 40mm × 160mm. Two samples were used in the bending and compression tests and the other one was tested for a CO_2 absorptionprocess

Reaction- HCL+ Na($HCO_3)_2$ →H_2O+ CO_2↑



Experimental procedure

Pure carbon dioxide gas was introduced into a container of 300 mm × 300 mm × 500 mm to establish the atmosphere that contained CO_2at 3 volumetric %. The concentration was measured with a digital carbon dioxide checker (CD-1, Fuso Co. Ltd., Tokyo, Japan). Then a mortar test piece was set in the container and the CO_2 content was continuously measured until the concentration became below the detection limit of 0.04 %. The experiment was repeated until total experimental time reached 100 hours.



Model

VI. RESULT AND DISCUSSION

The graph shows that there is increased weight of zeolite with CO_2.And there is no effect of gas on strength of block prepared by zeolite sand and powder as a substitute. Hence this can be utilized without any problem in the buildings. The zeolite block can be used in the road pavements, Chimney of factory as well as at the faces of building. The Zeolite is costly material hence only small substitution by it would make it affordable for the people. The zeolite is available in abundant amount. This can also be manufactured. As CO_2 Is causing too many problems which is leading to the heavier pollution effects like greenhouse effect, Environmental imbalance. The CO_2 plays major role in this. Hence it is very important to reduce its percentage from the environment. CO_2 is in gas form hence it will directly come in contact with construction built around. Apart from that construction industry contribute 70% of the total CO_2 expelling. As while cement production and at the time of curing of the structure it will get evolved into atmosphere. Hence it is very important to reduce its emission. This material will definitely reduce its emission. Hence it must be used in theconstruction.

VII. CONCLUSION

The recent trends in technologies are leading to tremendous increase in pollution. Hence it is need of time to reduce the pollution otherwise consequences will be devastating. The zeolite made concrete is capable of absorbing CO_2 without any emission of it. Otherwise general concrete evolve huge amount of CO_2 into the atmosphere. The zeolite of bottle of sixe 10 cmdia and 12 cm height has ability to absorb around 1 to 14 gmofCO_2in 5 days. This property does not lose its strength and durability. Hence it can be used at any place without any doubt.

VIII. ADVANTAGES

CO_2 from the surrounding environment and helps to stop the air pollutions. ddition Zeolite has important advantages: Improves mechanical strength to the cement and stops emission CO_2.

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