International Journal of Research (IJR)
e-ISSN: 2348-6848, p- ISSN: 2348-795X Volume 2, Issue 10, October 2015
Available at http://internationaljournalofresearch.org

A Review on Coal Fly Ash Utilization in Reduction of Green House Gas and Global Warming- A Sustainable Environmental Approach

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Abstract

Coal fly ash is generated especially from Thermal power plants, mining and others industrial operation and maintenance protocol and postulated as best material for pollutant removal as a low cost adsorption reaction. Coal fly ash is successively utilized in resolving different global environmental issues and make them effectively progressive useful to fulfill demand and supply ratio with compared to other applied beneficial material in different pollution removal technique as economically and easily availability on earth.fly ash reduces the GHG's and Global Warming issues to maintain climate change impact on planet with store and capture potential and additionally applying various changes in operation and maintenance protocol.

Key words:- Coal fly ash; GHG & Global Warming issues; operation & maintenance

Introduction

Fly Ash is an unwanted residual matter of coal in chimneys after combustion at high tem and low pressure, which is being utilized in a different industrial sector to fulfill commercial needs. However, It is presumed a resourceful waste material to succeed as a best alternative for next generation with numerous socio-techno based advanced application in a progressive eco-friendly surrounding environment. A systematic analysis of physico-chemical and morphological features of fly ash represents a valid analytical practices in pollutant removal to reduce Green House Gases and Global warming issues respectively, resulting in a climate change impact on earth. According to several Research work towards the reduction of GHG's and Global warming issues by the leading innovation of fly ash utilization as development of socio-economical and value-added products, concrete additives, biochar production, agricultural practices during soil-carbon interaction analysis etc. providing helpful approach but it is ultimately end with limited Industrial growth and unawareness of Waste Recycling.

Climate change has become an issue of global prominence often provokes animated debates over its origin. Most of the scientific evidence, however, links increased GHG emissions to the average warming of our planet. How do GHG emissions affect the climate? The Sun's radiation heats the surface of the Earth, which in turn radiates energy back to space. Some of this radiation (almost all in the infrared spectrum) is trapped in the atmosphere by GHGs, which have strong absorption bands in the infrared range. The trapped radiation warms the lower atmosphere (troposphere).This heat then finds its way back down to the Earth's surface, making it hotter than it would otherwise be. This is similar to what

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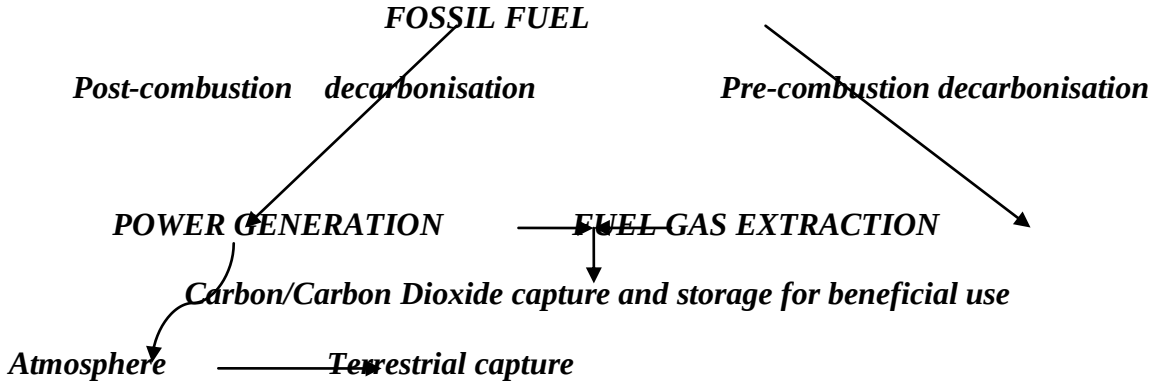
happens in a greenhouse. Atmospheric pollution determine the major GHG and Global Warming issue on earth, eventually Natural or anthropogenic generated sources. So, Research work is carried out to separate and capture carbon dioxide to utilize in the development of GHG emission reduction, analyzed as a primary concern in the name of carbon sequestration. Carbon sequestration is the removal of green house gases either directly from the exhaust streams of industrial/utility plants or indirectly from the atmosphere and storing them long term so that they cannot interact with the climate system.



Several processes based on chemical absorption with monoethanolamine solvent utilized as a carbon dioxide capture from industrial plants.MEA is modified as incorporate inhibitors to resist solvent degradation and equipment corrosion during the applied process of carbon dioxide from flue gases, required high amount of regeneration energy and large equipment to maintain lower solvent strength. Ultimately it requires high amount of energy from operating power plants, resulting as a reduction of power plant's net power output with effect of high cost demand and supply ratio. Likewise above process, carbon dioxide adsorption on zeolites/carbon bonded activated fibers and then separating it using inorganic membrane, which is promoted as advanced process but for smaller scale of pollution sources. Fly ash is the kind of waste most commonly used to CO2 fixation. Fly ash used to CO2 fixation should posses high calcium content because only in this way they can react with water directly. Although, morphological features of fly ash is linked to GHG emission store and utilizes in the development of sustainable environment.

Methodology as Conventional Approach

Dr A.Uliasz-Bochenczyk et al., (2006) suggested that carbon dioxide utilization in fly ash and water mixture by the mineral carbonation of mining waste. Mineral carbonation by fixation of Carbon dioxide in natural raw material, such as talc or serpentine, is a phenomenon occurring in natural conditions. This is one of the reactions which are followed by rock weathering process. Natural minerals which may be used in CO2 sequestration in mineral carbonation may be serpentine or olivine. Mineral carbonation is conducted by the means of two basic methods as mineral pre-treatment utilised carbon dioxide accelerator.

*direct method (one stage),in which the mineral undergo carbonation.

*indirect method (two stages),in which reactive minerals are pre-extracted from mineral matrix (first stage),and later undergo the reaction with

Carbon dioxide (second stage).Both the process is applied by In-situ and Ex-situ, depend upon possibilities and resources availability. This study is elucidated the utilization of brown and hard coal in power industry, which is not applicable of all types of power industry and resource availability everywhere due to various coal type differentiation and reactivity. So, technically, It is not valid.

M.L. Gray et al.,(2004) argued about the carbon dioxide capture by amine-enriched fly ash carbon sorbents from gas streams on the long term basis. Research work was focused regarding the substitution of solid-amine carbon dioxide sorbents to amine enriched fly ash carbon sorbents because of incorporation of the amine group onto the surfaces of this fly ash carbon concentrates should enable them to capture Carbon dioxide from gas stream in the present of moisture. The initial fly ash carbon sorbents were generated by the chemical treatment of carbon-enriched fly ash concentrates with a 3-chloropropylaminehydrochloride (CPAHCL) solution at 25ºC.The amounts of nitrogen incorporated onto the surfaces of these fly ash carbon concentrates were determined by XPS analysis for proposing better result. It is assumed that amine enriched fly ash carbon sorbents utilizing in capturing carbon dioxide percentage is very low due to lower surface area and high cost, high equipment demand, lack of valid procedure precisely, not applicable for broader emission sources with longer persistent time. M. Ondova and N.Stevulova.,(2012) proposed the maximum benefits of fly ash utilization in concrete road cover because of cement production generates an average world carbon emission of 0.81 kg Carbon dioxide perkg cement produced. Approximately,1 ton of concrete is produced for every human being in the world each year on average. Similarly, J.S. Damtoft et al., (2008) described a topic on sustainable development and climate change initiative. It is suggested that Fly ash, a byproduct of the coal burning power industry is a rich cementitious industrial waste which has the great potential to substitute Portland cement a major producer of Carbon dioxide. The pore filling effect and pozzolanic properties of fly ash improve the properties of fresh and hardened concrete. This type of concrete is more economic, environmental friendly, contributes to the reduced Portland cement use and reduces Carbon dioxide emissions. presumably, It is a notable substitute to maintain eco-friendly product but in the case of larger source of GHG emission, only 10% carbon dioxide can be reduced and ultimately this process is not suitable for transportation with lack of management roadmap. According to J. Bittner et al.,(2001)added the advanced knowledge of ammonia ‘slip’ as a reagent to reduce the Nitric oxide from flue gas, depend upon the amount of ammonia used, if higher amount of ammonia is found,it is produced the unpleasant odors then it should be removed by STI process just like fundamental process of alkali. however, ammonia removal from fly ash is not required with limited amount of ammonia utilized in fly ash concrete production. which is further utilized as GHG emission reduction due to physico-chemical and morphological properties of fly ash. Vimal Kumar et al.,(2005) referred to fly ash; a material for another green revolution, in which it is described fly ash reaction with soil act as a conditioner to improve soil fertility in agricultural practices and several advantages of fly ash is proposed but finally it shows lack of focus to GHG emission reduction and global warming issue with climate change.fly ash utilization in agricultural practices, concrete, value added products can also play the important role in GHG emission reduction which

is not facilitate to proceed as advanced socio-techno process with low cost value as well as rectified management roadmap by Indian government agencies.

Result and Discussion

Fly ash is a beneficial waste material with macro-micro and meso scale size materials and several possible physio-chemical, morphological properties to utilized in different environment friendly reactant process to save environment as well as maintain socio-economic order, technically and economically. So, comparatively in the case of Developing countries like India with dense population, lower investments, higher demand and supply ratio and poor infrastructure development along with highly competitive Manpower source in commercial sectors describing a major problem to develop roadmap in carbon sequestration, GHG emission reduction and climate change issues on the long term basis. Therefore, alternative beneficial option is coal fly ash from thermal power plants, which is discussed by A.Uliasz-Bochenczyk as proposed research work in utilization of carbon dioxide in fly ash and water mixtures and it is concluded the best option as natural mineral carbonation with low cost value and it can be processed In-situ(underground mineral carbon dioxide sequestration combined with geological storage of carbon dioxide)Ex-situ (above ground industrial process as integrated technology within the process and end of pipe technology)along with many advantages such as stable condition of long-term storage, carbonates are common in nature so they are neutral for the environment, possibility of concurrent carbon dioxide and fly ash utilization significantly applied in several economical processes.

Conclusion

Coal fly ash is remarkably introduced as best alternative source for pollutant removal as adsorption reaction on the basis of particle size in mesoporous scale after fusion of additional additives or reagent. Coal fly ash alters the pathway of manmade sources of GHG pollutant in the name of carbon dioxide capture and storage on the adsorption layer and ultimately remove the unwanted gas as well as further upgraded pure gas to surrounding environment. So, CFA with additives fusion is no doubt act as a best available material for GHG emission reduction around the world.

References

[1] Uliasz- Bochenczyk et.al.,(2006) utilization of carbon dioxide in fly ash and water mixtures. Chemical Engineering Research and Design, 84(A9) pp.843-846.

[2] J.S. Damtoft, et.al., (2008)Sustainable development and climate change initiatives. Cement and Concrete Research 38, pp.115-127.

[3] J. Bittner et.al.,(2001)Removing Ammonia from Fly Ash. International Ash Utilization Symposium paper-15

[4] M. L. Gray et.al.,(2004)Carbon dioxide capture by amine-enriched fly ash carbon sorbents Separation and Purification Technology 35, pp.31-34.

[5] M. Ondova And N. Stevulova (2012) Benefits of Fly Ash Utilization in Concrete Road Cover Theoretical Foundation of Chemical Engg.46 (6) pp. 713-718.

[6] M. Mercedes Maroto-Valer et al.,(2002) Environmental Challenges and Greenhouse Gas Control for Fossil Fuel Utilization in the 21st Century, Springer Science+Business media,LLC, NY.1st edition pp.76-118.