The Production Of Fly Ash And Its Uses In Various Countries

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Abstract **--** Fly ash is the coal burning residue generated from coal based thermal power plants in all over the world. From some decades the demand of electricity are increasing continually due to increase in population and new industries launched day by day in all over the world, hence the requirement of energy also increased. To fulfill these demands of energy there are a lot of pressure on coal based thermal power stations to produce more and more electricity and hence the amount of this waste by-product (fly ash) is increasing speedily and creates the problem to our environment, because it contains a large number of heavy metals etc. Because of this reason it is necessary to invent some new aspects of use of this fly ash in different fields and safe disposal of this waste material also required by human beings. Its disposal is of a serious environmental concern due to its hazardous properties, impact on agriculture and long term risks to ecosystems and human beings both.

Keywords— fly ash,coal,,environment,

1.INTRODUCTION

The large production of electricity I depending on the coal based thermal power plants in whole world, so the amounts of fly ash generated by these power plants are also increased regularly. According to various sources in India there is about 80% of the whole electricity generated by coal based thermal power plants and Jamwal 2003 reported that about 110 MT fly ash produced from these plants every year. Kalra i ml. has been documented that it will cross the 140 MT by the year 2020. Sinha and Basu' have also supported that in other countries like USA Germany, France and Netherland the use of fly ash about 70% in different aspects, but in our country it was very less only about up to 15%.So, it is necessary to invent some new field of the use of this solid waste in a proper and suitable way. Fly ash'" also plays an important role for our whole ecosystem, because its repeated exposure cans causes irritation in eyes, skin, nose, throat and respiratory tract and result in ash poisoning (Carlson and Adriano 1993 and Finkelman al. 2000). Now a days, this solid hazardous waste becomes a very useful material for different purposes such as for soil reclamation, for agriculture- as fertilizers and as pesticide to improve crop production and soil fertility, building materials etc. but its use in agriculture in a optimum or limiting quantity is useful for better crop productivity and soil properties like water holding capacity, pH, better porosity and reduce bulk density etc.

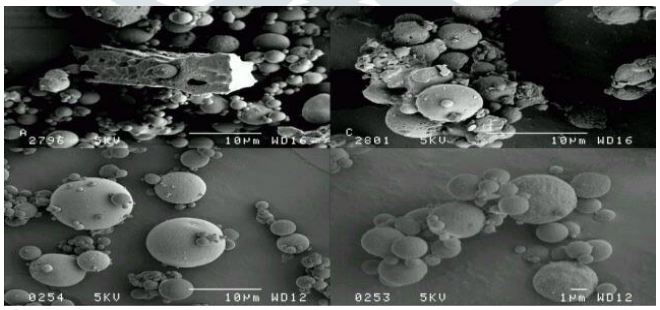

Figure 1-1: The predominantly spherical microscopic structure of fly ash

2.LITRATURE REVIEW

Shah and Ahmad (2008) carried out investigations regarding in mixing the detoxified and lime precipitate electro plating waste sludge with fly ash and cement to get stabilized mix. The involuntary constancy of the mix was judged by construct 100x100x100 mm cubes for varying percentages of waste sludge, fly ash and cement and formative the compressive strength of the cubes after 7, 14, 21, 28, 90 days of curing. The effectiveness of fly ash cement based technology in immobilizing heavy metal laden electroplating waste was assessed by conducting Toxicity Characteristics Leaching Procedure (TCLP). The TCLP test suggest that the technique is very useful in immobilizing the heavy metals present in the waste sludge. 30%-45% waste sludge, 50%-70% fly ash and 8% cement have given an standard compressive strength of 43.4 MPa. Daniels and Das (2006) reported the results of series of leaching tests carried out to evaluate the effectiveness of lime to reduce leaching of As, Cd, Cr, and Se from coal combustion fly ash. The percentage lime content used in the study varies between 0.5% and 3%. The authors observed that

the inclusion of lime reduces the leach ability of Cd and Se. On the contrary, escape of Cr was found to increase with increasing lime contented. For the case of As and Se, the authors concluded that a minimum of 1 % lime by weight is required for cementitious response leading to reduction in leach capability of heavy metals.

Sophiya and swaminathan (2005) investigated the efficiency of cement-fly ash to immobilize the electro plating waste sludge containing high amounts of chromium. The study found that the compressive strength of cement-based binder system was better than cement-fly ash based binder system. TCLP absorption of chromium in the leach ate of solidified material was smaller than the US EPA regulatory limit (5mgl/l) on the 28 day of curing. The concentration of chromium leached after NEN 7341 procedure was very low when compared to original sludge. The selected solidified blocks exhibited long-term chemical durability, as determined by Multiple TCLP. The leaching mechanism of the solidified waste form was controlled by diffusion as indicated by ANS 16.1 test. The study demonstrates that high content of
chromium in the sludge can be effectively using 1 part by weight of cement and 3 parts by weight of fly ash.

Doven and Pekrioghu (2005) investigated prospective relevance of high volume fly ash in cement paste designed for structural fill. Composite material which was comprising of cement paste, high percentage fly ash, silica fume, lime, and chemical admixtures, was tested for index (specific gravity, void ratio, and shrinkage), mechanical (unconfined compression and flexural strengths), and durability characteristics (hydraulic conductivity and soundness). The results of the tests compared with those from traditional fill material indicate that it possesses lower unit weight and high strength.

Malviya and Chaudhary (2004) considered the Solidification of dangerous sludge from steel making plant. Mechanical strength and escape production test of solidified manufactured goods was performed. The authors founds that the mechanical strength decreases with increase in waste content. Pb, Zn, Cu, Fe and Mn can be significantly powerless by the solidification process. The elements least powerless were Na, K, and CI.

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3.DISCUSSION

Industrialization particularly in the developing countries like India is a bane necessity in order to maintain economic growth. In developed countries like USA the annual per capita energy consumption ranges between 5- 11 KW, where as it is very less only l-I.5 KW in developing countries like India, Bangladesh etc. In India, the power sector is the large consumer of non coking coal, so the generation of fly ash is increasing day by day.

In present time, India consume 43000 T of coal per day in the process generate ash (fly ash and bottom ash) of about l8500T. The more developed countries having 25% of world population shows net combustion of 83% energy, whereas in less developed countries with rest of 75% population have only I7% of total energy consumption. The available data reported that Europe is the largest consumer of the world. Commercial energy consumption in India has stated from 30to 60% in last four decades. In India coal is the main source of energy and due to increase in demand of energy, the consumption of coal has also increased and the percentage of fly ash rose effectively, The use and safe disposal of this waste must be done in a proper and well managed ways; otherwise it will create a problem to our ecosystem. It can be used in varieties of ways, in such a large field like agriculture, horticulture, as chemical fertilizers, as insecticides, as pesticides etc, It has been reported by some workers that fly ash has some pozzolonic properties, because of this it can be used a5 raw material in construction of buildings and roads, by mixing with cement and Concrete. According to Nail arid Tyson , the use of I tone of fly ash in concrete will avoid 2 tons of carbon dioxide emitted from cement production and minimize green house effect and global warming, so the use of fly ash in this field can solve the major problem of
Disposal of this useful waste'7 Chemically, fly ash contains some essential macro and micro nutrients, which are necessary for plant growth; hence it is a very usefull in order to increase soil fertility and production of crops. According to Mishra and Shukla, it iastlie ability to enhance the growth and metabolic activities of some plants such as Maize and Soybean . Some workers suggested that when fly ash mixed with chemical fertilizers, it was found to be more beneficial to enhance soil fertility and crop productivity. While, besides this, fly ash also contains some toxic metals and radio nucleotides, so the optimum amount of fly ash must be used in agriculture and before using this material the chemical and physical nature of soil must be studied by the users'

According to 12‘ five year plan the total projected demand for coal during 2016- 2017 is 1048.73 MT of which 682 MT is estimated for power sector.

Table No.1 All India Projection Of Demand Of Coal Sector Wise (MT)

Sector	year	Year	Year	year	year
	2012-13	2013-14	2014-15	2015-16	2016-17
Power	466	545	631	663	682
Steel	46.3	52.9	57.9	63.2	67.2
Cement	30.24	33.81	37.81	42.29	47.31
Sponge Iron	33.69	37.24	41.18	45.52	50.33
Other	168.23	176.1	184.36	192.99	201.89
Total	744.46	845.05	952.25	1007	1048.73

Source – Working Group On Coal And Lignite For The 12th Five Year Plan

About 75% of total ash production is fly ash, its consist of dark gray color and light weight particle which can travel at the rate 45 to 50 km/h. in the down wind direction. It has been reported that the nature of fly ash is alkaline and its very useful for acidic soil

to increasing ph value of the acidic soil and its also contents large number of micro and macro nutrients so its use as a fertilizer but its process some toxic heavy metals such as Cu, Zn, Pb, Ni etc. Which limit to greater amount in agriculture

4.RESULT

Due to demand of energy is increasing very fast during last some decades in all over world. So the quantity of fly ash also found to increase very fast hence it is very important and necessary to use fly ash in a safe way in different aspects.

Table No.2 Present and projected demand for power generation in India

Plan	Thermal year of plan	Capacity (MW)	Requirement of coil (MT)
IX Plan	2001-02	87100	285
X Plan	2006-07	116400	400
XI Plan	2011-12	138000	500
XII Plan	2016-17	216900	682

Source:- sinha and basu (1998)

In plan (2016-17) requirement of coal in India is 682 MT in the coming year the demand of coal is increasing because number of power generation plant increasing year by year according to the international report utilization of fly ash in developed countries like Germany, USA and UK up to 75% where is developing countries such as India it is less than 20%

Table No. 3 In the year 2005-06 Fly ash production and its utilization in the world

Name of country	Annually fly ash production (MT)	Fly ash utilization in %
India	112	38
China	100	45
USA	75.0	65
Germany	40.0	85
UK	15.0	50
Australia	10.0	08
Canada	6.00	75
France	3.00	85
Denmark	2.00	100
Italy	2.00	100
Netherland	2.00	100

Source http/www.tifac.org.in [accessed 26.07.2008]

The data provided by Govt. of India. In India during 2005-06 about 112 MT fly ash was produced and documented that the fly ash production in India will increase 175 MT BY 2020. The percentage of utilization of fly ash is only 38% and rest of this were dumped in to basin or landfill near power plant which is not environmentally.

Table No.4 In the year 20015-16 Fly ash production and its utilization in the world

Country name	Annually fly ash production (MT)	Fly ash utilization in %
India	140	43
China	125	51
USA	95.0	71
Germany	55.0	88
UK	25.0	58
Australia	20.0	12
Canada	10.0	78
France	5.00	90
Denmark	4.00	100
Italy	3.50	100
Netherland	3.00	100

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