

Utilization or Disposal of Fly Ash

Ms. Rajlaxmi Choudhary

Department of Civil Engineering, GEC Banswara, Rajasthan, India

E-Mail:- laxmir874@gmail.com

Abstract : *Electricity generation in the country is and will remain predominantly by coal based stations in the near future. The Indian coal is of low grade having high ash content of the order of 30 - 45%, generating large quantity of fly ash at coal/lignite based thermal power stations. At present, the Ash utilization is lower than the generation on all India basis. As a result, there is surplus ash stock, which has been increasing every year. The management of fly ash has thus been a matter of concern in view of requirement of large area of land for its disposal because of its potential of causing pollution of air and water.*

Keywords:-Electricity Generation; Coal; Fly Ash; Thermal Power Stations; Utilization; Disposal; Pollution;

Introduction

What is fly ash?

Fly ash is a fine gray powder consisting mostly of spherical, glassy particles that are produced as a byproduct in coal-fired power stations. This fly ash is pozzolanic in nature, and contains less than 7% lime (CaO). It is commonly known as a supplementary cementitious material and also known as flue-ash or simply ash. Since the particles solidify rapidly while suspended in the exhaust gases, fly ash particles are generally spherical in shape and range in size from 0.5 μm to 300 μm .

In the short **“Fly ash is one of the coal combustion products, composed of the fine particles.”**

The main chemical components present in fly ash are:

- Silicon dioxide (SiO_2)
- Aluminum oxide (Al_2O_3)
- Ferric oxide (Fe_2O_3)
- Calcium oxide (CaO) (occasionally)

Fly Ash Generation

Fly ash is generated by:

- Thermal power plants (generally coal\lignite based plants)
- Biogas plants

A large number of technologies have been developed for gainful utilization and safe management of fly ash under the concerted efforts made by Fly Ash Mission/Fly Ash Unit under Ministry of Science & Technology, Government of India since 1994. As a result, Fly ash earlier considered to be

“**hazardous industrial waste**” material, has now acquired the status of useful and saleable commodity. The utilization of fly ash has increased from 6.64 million tonne in 1996-97 to a level of 107.10 million tonne in 2016-17. The percentage of fly ash utilization during 2016-17 is 63.28%.

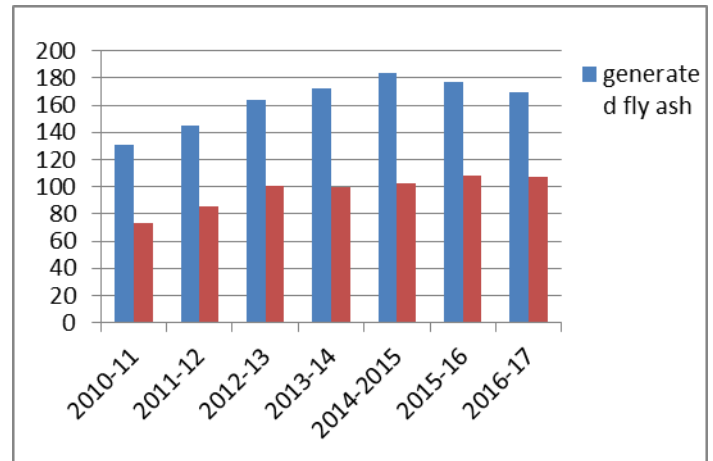


Figure 1:-Generated and Utilized Fly Ash (in million tonnes)

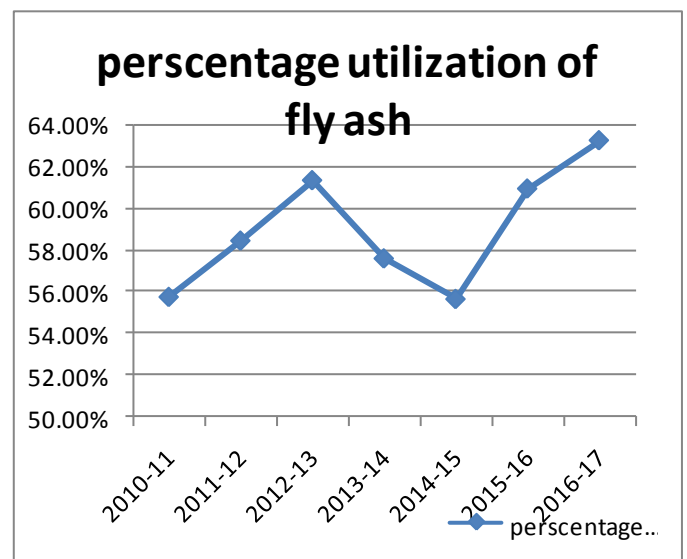


Figure 2:-Percentage Utilization of Fly Ash

It may be seen from Figure-1 and Figure-2 above that:

- The fly ash generation as well as utilization has generally been increasing since 1996-97.
- Fly ash utilization has increased from 9.63% in 1996-97 to the highest level of 63.28% during 2016-17.

- The fly ash generation has increased from 68.88 million-ton in 1996-97 to 169.25 million ton in 2016-17 i.e. nearly 2.45 times.
- However, fly ash utilization has increased from 6.64 million-ton in 1996-97 to a level of 107.10 million ton in 2016-17 i.e. nearly more than 16 times over the same period.
- From the Table XVII, it is seen that quantities of fly ash generation during 2014-15, 2015-16 and 2016-17 have been 184.14, 176.74 and 169.25 million-ton respectively. Fly ash utilization during the said three years are 102.54, 107.77 and 107.10 million-ton. The utilization of fly ash during 2015-16 and that during 2016-17 are almost same with marginal fall during current year i.e. 2016-17.

Objectives

Environmental Effects of the Fly Ash

Fly ash is a “**hazardous industrial waste**” material which affected the our body through to environment. It’s affected:

- **Air-** air is polluted with the fly ash elements and it is hazardous for our life.
- Water resources like: ponds, lacks, rivers, dams, etc. affected with fly ash.
- Fly ashes having high content of toxics/ heavy metals may be used deposited under expert advice.
- The environment ministry’s expert panel opined that the interface between the water and fly ash at the bottom of fly ash filled void results in leaching of heavy metals(Si, Al, Fe, etc.) into groundwater system as evident by high levels of trace elements particularly heavy metals in ground water samples collected from sites located close to the ash filled voids.
- It also found out that there is Reduction in recharging of groundwater due to fly ash filled mine voids.
- Ash-filled voids cannot support tree species because of poor root system development which in turn results in uprooting of trees even by low velocity winds.
- Further according to a recent study by the Centre for Science and Environment (CSE) which is the NGO working on environmental issues that fly ash disposal remains a major problem with only about 50-60% of the total fly ash generated by the power sector being utilized. Around 107.10 million tonnes of fly ash was produced across India in 2016-17.

Fly Ash Utilization Status as per Notification of 3rd November, 2009 during the year 2016-17 (target achieved /not achieved)

As per the targets mandated by the MoEF&CC’s notification of dated 3rd November, 2009 for fly ash utilization by the power stations, a total of 56 stations achieved their target and

as many as 89 Nos. could not reach the targets, while there were 10 stations where no fly ash was generated.

Fly Ash Utilization or Disposal in Different Areas

In the financial year 2016-17 it is expected to increase the production of fly-ash around 300-400 MT/year. The large amount of fly-ash produced if not utilized in right quantity will be hazardous to environment.

The ash utilization has been deliberated at various different forum and at all levels at the Central, State Govts., Power Utilities, thermal power plants and all concerned user groups, agencies etc. All Power Utilities and Thermal Power Plants are to plan & implement ash utilization targets, keeping in view long term strategies on sustainable basis.

The ash utilization is required to be carried out at all the coal and lignite based thermal power plants that are emitting ash and it needs to be carried out by all projects that are under construction, renovation, modernization and those at the preliminary stage of investigation and infrastructure development within 100km radial distance and if necessary, ash utilization may also be carried out beyond 100km radial distance.

The important areas of ash utilization are indicated below:

- i) Building Sector for use in construction:- bricks, blocks, tiles, cement, concrete, plaster, etc.
- ii) Land reclamation, filling low lying areas, raising ground levels.
- iii) Roads, embankments, ash dykes, road blocks, kerbed stones, etc.
- iv) Agriculture and wasteland area development.
- v) Hydro Sector, Irrigation, drains, water supply & drainage, lining of rivers, tributaries, canals, minors, sub-minors etc.
- vi) waste treatment and stabilization
- vii) Mine filling.
- viii) Industrial applications & high value areas.
- ix) Roller compacted dams, pavements, roads etc.
- x) Special use for ash e.g., collecting cenospheres from floating ash.





TABLE-1:- Modes of Fly Ash Utilization During The Year 2016-17

S. No.	Mode of utilization	Quantity of Fly Ash utilized in the mode of utilization	
		Million-ton	Percentage (%)
(1)	(2)	(3)	(4)
1.	Cement	40.5869	23.98
2.	Mine filling	11.7827	6.96
3.	Brick & tiles	14.9110	8.81
4.	Reclamation of low lying area	11.0392	6.52
5.	Ash Dyke Raising	11.8888	7.02
6.	Roads & flyovers	6.1942	3.66
7.	Agriculture	1.9243	1.14
8.	Concrete	0.7647	0.45
9.	Hydro Power Sector	0.0197	0.01
10.	Others	7.9840	4.72
11.	Unutilized Fly Ash	62.1577	36.72
	Total	169.2534	100.00

It may be seen from Table-1 above that:

- During the Year 2016-17, the maximum utilization of fly ash to the extent of 23.98% of total fly ash generated was in the Cement sector, followed by 8.81 % in making bricks & tiles, 7.02 % in ash dyke raising, 6.96 mine filling, 6.52 % in reclamation of low lying area, 3.66 % in roads & embankments, 1.14 % in Agriculture, 0.45 % in Concrete, 0.01 % in Hydro Power Sector, 4.72 % in Others and 36.73% remained as unutilized fly ash.

We want increasing the percentage of fly ash utilization in various sector for reducing the garbage, pollution of fly ash and to protect our environment.

Important Issues Envisaged are as under:

(i) The disposal of dry fly ash require technological innovations of high efficiency electrostatic precipitators, dry fly ash collection and storage facility in silos outside the plant boundary and facilities for loading into the mode of conveyance as well as transportation up to the location of user

agencies / manufacturing units of cement, bricks, and ash based products etc.

(ii) The use of fly ash in dry form requires fly ash based Industries, conversion of fly ash in to fly ash based products, availability of ash based products in the markets for use by all user groups, agencies, and the people at large.

(iii) The use of fly ash and fly ash based products are based on proven technology, supported by research and development efforts, development of confidence level, dissemination of technology, and promotional measures that are in progress and have been initiated by the Power Utilities and thermal power plants.

(iv) The fly ash being used as construction materials require inclusion of the same in the technical specifications, schedule of rates, analysis of rates, tender documents by CPWD, PWD's, Construction Agencies, Bureau of Indian Standards, Roads. Transportation, Highways, Hydro Sector, Railways, Mining Sector, etc. These reforms require careful consideration.

(v) The mining Sector, require identification of abandoned mines within reasonable distance and location of the thermal power plants.

(vi) The Agriculture requires research and development, dissemination of technology and guidelines for use by all. The use of ash in wasteland area developments requires research efforts, identification of wasteland areas & dissemination of technology.

(vii) The Hydro Sector requires construction material surveys to investigate the use of ash and ash based products at initial stage itself. Roller compacted concrete dam and pavements have vast scope of ash utilization.

(viii) The use of Bottom ash , pond ash , mound ash etc. for embankments in Roads etc, requires their engineering properties and shear parameters to be tested half yearly and a data bank of Engineering properties prepared.

(ix) Data Management system on Ash generation & utilization and software developed to process the ash quality, quantity, suitability and availability of ash for various usage's.

(x) It is envisaged that there is need of an ash management agency for collection, distribution and management of ash utilization in various modes and by various organizations and construction agencies etc.

(xi) It is also envisaged that the ash utilization may be handled by a separate ash utilization division exclusively entrusted with the relevant functions including marking aspects and sale of ash and ash based products and also to ensure their availability in the markets like other construction materials.

(xii) All ash pond, top roads, access roads, slope protection of ash dykes, lining of canals, minors, drains etc. may be provided with ash based bricks, blocks, tiles, panels etc. or roller compacted pavements. The ash utilization has priority over ash disposal in traditional forms. It needs to be a continuous activity at the coal/lignite based Thermal Power Plants. The provision of facilitation component of expenditure

on ash utilization needs to be capitalized and passed on to the tariff. The ash utilization needs to be included as part of tariff policy.

Conclusions

- It is important to protect environment, conserve the top soil, and prevent dumping of fly ash from Thermal Power Stations on land and to promote utilization of ash in the manufacture of building materials and construction activity.
- It is by virtue of their continuous pursuance & efforts that the overall ash utilization has increased in spite of increase in capacity addition (MW) and ash generation rate.
- Fly ash even though it is an environmental pollutant, it is an important raw material for various applications. The utilization of fly ash in different sectors can help a great emphasis on the development of new technology for efficient utilization of fly ash. Fly ash utilization programmed must be extensively taken up covering various aspects at different level to minimize the environmental pollution. There is a limited amount of research information on the environmental impact of fly ash as an ingredient in the preparation of materials.

References

- Conference Paper Which Is Title As "Indian Fly-Ash: Production And Consumption Scenario" Written By "Md Emamul Haque" Department Of Mechanical Engineering, Faculty Of Engineering And Technology Jamia Millia Islamia (Central University), New Delhi 110025 INDIA*
- Report On "Fly Ash Generation At Coal/Lignite Based Thermal Power Stations And It's Utilization In The Country For The Year 2010-11", "CENTRAL ELECTRICITY AUTHORITY", NEW DELHI, DECEMBER 2011.*
- Report On "Fly Ash Generation At Coal/Lignite Based Thermal Power Stations And It's Utilization In The Country For The Year 2011-12 And 2012-13", "CENTRAL ELECTRICITY AUTHORITY", NEW DELHI, JANUARY 2014.*
- Report On "Fly Ash Generation At Coal/Lignite Based Thermal Power Stations And It's Utilization In The Country For The Year 2013-14", "CENTRAL ELECTRICITY AUTHORITY", NEW DELHI, AUGUST 2014.*
- Report On "Fly Ash Generation At Coal/Lignite Based Thermal Power Stations And It's Utilization In The Country For The Year 2014-15", "CENTRAL ELECTRICITY AUTHORITY", NEW DELHI, OCTOBER 2015.*
- Report On "Fly Ash Generation At Coal/Lignite Based Thermal Power Stations And It's Utilization In The Country For The Year 2015-16", "CENTRAL ELECTRICITY AUTHORITY", NEW DELHI, OCTOBER 2016.*
- Report On "Fly Ash Generation At Coal/Lignite Based Thermal Power Stations And It's Utilization In The Country For The Year 2016-17", "CENTRAL ELECTRICITY AUTHORITY", NEW DELHI, DECEMBER 2017.*
- https://en.wikipedia.org/wiki/Fly_ash
- <https://www.corrosionpedia.com/definition/1624/fly-ash>