2.0 History of Fly Ash Utilization

Conversion of waste into a resource material is an age-old practice of civilization. The fly ash became available in coal based thermal power stations in the year 1930 in USA. For its gainful utilization, scientist started research activities and in the year 1937, R.E. Davis and his associates at University of California published research details on use of fly ash in cement concrete. This research had laid foundation for its specification, testing & usage. The research had established that fly ash possesses pozzolanic property similar to volcanic ash and deserves to be utilized in lime/ cement concrete works. The pozzolanic property is defined as "A Siliceous or Siliceous and Aluminous material, which in itself possesses little or no cementitious property but will, in finely divided form and in the presence of moisture, chemically react with calcium hydroxide at ordinary temperatures to form compounds possessing cementitious properties. The investigation had also established that it has geo-technical properties similar or better than many of the soils and can be utilized for structural fill & embankment construction by substituting soil."
In India, Bureau of Indian Standard (BIS) had published Indian specification: 3812 for fly ash in Pozzolana & Admixture in 1966 in three parts: part-1 use of fly ash as a Pozzolana, Part-II covering use of fly ash as admixture, and part III use of fly ash as a fine aggregate so that fly ash to be utilized in these areas. In the 1981 this specification had been revised and the requirement of fly ash for these usages had been covered in single standard. In this revision fly ash has been classified in two grades, Grade 1 specifies requirement of fly ash for use in cement, mortar and concrete and lime Pozzolana mixture and manufacture of Portland Pozzolana cement. In Grade - 2 specifications for incorporation in cement, mortar and concrete and in lime Pozzolana mixture.

Over a period of time, advancement in technology for combustion process of coal and collection process of fly ash have taken place which resulted in significant improvement in quality of fly ash. This has necessitated further revision in this standard and another revision issued in the year 2003 in two parts. Part -1 for use as Pozzolana in cement, cement mortar and concrete and Part -2 for use as admixture in cement mortar and concrete. In this revision the ash generated by burning of ground, crushed or pulverized coal which may be of fly ash, bottom ash, pond ash or mound ash is termed as Pulverized Fuel Ash (PFA). However, in popular term, all these types of ash are called fly ash.

To find out the more and more uses of fly ash, research activities were continued and it had been established by various institutes like Central Building Research Institute, Roorkee, National Council for Cement & Building Materials, Ballabghar, Central Fuel Research Institute, Dhanbad etc that fly ash can be used in manufacture of clay ash bricks, fly ash lime/ cement bricks and other building products. Central Road Research Institute, New Delhi has also confirmed that it can be very well used for road embankment and fill applications.

To utilize fly ash in brick manufacturing, BIS has issued Indian Standard IS: 12894 specification for fly ash lime bricks in year 1990 which was revised in the year 2002. For use of ash in burnt clay bricks, Indian Standard IS: 13757 Specification for burnt clay fly ash building bricks was issued in the year 1993.

Research Institutes like Advanced Materials and Processes Research Institute (Previously known as Regional Research Laboratory), Bhopal, Central Institute of Mining & Fuel Research Institute (Previously known as Central Fuel Research Institute) Dhanbad etc found its use in agriculture also.
The investigations carried out by these institutes have established that fly ash is a versatile resource material and can be utilized in variety of applications. The pozzolanic property of fly ash makes it a resource for making cement and other ash based products. The Geo-technical properties of bottom ash, pond ash & coarse fly ash allow it to be used in construction of embankments, structural fills, reinforced fills, low lying area development etc. The physico-chemical properties of pond ash is similar to many of the soils and contains P, K, Ca, Mg, Cu, Zn, Mo, and Fe, etc. which are essential nutrients for plant growth. These properties enable it to use as a soil amender & source of micronutrients in Agriculture/Soil Amendment. The various usages of ash are listed below: