CHAPTER – 1
INTRODUCTION

POND ASH:

Pond ash is a by-product of thermal power plants, which is considered as a waste material and its disposal is a major problem, both, from an environmental point of view and land requirements for its disposal. There are three types of ash produced by thermal power plants, viz. (1) fly ash, (2) bottom ash, and (3) pond ash. Fly ash is collected by mechanical or electrostatic precipitators from the flue gases of power plant; whereas, bottom ash is collected from the bottom of the boilers. When these two types of ash, mixed together, are transported in the form of slurry and stored in the lagoons, the deposit is called pond ash.

The volume of pond ash produced by thermal power plants is very large compared to that of the other two ashes, viz. fly ash and bottom ash .The task to utilize/dispose pond ash to the maximum possible extent is still a major problem throughout the world. To solve the problem, efforts have been made to find potential applications of pond ash in different areas like structural fills and highway embankment. Pond ash is a light-weight and self draining material compared to natural soil. For successful application of pond ash in civil engineering construction, knowledge of compaction properties of the material of the fill material is essential to achieve effective compaction on field.

The present scenario of the utilization of pond ash in India is grim. About 8% of the produced fly ash is being used commercially .This shows that there exists a tremendous potential for the utilization of pond ash in various construction activities and to replace and preserve the valuable top soil. Constructions like embankments, retaining structures, etc require huge amount of earth materials. Researches have been carried out in order to confirm the suitability of pond ash for

these purposes. However, these structures are to be protected from getting wet in order to preserve the inherent strength of the compacted pond ash, which is difficult task in field situations. Rapid industrialization and non availability of conventional Earth material has forced the engineers and scientist to utilize the waste product of industries which either degrades the environment posing problems for their disposal. In this connection utilization of by-products like pond ash needs special attention.

PROPERTIES OF POND ASH

Table 1 – Physical properties of pond ash

PARAMETERS	
pH	**6 – 10**
Specific Gravity	**1.65 – 2.55**
Bulk Density (gm/cc)	**0.85 – 1.2**
Grain Size Distribution	**Sandy Silt to Silty Loam**
Porosity (%)	**45 – 55**
Water holding capacity (%)	**45 – 60**
Electrical Conductivity (dS/m)	**0.15 – 0.45**

Table 2 – Chemical composition of pond ash

COMPOUNDS	PERCENTAGE PRESENT
SiO_2	37.7 – 75.1
Al_2O_3	11.7 – 53.3
TiO_2	0.2 - 1.4
Fe_2O_3	3.5 – 34.6
MnO	*BD – 0.6

MgO	0.1 – 0.8
CaO	0.2 – 0.6
K_2O	0.1 – 0.7
Na_2O	0.05 – 0.31
Loss on Ignition	0.01 – 20.9

*BD = Below Detection

NOTE – SEM studies conducted to have a closer view of the individual particles of coal ashes show that fly ashes are fine particles compared to bottom ashes. Pond ashes consist of both finer and coarser particles. Investigations at IISc show that the coal ash particles are generally cenospheres leading to low values for specific gravity. They also confirm that fly ash particles are finer compared to bottom ash particles and the pond ash particles are sized in between fly and bottom ashes.

The chemical properties of fly ashes greatly influence the environmental impacts that may arise out of their use/disposal as well as their engineering properties. The adverse impacts include contamination of surface and subsurface water with toxic heavy metals present in the coal ashes, loss of fertility around the plant sites, etc. Hence, this calls for a detailed study of their chemical composition, morphological studies, pH, total soluble solids etc.

POLYPROPYLENE FIBERS:

Propylene is one of the constituents obtained from thermal or catalytic cracking of petroleum. Under suitable polymerizing conditions, propylene produces fibers forming polypropylene.

Polymerization is done by dissolving propylene in heptane using $TiCl_3Al(C_2H_5)_3$ catalyst system at about 100^0 C under a pressure of 30 Atm for 8 hours. The polymer has a molecular weight of about 80000.

Pic. 1 – Polypropylene fibers

Polypropylene is melt spun. The filaments are extruded at 100^0 C above the melting point, cooled in air chamber and collected on bobbins. The filaments are hot drawn (polyethene - cold drawn) and twisted into yarns. A very widespread use of polypropylene fibers is nowadays observed in field of concrete technology and it's found from various investigations that polypropylene fibers impart significant improvement in various properties of concrete such as

- Effective control of cracking due to plastic shrinkage
- Reduction in water absorption properties of final concrete and thus increased resistance towards the penetration by salt solutions.
- Increased resistance to freezing and thawing
- Better resistance to abrasion and impacts
- Improved chemical resistance
- Improved fire resistance

- Improved earthquake resistance

In the present investigation, an attempt is being made to study the effect of addition of polypropylene fibers, in various amounts by weight, on the compaction properties of pond ash. Variations of 0.5%, 1%, 1.5%, 2% and 2.5% of PP fibers are taken into study. Since, pond ash finds a major application in construction of embankments and structural fill compaction properties need to be investigated and improved. This study is also supported by an economy analysis if the following combination is used on field. The whole study is supported by experimentation and analysis of results and final conclusive remarks.