Chapter 4

OBJECTIVES OF THE PRESENT STUDY

Concrete is the most widely used construction material. Because of its speciality of being cast in any desirable shape, it has replaced stone and brick masonry. Plain concrete is weak in tension and has limited ductility and little resistance to cracking. Micro cracks are present in concrete and because of its poor tensile strength; the cracks propagate with the application of load, leading to brittle fracture of concrete. Micro cracks in concrete are formed during its hardening stage. A discontinuous heterogeneous system exists even before the application of any external load. When the load is applied, micro cracks start developing along the planes, which may experience relatively low tensile strains, at about 25-30% of the ultimate strength in compression. Further application of the load leads to uncontrolled growth of micro cracks. The low resistance to tensile crack propagation in turn results in a low fracture toughness, and limited resistance to impact and explosive loading.

The low tensile strength of concrete is being compensated for in several ways, and this has been achieved by the use of reinforcing bars and also by applying pre-stressing methods. Though these methods provide tensile strength to concrete, they do not increase the inherent tensile strength of concrete itself. Further, conventionally reinforced concrete is not a two-phase material in true sense. Conventionally reinforced concrete is true two phase material only after cracking when the reinforcing bars hold cracked matrix. Existence of one phase (i.e., steel or concrete) does not improve the basic strength characteristics of the other phase and consequently the overall performance of the traditional reinforced concrete composite is dictated by the individual performance of the concrete and steel phase separately.

These deficiencies have led researchers to investigate and develop a material, which could perform better in areas where conventional concrete has several limitations. One such development has been two phase composite materials i.e., fibre reinforced concrete, in which cement based matrix is reinforced with ordered or random distribution of fibres.

Fibres in the cement based matrix acts as cracks arrester, which restricts the growth of flaws in the matrix, preventing these from enlarging under load, into cracks, which eventually cause failure. Prevention of
propagation of cracks originating from internal flaws, can result in improvements in static and dynamic properties of the matrix.

The idea of mixing more than one material to obtain a composite is not new. The two-phase concepts in which two materials are combined to produce a composite have been known since ancient times. The use of straw to strengthen sun-dried mud bricks and stabilize their dimensional stability pre-dates the use of Portland cement.

Mortar and concrete are themselves essentially two-phase composite systems in which relatively stiff aggregate particles are embedded in a soft brittle matrix imparting stiffness and stability to the composite. The behavior of mortar and concrete indicates the role of fiber reinforcement of the cement matrix. The idea that concrete can be strengthened by the inclusion of fibers was first put forward by Portar in 1910, but little progress was made in the development of this material until 1963 when Romualdi and Batson published their classic paper on the subject. Since then there has been a wave of interest in fiber reinforced concrete and several kinds of fibers such as steel, fibrillated polypropylene, nylon, asbestos, coir, jute sisal, kenaf, glass, carbon have been tried. Very recently, the waste plastic fibers are being tried in concrete to produce fiber reinforced concrete.

Plastics are non-biodegradable materials. They cannot be destroyed easily. Any effort of destroying it, again results in the environmental pollution.

Many efforts are being continuously made to bring down the environmental pollution on this mother earth. Almost everything is polluted on this earth. The breathing air which sustains the life is being polluted; the drinking water which ushers life into all living beings is being polluted; the hearing sound which is a communication media is being polluted; the edible food which nourishes the living beings is being polluted; finally, the minds of the people is also being polluted. Pollution has not left any area. It is spreading its tentacles in all walks of life.

Many of the wastes and especially the industrial wastes are causing enormous pollution of the environment. Among them, the noteworthy are fly ash, blast furnace slag, silica fume, stone crusher dust, etc. The safe disposal of these industrial wastes has become a major problem to the industrialists as well as to the environmentalists. Another major pollutant is the plastic.
Plastics have entered every conceivable field like medical, agricultural, automobile and of course households. They come in handy on account of their useful properties like being lightweight and economical. They are one of the useful materials ever created by man. Engineers have shaped plastics that are as rigid as steel or as soft as cotton or sponge. The word plastic comes from the Greek word “plastikos” which means able to shape. Chemically plastics are polymers. A polymer is a substance, which contains a particular molecular group repeated hundred times, linked together in definite pattern. There are hundreds of different plastics. But basically they belong to two primary groups viz. “Thermosetting Plastics” and “Thermo Plastics”.

Engineers have created hundreds of different plastics and each has its own properties. Plastic parts are replacing metals in aero planes, cars and other mechanical devices. Aeroplane wings are now made of plastics, which reduce the weight of the aircraft, and there by reduces fuel consumption. Plastics have also replaced metals in building construction materials such as pipes because they are lightweight and do not corrode. Plastic fibres and fabrics have replaced natural fibres like cotton, silk and wool.

Even though plastic is making wonders in all the fields, it is endangering the environment. It is causing environmental pollution in different ways. Plastic cannot be perished. It cannot be dumped in soil. If dumped in soil it causes the soil pollution. It cannot be dumped in water. If dumped in water causes water pollution. When the waste plastic did not find any place in America and Europe, they dumped million tones of waste plastic in Atlantic and pacific oceans. This has resulted in many accidents of ships and the death of many aquatic lives. It cannot be burnt also. If burnt it causes air pollution by releasing many toxic gases. Many metropolitan and industrial cities of the world have become population less due to the environmental problem caused by the plastic. Thus plastic is causing tremendous environmental pollution. Many researches now focused on the effective utilization of plastic in a safe manner.

Recycling technology or reusing technology is not a new technology. Since civilization, man, in one form or the other, is recycling some of the other materials for his convenience. Today, the recycling technology is gaining importance because of the reasons of growing quantity of wastes and to save natural resources.

Waste plastic is one of the major environmental pollutants. Plastic is a non-biodegradable material. It cannot be destroyed easily. Any effort of destroying it again results in environmental pollution.
The main objective of this experimental investigation is to throw some light on the effective use of waste plastics in concrete. The effect of addition of waste plastics in the form of fibres into the concrete has been studied in this experimental investigation.

To understand the behavior of waste plastic fibre reinforced concrete (WPFRC) thoroughly, the following experiments are conducted

1. Effect of Different Aspect Ratios of Waste Plastic Fibres on the Properties of Fibre Reinforced Concrete
2. Effect of Fly Ash on the Properties of Waste Plastic Fibre Reinforced Concrete
3. Effect of Micro Silica on the Properties of Waste Plastic Fibre Reinforced Concrete
4. Effect of Redmud on the Properties of Waste Plastic Fibre Reinforced Concrete
5. Effect of Replacement of Natural Sand by Stone Crusher Dust on the Properties of Waste Plastic Fibre Reinforced Concrete
6. Effect of Recycled Aggregates on the Properties of Waste Plastic Fibre Reinforced Concrete
7. Effect of Addition of Polymer on the Properties of Waste Plastic Fibre Reinforced Concrete
8. Effect of Different Curing Method on the Properties of Waste Plastic Fibre Reinforced Concrete
10. Bond Characteristics of Waste Plastic Fibre Reinforced Concrete