

# Plastic Waste Management with Expanded Polystyrene Beads



Modi Musalaiah, T. Phani Madhavi

**Abstract:** Plastic waste is the one of the serious environmental issue due to its non-biodegradability nature. The disposing of plastic waste and plastic waste management becomes a major task in developing countries like India due to rapid growth of population and industrialization. Plastic stands in the top most place among variety of solid waste materials, and causes heavy environmental hazards which will affect the future generations and peers. The present study was focused to investigate and understand the attributes of concrete which is made of partial replacement of coarse aggregate with Expanded Polystyrene Beads using M<sub>20</sub> mix design. Concrete cubes were casted taking 0%, 5%, 10%, 15% and 20% of Expanded Polystyrene beads as partial replacement of coarse aggregate and tested for 7days, 14days and 28days of compressive strength of concrete.

**Keywords:** Waste Management, Plastic Waste, Expanded Polystyrene Beads (EPB)

## I. INTRODUCTION

Increase in the developmental activities world over, the demand for construction materials is increasing exponentially [4]. Plastic waste is considered as a serious problem to the environment due to inability of plastic to degrade naturally [1]. The demand for building material is increasing and increase in cost of building material is also a matter of concern [2]. The generation of waste plastic was drastically increasing every year due to its usage for various activities and remains on landscape for many years. However, the intensity of plastic can be reduced through recycling. In case, the recycling process was not effective, million tons of plastic waste are disposed into oceans which has a great impact on Marine ecosystem. In the present study, the plastic material Expanded polystyrene was used in construction activity in order to manage the plastic waste and also utilizing the plastic material for several constructional purposes in civil engineering. Expanded Poly Styrene Beads (EPB) is a white foam plastic fabric made from solid beads of polystyrene. Polystyrene is the plastic category that is widely being used as food containers and packaging [1]. The main sources of polystyrene waste was from municipal and industrial solid waste.

It is a closed-cell, inflexible foam material made from Styrene and Pentane. Both styrene and pentane are hydrocarbon compounds and are acquired from petroleum and natural gas as a by-product and it is very light weight with very low thermal conductivity. Its chemical resistance is almost equal to the material upon which it is based polystyrene, and it comprised of 98% air. Concrete is in general, cement-based concrete, which meets special performance requirement with regard to workability, strength and durability, that cannot always be obtained with techniques and materials adopted for producing conventional cement concrete [5]. Light weight aggregate posse's different salient features such buoyancy which helps the concrete to float and dead load can be reduced [3]. In this, we strive to evaluate the strengthening of concrete with recycled plastic called Expanded Polystyrene Beads as a partial replacement to coarse aggregate by 0%, 5%, 10%, 15% & 20% as an alternative of coarse aggregate and by utilizing this plastic, cubes are prepared and tested at 7days, 14days, and 28days of curing age, the compressive strength of specimens were determined with the w/c ratio of 0.5 and mix proportion of 1:1.5:3.

## II. MATERIALS & METHODS

In the present study, concrete preparation was well done by using several materials. The ingredients of concrete were Ordinary Portland Cement 43 Grade - specification IS: 8112, River sand was considered as fine aggregate, Crushed granite stones was taken as coarse aggregate, Water and Expanded Polystyrene beads in the form of spheres.

Specific Gravity	Bulk Density	Particle size
0.011	6.86 kg/m <sup>3</sup>	Spherical (8-9mm dia)



Manuscript received on 30 March 2022 | Revised Manuscript received on 06 April 2022 | Manuscript Accepted on 15 November 2022 | Manuscript published on 30 November 2022.

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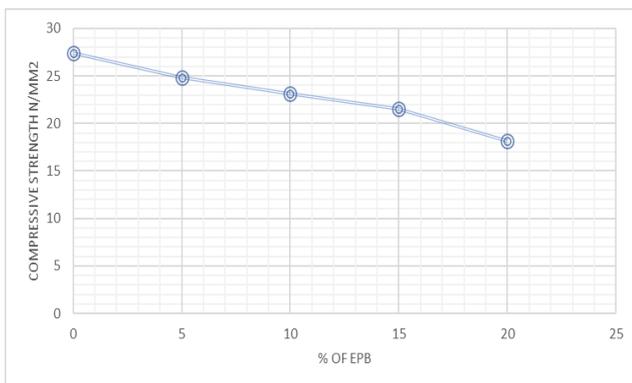
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The physical properties of ingredients were evaluated. The mix proportions for M<sub>20</sub> conventional concrete mix was derived as per IS: 10262-2009, by including w/c of 0.5, and the partial replacement of coarse aggregates by EPS beads, the concrete was prepared and workability was determined by slump cone and compaction test methods. The Cubes of 150mmx150mmx150mm size were casted for compressive strength evaluation. The specimens were removed from the molds and cured in water for 7days, 14days and 28days and tested. For every mix of expanded poly styrene beads of 0%, 5%, 10%, 15% & 20%, 3 cubes were prepared.

## III. RESULTS AND DISCUSSIONS

From the above information, the cured cubes were tested at an age of 7days, 14days and 28days for all the replacement proportions, from 0% to 20% by maintaining 5% interval. The 28days test results showed in the below table and the results are plotted and discussed.

S. No.	% of EPB	28 Days Compressive Strength, N/mm <sup>2</sup>
1	0	27.45
2	5	24.8
3	10	23.1
4	15	21.5
5	20	18.2



From the above analysis, for no replacement mix, 0% EPB, the strength obtained as 27.45 N/mm<sup>2</sup>, and then it was reduced for every addition of EPB. 24.8 N/mm<sup>2</sup> was obtained for 5% replacement, for the 10% replacement it was noted that 23.1 N/mm<sup>2</sup>, 21.5 N/mm<sup>2</sup> is the tested value of 15% replacement and finally for the 20% replacement the obtained compressive strength is 18.2 N/mm<sup>2</sup>

## IV. CONCLUSION

The present study was done for the prediction of compressive strength of M<sub>20</sub> mix concrete by partially replacing of coarse aggregate with expanded poly styrene beads as 0%, 5%, 10%, 15% and 20%. The test methods were done according to IS codes and the results were analysed. From the above analysis it was concluded that, the compressive strength of concrete was declined with an increase of % addition of expanded poly styrene beads as a replacement to the coarse aggregate. It is recommended that the further study was needed before using of these EP beads as a concrete material.

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