

# An Experimental Study on Behaviour of Synthetic Squander Utilized Hollow Column and Solid Column

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**ABSTRACT:** The main environmental problems today are the disposal of the waste synthetics. The use of synthetics in various places as packing materials and the products such as bottles, polyethylene sheets, containers, packing strips etc., is increased. To circumvent this pollution crisis, many products are being produced from reusable waste synthetics. The Indian construction industry is facing troubles due to inadequate and unavailability of construction materials. So, we need to search for innovative construction materials as well as a method to dispose the synthetic waste. In this experimental study, an attempt has been made to use the waste synthetics in concrete and studies have been conducted to focus mainly on the behaviour of compression members with various proportions of synthetic wastes. The synthetics used in this investigation were polythene sheets, raw synthetics the raw material used for straw manufacturing), road wastes (waste synthetics collected from road sides are melted and shredded) and synthetic straw. The above synthetic wastes were mixed with cement concrete in various proportions (0.5% to 1.5%) and test specimens were cast (cubes and columns) to study the behaviour of synthetic squander mixed concrete in axial compression. Hollow sections are the most adaptable and efficient form of construction and mechanical applications. Many of the strongest and most remarkable structures in the world today would not have been possible without hollow sections. So we made an experimental attempt by comparing both solid columns and hollow columns through their strengths.

**KEYWORDS:** Synthetic waste, compressive strength, Compression of hollow and solid column.

## I. INTRODUCTION

The Indian concrete industry is today consuming about 400 million tonnes of concrete every year and it is anticipated, that this may reach a billion tons less than a decade. All the materials required to manufacture such enormous quantities of concrete. On the other hand, human activities on earth produce solid wastes in considerable quantities

The plastic is one of the most recent engineering materials which have appeared in the market all over the world. Domestically plastics were used in different forms as carry bags, bottles, cans and also in various medical utilities. There has been a sudden rise in the production of plastics from a mere 30 million in 1955 it has touched 1000 million tonnes at present. It is anticipated that on an average 25% of the total plastic production in the world is used by the construction industry. There is however now increase in alertness regarding the utilization of plastic as a useful construction material in our country. Concrete in general has a higher brittleness with an increase in strength. This is a foremost drawback since brittleness can cause sudden and catastrophic failure, especially in structures which are subjected to earthquake, blast or suddenly applied loads i.e., impact. This serious disadvantage of concrete can at least partly be conquered by the incorporation of SQFs, particularly, steel. The incorporation of SQF can cause a change in the failure mode under compressive deformation from brittle to pseudo-ductile, thereby imparting a degree of toughness to concrete. In India, domestic waste plastics are causing considerable damage to the environment and hence an attempt has been made to realize whether they can be successfully used in concrete to develop some of the mechanical properties as in the case of the steel fibre

## International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 4, April 2016

Additionally, we consider another one criteria, that, the hollow sections are the most versatile and efficient form of construction and mechanical applications. Many of the strongest and most imposing structures in the world today would not have been possible without hollow sections.



Fig.1 synthetic (plastic) wastes

This figure illustrates the samples of Synthetic (plastic ) wastes which are available at the site located nearer to Pudukkottai Sipcot plastic industry and the same is collected for the research along with domestic wastes from pudukkottai municipality



Fig.2 SQF (prepared by us from synthetic squanders)

This figure illustrates the plastic are transformed into the above shapes(the shapes are cutted into some random shapes ) from the collected plastic wastes so as to mix the plastic with concrere for casting process.

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## II. RELATED WORK

Generation of plastic waste is one of the fastest growing areas. Every year, more than 500 billion plastic bags are used. The splitting tensile strength observation shows the improvement of tensile strength of concrete. Up to 0.8 % of the plastic improvement of strength recorded after that addition of strength of concrete decreases with the addition of plastic. Thus, it is concluded that the use plastic can be potential to increase the tensile strength of concrete. From the above discussion, it is identified that the use of plastic can be possible to improve the properties of concrete which can act as a one of the plastic disposal methods by RaghatateAtul M et al. [1]. The major ecological strain in the disposal of solid waste may be due to the presence of waste plastics in it. Four types of plastic materials were selected to mix along with the concrete: (1) Polythene Sheet (2) Raw Plastics (3) Road Wastes (4) Plastic Straw to study their behaviour in conjunction with concrete. The properties of the materials used in the present investigations were completely studied and the optimum mix of the above plastic materials was found based on their compressive, split tensile, flexural strengths. After finding the optimal mix percentages in compression, RC columns were cast and tested for its compressive strength. From the investigation, the road waste mixed concrete was found to take more loads in compression. Raw plastic mixed concrete as well as plastic straw mixed concrete was also found to give better strength than the reference RC column. Prabir Das (2004) have suggested that plastics can be used in the construction industry in various places. Proper selection of material / grade and suitable design considerations can help to replace many more applications. Lighter weight, design flexibility proposed by Rajkumar et al. [2]. In construction, hollow sections create lightweight and visually attractive structures that benefit communities and environments. Steel buildings are inherently adaptable and can be easily extended. Steel is lighter in weight than other construction materials. This enables extensions to be built into existing buildings without overloading their foundations. Structures can be unbolted, reconnected, modified, repaired, reused and recycled. Steel itself generates very little waste and, what there is, can be fully recycled. Steel construction is dry, dust-free, and comparatively quiet and requires relatively small volumes of materials to be delivered to site. In turn, it reduces site construction times; minimizing the impact on surrounding communities this enhances efficiency and reduces cost. With high torsion rigidity and compressive strength, these hollow sections are comparably more efficient than conventional steel sections. The smooth and uniform profile of the sections minimizes corrosion and facilitates easy, on site fabrication to significantly enhance the aesthetics of structures. A higher strength to weight ratio credits these sections with nearly 20% reduction in the use of steel. Hollow sections command several techno-economic advantages over conventional structures by Tata steel [3]. This research programme considers the following aspects, Investigation whether the existing design formulae determined for open sections can also be used (with possible modifications) for circular and rectangular hollow sections. Theoretical work (financial support of the German Research Foundation, DFG, is applied for) substantiates the low number of tests. Especially for circular hollow sections, a more favourable mechanism of load shedding and failure is expected, where the embedded length to be selected or designed is reduced again, in comparison to open sections by Prof. Dr.-Ing. Ö. [4]

## III. EXPERIMENTAL WORK

Detailed descriptions about the materials used, specimens tested and testing methods are essentials for an experimental investigation. The investigations are taken up to evaluate compressive strength of plain and synthetic squander fibre concrete specimens as per standards. Casting and curing of specimens The constituent materials of concrete, viz., Cement, Sand and aggregates was tested as per the relevant Indian codes of Practice and their properties are studied . Concrete of M30 grade was designed as per the procedure given. Concrete was mixed by hand mixer method and the specimens were casted. Fibres from the domestic waste were cut and added to the concrete at a dosage of 0%, 1% and 1.5%, by weight of cement. Standard steel moulds were used for casting of cubes of size 150mm x 150mm x 150mm Concrete was placed uniformly over the length of the mould in three layers and compacted satisfactorily. For molding the columns using the PVC pipes of diameter 150mm and 1000mm height for solid circular column and using 38 mm diameter pipe to fix the inner diameter of hollow column. Since the comparison column was also casted. After compacting the entire concrete, the excess concrete at the top of the mold was stuck off with a wooden straight edge and the top finished with a trowel. Demolding was done after 24 hours and the specimens were cured under water.

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Vol. 5, Issue 4, April 2016

After 7days, 14days and 28days, the cube specimens were removed from curing tank and taken for testing. Totally 27 cubes casted in which 9 cubes for 0% of SQF, 9 cubes for 1% of SQF and 9 cubes for 1.5 % of SQF. Totally 12 column was casted in which 6 specimens for solid column and 6 specimens for hollow column. In these test specimens 1.5% of SQF were added to the concrete and the specimens were tested.



Fig.3 Mixing of SQF in concrete

This figure denotes that the synthetic plastic wastes which are cut into various random shapes are mixed with the dry cement, fine aggregate and coarse aggregate by means of volume batching. The plastics are added to the mix in terms of percentage such as 0.5 % , 1% & 1.5 % respectively.



Fig.4 Casting of cube

The dry components such as cement, synthetic plastics, Fine aggregate and coarse aggregate are mixed with suitable water cement ratio and the same is mixed for casting the cube in which the concrete is filled in the steel mould whose the size is 150\*150\*150 mm



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Fig.5 curing of specimen

After the concrete has attained the sufficient setting, they are removed from the Mould and the same is placed in the curing tank for curing process for 28 days



Fig.6 Test on a compression testing machine

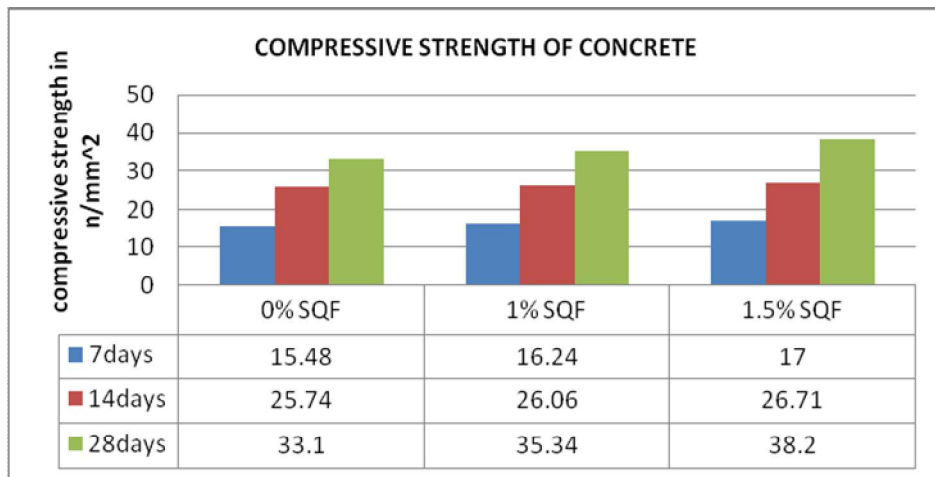
After the completion of curing process, the concrete is kept free for 24 hours for drying process and after that the concrete is tested in compression testing machine for its compressive strength and the loads are recorded.

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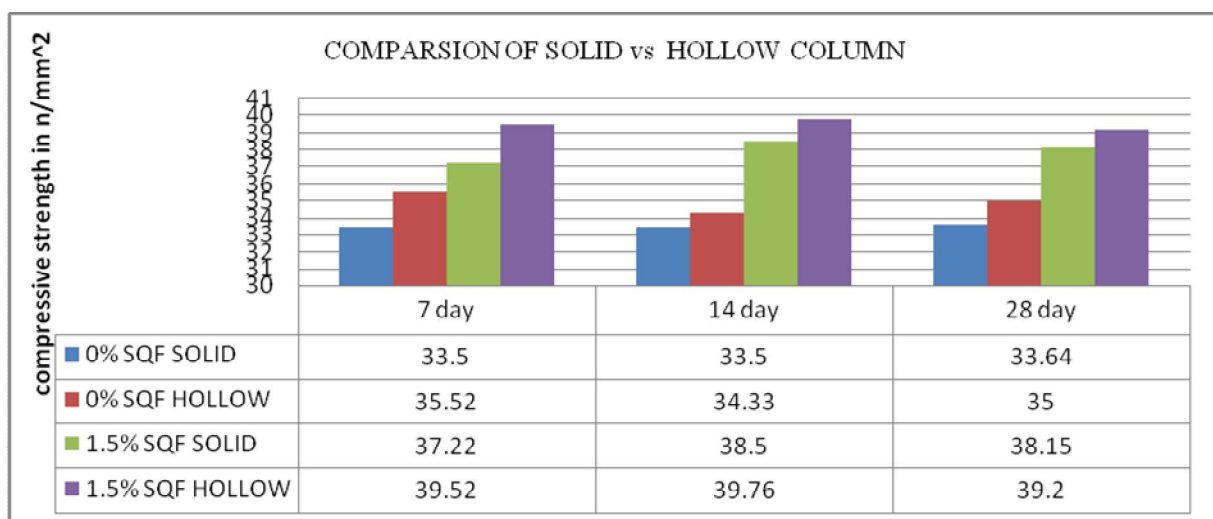
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## IV. EXPERIMENTAL RESULTS



Graph.1 Colour graph represents the compressive strength of the cube

Suggestions from the above graph cube test results experimental investigations of this work shows that the addition of SQF fibres to concrete results in a significant increase in ultimate strength of cubes. It was also observed that the failure of fibre concrete cubes with SQF was more ductile and gradual compared with the failure of conventional concrete cubes. The increase in the SQF percentage has also resulted in the increased ultimate load capacity of cubes in the addition of 1.5 %. Hence, we want to implement these conclusions in concrete columns and also we want to make an experimental study on comparisons of solid columns with a hollow column with additions of same SQF.



Graph.2 The graph represents the comparison between hollow and solid column

The influence of the addition of 1.5% SQF fibre on the mixes tested is compared solid columns with hollow columns to get a different view on concrete to reuse the synthetic squanders and to reduce the amount of concrete by providing hollow sections. It is the stage of initial comparison and aim to take further steps for attaining the ratio of strengths

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criteria between solid and hollow concrete structural members. Such analysis was made and the results were observed and tabulated.

## V. CONCLUSION

The plastic mixed concrete can be used in the plain concrete structures and also it can be used in reinforced concrete structures. In this experimental investigation, RC columns were cast by mixing optimum percentage of plastics of various designations and the compressive strength was tested. With the judicious analysis done, the following conclusions were arrived. In the above comparison the hollow columns with solid one, the hollow column gives better results in compression. It can be used for concrete structures with modern and reuse. The behaviour of RC columns mixed with different plastic materials is more or less similar to the normal RCC columns. The following conclusions are presented based on experimental results from the present investigation. The Addition of 1.5% of polythene (domestic waste polythene bags) SQF to concrete

Increases the cube compressive strength of concrete in 7 days to an extent of 9.8%, and in 14 days an extent of 18.12%. In this experimental study, we conclude that the synthetic squanders are utilized in concrete as a fibre for 1.5 %, The increase in the various mechanical properties of the concrete mixes with polythene SQFs is not in the same league as that of the steel fibres. When included the synthetic squander, the strength of concrete was increased and alternatively a small amount of concrete was also replaced by providing hollow section. In this case 6.4% of concrete was replaced in hollow column, but the strength of column with 1.5% of SQF can give increase in strength by 16.26% when compared to normal conventional concrete strength. Hollow sections are the most versatile and efficient form of construction and mechanical applications. Many of the strongest and most impressive structures in the world the tubular form is inherently strong and efficient. It gives buildings a better strength to weight ratio than those using comparable steel, concrete or timber products. In construction, this strength-to-weight ratio reduces material usage and allows for greater spans. This results in lightweight, airy structures that are aesthetically pleasing within our communities and environments.

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