DOI:10.21276/sjeat.2016.1.4.5

Saudi Journal of Engineering and Technology **ISSN 2415-6272 (Print)**
Scholars Middle East Publishers **ISSN 2415-6264 (Online)**
Dubai, United Arab Emirates
Website: http://scholarsmepub.com/

Research Article

Partial Replacement of Fine Aggregate by Tannery Shredded Waste in Concrete

Dr. M. Vijaya Sekhar Reddy[1]*, K. Ashalatha[2], K. Sasi[2]
[1]Head and Assistant Professor, Department of Civil Engineering, Srikalahasteeswara Institute of Technology, Srikalahasti, Andhra Pradesh, India
[2]Lecturers, Department of Civil Engineering, Srikalahasteeswara Institute of Technology, Srikalahasti, Andhra Pradesh, India

***Corresponding Author:**
Dr. M. Vijaya Sekhar Reddy
Email: skitce.hod@gmail.com

Abstract: This paper presents the results of an experimental investigation carried out to evaluate the compressive strength of concrete. An exploratory study on the suitability of the tannery shredded waste as partial replacement for normal fine aggregate in concrete works has been carried out. Physical and mechanical properties of tannery shredded waste and locally available normal aggregates have been determined and compared. A large number of concrete cubes of size 150X150X150 mm were cast with different percentage replacements of fine aggregates by tannery shredded waste in the order 100:0, 5:5, 10:10, and 15:15, were cast and compressive strength test values were determined.
Keywords: Compressive strength, fine aggregate, tannery shredded waste.

INTRODUCTION

River sand is considered to be the one unavoidable ingredient in construction. Due to increase in construction activities there is demand for the fine aggregate. The price of the fine aggregate is also increasing day by day. On the other hand tanneries in India are mainly located in Tamil Nadu, West Bengal, Uttar Pradesh and Punjab. About 900 tanneries are present in Tamil Nadu. It has been found that the amount of tannery waste produced from these industries is about 43 million ton/year and about 30% is from Tamil Nadu. The wastes produced from these industries are difficult in disposal. The disposal of such waste can be done either by incineration or by land filling which leads to air or land pollution respectively. So to avoid pollution and reduce the cost of construction the experiment is carried out and the results are inferred.

Tannery effluents are characterized by high contents of dissolved, suspended organic and inorganic solids giving rise to high oxygen demand and potentially toxic metal salts and chromium metal ion. The tannery effluent, if not treated properly, can cause serious damage to soil and water bodies. The high amount of salt contained in the effluent, for example, can increase soil salinity, reduce fertility and damage farming in large areas. Tanneries also produce harmful gases, dust and a large amount of solid waste. The graveness of the problem can be understood by the fact that these toxic effluents are being discharged into natural water courses without/with minimal treatment in several parts of the world.

LITERATURE REVIEW

The animal skin undergoes many processes to change from its raw nature to leather. The process called as “chrome-tan” is the widely used method to produce the leather. During the end of the formation of leather, the leather is made into approximate size when it is in wetted form. The size is maintained by shredding the materials. The shredded waste which is so obtained is used for the replacement of the fine aggregate. Angeline studied the strength by the replacement of the tannery sludge waste in the manufacturing of brick and strength parameters are determined [1].

MATERIALS AND METHODS

Cement

Ordinary Portland cement Zuari 53 grade conforming to IS: 12269-1987 [2] was used in concrete. The physical properties of the cement are listed in Table 1.

Aggregates

The aggregates are the main components of the concrete which greatly varies the strength, density and other properties of the concrete. Different types of aggregates used are discussed below.

Fine Aggregate

The fine aggregate used in the project was locally supplied from the river Swarnamukhi, near Srikalahasti in Chittoor district and conformed to grading zone II as per IS:383-1970 [3]. It was first sieved through 4.75mm sieve to remove any particles greater than 4.75mm. Properties of the fine aggregate are tabulated below in Table 2.

Coarse Aggregate

Locally available coarse aggregate having the maximum size of 20mm were used in this work. Properties of the coarse aggregate are tabulated in Table 3.

Table 1: Physical Properties of Zuari-53 Grade Cement

SNo	1	2	3	4	5		
Properties	**Specific Gravity**	**Normal Consistency**	**Initial Setting Time**	**Final Setting Time**	**Compressive Strength (MPa)**		
Values	3.15	32%	60 min	320 min	3 days	7 days	28 days
					29.4	44.8	56.5

Table 2: Properties of fine aggregates

S.No	Characteristics	Values
1.	Type	Uncrushed (natural)
2.	Specific gravity	2.54
3.	Bulk Density	1668 kg/m^3
4.	Fineness modulus	2.76
5.	Grading zone	Zone II

Table 3: Properties of Coarse aggregates

S.No	Characteristics	Values
1.	Type	Crushed
2.	Specific gravity	2.74
3.	Bulk Density	1765 kg/m^3
4.	Fineness modulus	6.45
5.	Maximum size	20mm

TANNERY SHREDDED WASTE

The shredded waste of the processed tannery is brought from Gokulram leathers, Pallavaram, Chennai. As the tannery is replaced for fine aggregate, the waste that is obtained should be sieved and used for the work. The tannery waste obtained from the industry is sieved with 2.36mm sieve and the passed materials are taken for the replacement. Physical properties of the tannery shredded waste is tabulated below in Table 4.

Table 4: Physical Properties of Tannery Shredded Waste

Physical properties	Fine aggregate	Tannery waste
Shape	Irregular	Irregular
Appearance	Brownish yellow	Greenish blue
Water absorption (%)	1.23	0.15-0.20
Moisture content (%)	0.50	0.10
Density (kg/m^3)	511.40	240.90
Bulking point (%)	12	10
Specific gravity	2.41	2.56

Water

Potable water was used for mixing and curing of concrete cubes.

MIX PROPORTION

In the present work, mix proportion for concrete grade of M30 was carried out according to IS: 10262-2009 recommendations [4]. The mix proportions are presented in Table 5.

Table 5: Mix Proportion for M30 Concrete

Parameter	Weight in kg/m^3
Cement (kg/m^3)	413
Water (kg/m^3)	186
Fine aggregate (kg/m^3)	706
Coarse aggregate (kg/m^3)	1127

RESULTS AND DISCUSSIONS

Compressive Strength

The tests were carried out as per IS: 516-1959 [5]. The 150mm size cubes of various concrete mixtures were cast to test compressive strength. The cube specimens after de-moulding were stored in curing tanks and on removal of cubes from water the compressive strength tests were conducted at 7 days and 28days. The test results were compared with controlled concrete. The compressive strength results are presented in Table 6 and Fig 1.

Table 6: Compressive Strength for Different Trail Mixes

Trail Mix	Compressive Strength N/mm^2	
	7 Days	28 Days
Control Mix	25.86	38.56
Mix 1	27.62	40.20
Mix 2	29.20	43.64
Mix 3	26.52	39.58

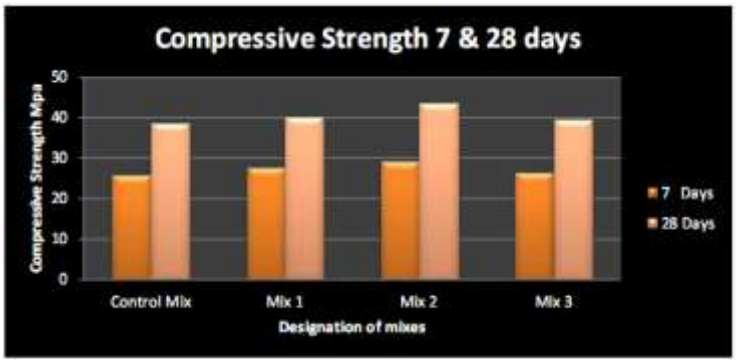

Fig-1: Variation of Compressive Strength for different trail mixes

CONCLUSIONS

On the basis of results produced in this study it is concluded that:

The experimental results reveals that the maximum compressive strength achieved for seven and 28 days are 29.20 and 43.64 N/mm^2 by 10% replacement of tannery waste in fine aggregate

The partial replacement of 10% of tannery waste over fine aggregate will eventually increase the strength of concrete and found to be optimum replacement

Compressive strength of standard concrete with various trail mixes is comparatively increasing more than that of conventional concrete. Tannery waste concrete can reduce the use of river sand in concrete and results in light weight concrete.

There is reduction in the cost of construction and provides a new replacing material for the concrete. The disposal of tannery waste can be done safely without causing any pollution to the environment.

REFERENCES

1. Angeline Swarna, M., & Venkatakrishnaiah, R. (2014). A paper on Manufacturing bricks using tannery effluent sludge. IJRDET, 4(4).
2. IS: 12269-1987, Bureau of Indian standards, New Delhi, India, 53 grade Ordinary Portland Cement-specification.
3. IS: 383-1970, Bureau of Indian standards, New Delhi, India, Specifications for Coarse and fine aggregates.
4. IS: 10262-2009, Bureau of Indian Standards, Mix design guidelines and Specifications for casting of specimens.
5. IS: 516-1959 , Methods of tests for Compressive strength of concrete (eleventh reprint, April 1985), Bureau of Indian standards, New Delhi.