Retraction

Retraction: Appraisal of Green Construction Material by Optimizing the Strength of Tannery Sludge Concrete (IOP Conf. Ser.: Mater. Sci. Eng. 1145 012003)

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This article (and all articles in the proceedings volume relating to the same conference) has been retracted by IOP Publishing following an extensive investigation in line with the COPE guidelines. This investigation has uncovered evidence of systematic manipulation of the publication process and considerable citation manipulation.

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IOP Publishing regrets that our usual quality checks did not identify these issues before publication, and have since put additional measures in place to try to prevent these issues from reoccurring. IOP Publishing wishes to credit anonymous whistleblowers and the Problematic Paper Screener [1] for bringing some of the above issues to our attention, prompting us to investigate further.

[1] Cabanac G, Labbé C and Magazinov A 2021 arXiv:2107.06751v1

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Appraisal of Green Construction Material by Optimizing the Strength of Tannery Sludge Concrete

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Abstract. Tanning industries are emerging as economic contributor for developing countries with fifth position and largest among processing work in India. Due to the large production (144 million tons per year) and wastage (1.3 million tons per year) of leather products, it is mandatory to utilize the wastes generated in a proper way. In this work it is considered to use the tannery sludge as admixture and as replacement material of coarse aggregate to reasonable increase in composition for potential application in modern construction industry.

Keywords: Tannery Waste, Bulk Density, Workability, Setting time, Compressive Strength.

1. Introduction
India is an industrial and marketing-based country with massive population running the tanning industry as the oldest and largest sector that produces a huge amount of processed sludge [1,2]. Considering the quantity of waste generated it is planned to convert as raw material for different sectors with different new ideas and execution. Based on which our idea towards construction techniques emerges as “Design of next generation low cost concrete block using tannery waste”. In India tannery industry is one of the leading industries with approved certification from NEERI and CETP for effective waste handling and sludge removal since 1973. Among the world tannery production our country produces 13% that includes all major cattle skins (goat, sheep, buffalo, cow, etc.), where the contribution from Tamilnadu is 40%. In general the tanning industry undergoes a continuous process named chrome-tan for proper segregation of
animal skin to leather, where size is maintained using shredding. The shredded waste is also considered as replacement material in case of fine aggregate [3]. In this study a composition of sludge is considered as admixture for the partial replacement of coarse aggregate, as well as fine aggregate as per standards with increase in percentage is suggested in mix ratio proportioning [4,5]. Attention is focused towards analysing the extra strength of the concrete, to use leather waste in a productive manure, to reduce the usage of fine aggregate, to analyse the lifetime of the concrete by different ratio and to increase bonding strength of concrete [6]. The objectives are to assess the characteristics of sludge collected from tannery, to find concrete strength with different tannery mix ratio, to reduce the time requirement for curing, to assess the influence of sludge adding on the workability and setting time of the concrete in addition to analyze and establish the strength of heavy metal.

2. Materials & Methods

2.1. Deliverables

As per standard ratio the concrete mould is prepared by varying tannery waste by replacement of fine aggregate. By this process the strength of concrete gets analyzed and the concrete structure gets designed as per valid strength of tannery waste used in concrete.

Collection of Tannery Sludge and Raw Material

Design of Mixing Proportion

Experimentation of Cubes

Curing for 7, 14 and 28 Days

Strengthening on Workability, Permeability and durability

Figure 1. Proposed Methodology.

2.2. Novelty

The tannery waste is used as admixture and replacement material aggregates. It contains heavy metals such as like chromium, lead, copper, cadmium. Due to those heavy metals naturally the strength of concrete increases its workability, durability and permeability.

2.3. Proof of Concept

The process of replacement of tannery waste instead of fine aggregate partially has been experimented. Figure 1, shows the proposed methodology.

2.4. Indian Scenario

To reduce the increasing tannery waste Indian institute of chemical biology (CSIR-IICB) Kolkata is undergoing the process of removing chromium from the tannery waste. Ambur and vaniyambadi tannery...
industry is currently undergoing in the process of purification. The inorganic rich tannery sludge has not been utilized in concrete so far [7].

2.5. Global Scenario
As the usage of tannery products gets widely increases among the world, its waste get increases and to make its wastage in useful manner following countries (Mexico, Jamaica, Honduras, China) are undergoing treatment process under UNIDO.

3. Result & Discussion

3.1. Cement
An extensive usage of cement in the field of construction industry places a predominant role which is responsible for the binding strength. The actual potency is enhanced in the form of mortar in the masonry exertion which is most effective based on mix ratio and even excels by professionals based on their experience get used to it [8,9]. Cement is the product obtained by burning well proportion mixture of material such as limestone, argillaceous materials such as clay at very high temperature with comprehensive assets such as glue and solid that unites raw materials. In this experimentation OPC-53 grades conforming to IS 12269:1987 is used and their possessions are tabulated in Table 1.

| Properties     | Value |
|----------------|-------|
| Specific gravity | 3.15  |
| Consistency     | 32%   |
| Fineness        | 90    |
| Initial setting time | 10 minutes |
| Final setting time   | 50 minutes |

3.2. Fine Aggregate
A fine aggregate particle which gets passed through the 9.5mm sieve, almost entirely passes through the 4.75mm sieve and predominately get retained on the 75 mm (No. 200) sieve get commonly used for this type of construction [10]. Normally the compactness by the cement is enhanced by application of fine aggregates that will reduce the voids created by coarse aggregate that leads to a strong bond and will not segregate. Introduction of tannery shredding as fine aggregated composition is advantageous over economic aspects and increasing workability is to be evaluated [11].

3.3. Coarse Aggregate
The particles that are predominately retained on the 4.75 mm sieve and will pass through 3-inch screen are considered as coarse aggregate, where dried tannery sludge with higher heavy metal composition is used in this case [12]. Introducing a novel raw material for replacing coarse aggregate will be reasonably priced. Table 2 shows the properties of material and Table 3 shows the quantity of materials.

3.4. Tannery waste
To make an animal (cattle) skin into leather by greeting with certain substances (courtier). Based on people wish the treated leather is get manufacture onto several leather materials [13]. During the preparation of leather protects some material get wasted during the manufacturing process, the waste may be in the form of solid, colloidal and liquid state. We have selected solid tannery waste (dry threaded) and by making it powdery to mix in concrete mix [14,15].
Table 2. Properties of Material

| Test            | Coarse aggregate | Fine aggregate | Tannery waste |
|-----------------|------------------|----------------|---------------|
| Specific gravity | 2.68             | 2.71           | 2.56          |
| Water absorption| 0.4%             | 2.4%           | 0.15-0.25     |
| Density (Kg/m³) | 1765             | 1811.40        | 540.90        |

Table 3. Quantity of Materials

| S. No | Material | Quantity (kg) |
|-------|----------|---------------|
| 1     | Cement   | 413.33Kg      |
| 2     | Sand     | 843.763Kg     |
| 3     | Aggregate| 1064.594Kg    |
| 4     | Water    | 199.763L      |

Table 4. Mix Calculation of Cubes

| S. No | Cubes | Percentage of Sludge | Cement (kg) | Tannery Shredding waste (kg) | Fine Aggregate (kg) | Tannery Sludge (kg) | Coarse Aggregate (kg) |
|-------|-------|----------------------|-------------|-----------------------------|---------------------|---------------------|-----------------------|
| 1     | 1     | 0%                   | 1           | 0.2                         | 1.8                 | 0                   | 4                     |
| 2     | 3     | 3%                   | 1           | 0.2                         | 1.8                 | 0.3                 | 3.7                   |
| 3     | 3     | 6%                   | 1           | 0.2                         | 1.8                 | 0.6                 | 3.4                   |
| 4     | 3     | 9%                   | 1           | 0.2                         | 1.8                 | 0.9                 | 3.1                   |
| 5     | 3     | 12%                  | 1           | 0.2                         | 1.8                 | 1.2                 | 2.8                   |
| 6     | 3     | 15%                  | 1           | 0.2                         | 1.8                 | 1.5                 | 2.5                   |

Figure 2. Compressive strength of Tannery sludge
This trial promotes a new innovation in building construction materials by providing durable concrete with accessibility of withstanding potential. The insertion of ragged tanning composition acts like a conservative fibred string that set in motion to shrink and close gaps. Thus the research project targets building industry. From the research outcome it is identified that the strength of concrete gradually increases with additional tannery waste mix. The control run is compared with 3, 6, 9, 12, 15 percentage of novel raw material and their respective compression strength is evaluated. The mix calculations for cubes are tabulated in Table 4 and their findings are graphically illustrated in Figure 2. The trial run is demonstrated as 7R1, 7R2 for respective seventh day strength analysis which given as 17.65 N/mm². Similarly, for 14R1, 14R2 it is observed to be 22.74 N/mm² and the compression strength in the addition of 12% of tannery waste at 28R1, 28R2 averaged has got a replacement for coarse aggregate as 25.42 N/mm² the uppermost strength mentioned as 28CS.

4. Conclusion

Sludge from the tannery wastewater treatment unit has been categorized as hazardous waste, particularly due to the presence of heavy metals i.e., lead, chromium, cadmium etc. in it. Inappropriate discarding of the above mentioned waste into waterway may cause growth of biological nutrients that leads to contamination and have shown how it can cause irreversible damage to the environment in the vicinity. Meanwhile the environment is under increasing pressure from this emanating sludge and other wastes of tannery industry. The primary outcome of this evaluation assessed the viability of using solidification technology in stabilizing and converting the risky, poisonous metallic chemical element into an inert, physically stable mass, with very low legibility. For the moment it is acceptable because of its high relative density in even at little concentration. The secondary outcome of the study was to assess the performance of the sludge added concrete to recommend a suitable concrete mix for minor construction work using sludge partially replacing the aggregates in concrete mix.

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