# Strength Evaluation on M25 & M30 Grades of Self-Compacting Concrete By Partially Replacement of Saw Dust In Fine Aggregates

**K. Hema Santhi[1], Mani Deep.V[2]**
[2] Assistant Professor
[1, 2] Kakinada Institute of Engineering & Technology-II College,
Korangi, AP, India.

***Abstract-*** *Self-compacting concrete(SCC)is a high-performances on crete that can flow under its own weight to completely fill the form work and self-consolidates without any mechanical vibration. Such concretes are an accelerate for the placement, to reduce the labour requirements needed for consolidation, finishing and eliminate environmental pollution. This will ensure that the concrete obtained has good flow ability, self-compacting ability and other desired SCC properties. The European Federation of Producers and Applicators of Specialist Products for Structures ( EFNARC)[2005]have also laid down certain guidelines for fresh properties of SCC. Self-compacting concrete is a type of concrete that gets under its self-weight. It is commonly abbreviated as the concrete. Which can placed and compacted in to every corner of a formwork; purely means of its self weight by eliminating the need of either external energy input from vibrators or any type of compacting effort.*

*There is a current trend in all over the world to utilize the treated and untreated industrial By products, domestic wastes etc. as raw materials in concrete. These not only help in the reduce of the waste materials but also create a cleaner and greener environment. This report demonstrates the possibilities of using saw dust as partial replacement of fine aggregate in concrete. This experimental investigation was performed to evaluate the strength and durability properties of M25 and M30 grade of self compaction concrete, in which fine aggregate was partial, replaced with saw dust waste. Fine aggregate was replaced with four percentage (0%, 10%, 20%, 30%) of saw dust waste by weight. Fresh properties of self-compacting concrete were studied. Compression test and splitting tensile strength test were carried out to evaluate the strength properties of concrete at the age of 7, 14, and 28 days.*

***Keywords****-* Self-compacting concrete (SCC), Saw dust, strength and durability properties of concrete, Compression test and splitting tensile strength test.

## I. INTRODUCTION

Concrete is a widely used construction material around the world, and its properties have been undergoing changes through technological advancement. Numerous types of concrete have been developed to enhance the different properties of concrete. So far, this development can be divided into four stages. The earliest is the traditional normal strength concrete which is composed of only four constituent materials, which are cement, water, fine and coarse aggregates. With a fast population growth and a higher demand for housing and infrastructure, accompanied by recent developments in Civil Engineering, such as high-rise buildings and long-span bridges, higher compressive strength concrete was needed.

## II. REVIEW OF LITERATURE

The overall relevance of concrete in virtually all civil engineering practice and building construction works cannot be overemphasized (Adewuyi and Adegoke, 2008). Concrete is a combination of cement, fine and coarse aggregates and water, which are mixed in a particular proportion to get a particular strength. The cement and water react together chemically to form a paste, which binds the aggregate particles together. The mixture sets into a rock-like solid mass, which has considerable compressive strength but little resistance in tension (Agbede and Menessh, 2009). However, the construction industry relies heavily on conventional materials such as cement, granite and sand for the production of concrete. The high and increasing cost of these materials has greatly hindered the development of shelter and other infrastructural facilities in developing countries (Olutoge,2010). As the infrastructure of the entire world is kept developing, the construction industry is in need of large amount of raw materials. As the consumption of raw materials increases the demand increases material (Murali and Ramkumar, 2012). The growing concern of resource depletion and global pollution has challenged many researchers and engineers to seek and develop new materials relying on renewable resources. These include the use of by-products and waste materials in building construction. Many of these by-products are used as aggregate for the production of lightweight concrete (Adewuyi and Adegoke, 2008). The most widely used fine aggregate for the making of concrete is the natural sand mined from the riverbeds. However, the availability of river sand for the preparation of concrete is becoming scarce due to the excessive nonscientific methods of mining from the riverbeds, lowering of water table and sinking of the bridge piers among others, are becoming common treats (Mageswari and Vidivelli, 2010). The worldwide consumption of sand as fine aggregate in concrete production is very high, and several developing countries have encountered some strain in the supply of natural sand in order to meet the increasing needs of infrastructural development in recent years (Divakar et al,2012). Nonetheless, accumulation of unmanaged wastes especially in developing countries has resulted in an increasing environmental concern. However, the increase in the popularity of using environmental friendly, lightweight construction materials in building industry has brought about the need to investigate how this can be achieved by benefiting environment as well as maintaining the material requirements affirmed in the standards Since a large demand has been placed on building material industry especially in the last decade owing to the increasing population that causes a chronic shortage of building materials, the civil engineers have been challenged to convert the industrial wastes to useful building and construction materials (Turgut, 2007). Sawdust is an industrial waste in the timber industry constitute a nuisance to both the health and environment when not properly managed (Elinwa and Abdulkadir, 2011). Wood sawdust wastes are accumulated from the countries all over the world and cause certain serious environmental problems and health hazards. It is one of the major underutilized by products from sawmilling operations. Generatihence great efforts are made in the utilization of such waste (Zziwa1 et al, 2006).Thus, this research investigates the potential use of wood sawdust wastes to produce a low-cost and lightweight composite for construction and engineering purpose. on of wood wastes in sawmill is an unavoidable.

## III. EXPERIMENTAL WORK

### 3.1 Materials

The materials used in the experimental investigation are locally available cement, sand, coarse aggregate, mineral and chemical admixtures. The chemicals used in the present investigation are of commercial grade. 3.1.1 Cement Ordinary Portland cement of 53 grade [IS: 12269-1987, Specifications for 53 Grade Ordinary Portland cement] has been used in the study. It was procured from a single source and stored as per IS: 4032 - 1977. Care has been taken to ensure that the cement of same company and same grade is used throughout the investigation. The cement thus obtained was tested for physical properties in accordance with the IS: 12269 - 1987.

### 3.1.1 CEMENT

Selection of the type of cement will depend on the overall requirements for the concrete, such as strength, durability, etc. C3 content higher than 10% may cause problems of poor workability retention.

### 3.1.2 FINE AGGREGATES

All normal concreting sands are suitable for SCC, both crushed or rounded sands can be used. Siliceous or calcareous sands can be used. The amount of fines less than 0.125 mm is to be considered as powder and is very important for the rheology of the SCC. A minimum amount of fines (arising from the binders and the sand) must be achieved to avoid segregation.

### 3.1.3. SAW DUST:

Saw dust is a by-product of cutting, grinding , drilling, sanding, or otherwise pulverizing wood with a saw or other tool; it is composed of fine particles of wood. It is also the byproduct of certain animals, birds and insects which live in wood, such as the woodpecker and carpenter ant. It can present a hazard in manufacturing industries, especially in terms of its flammability. Saw dust is the main component of particleboard. A major use of saw dust is for particleboard; coarse sawdust may be used for wood pulp. Water absorption 2%and pH 8.

The details of the compressive strengths of M25, and M30 grade of SCC are shown in Table 1.

| MIX | SAW DUST % | COMPRESSIVE STRENGTH (Mpa) | | |
|---|---|---|---|---|
| | | 7 Days | 14 Days | 28 Days |
| M25 | 0 | 22.27 | 26.6 | 32.25 |
| | 10 | 23.68 | 27.2 | 33.71 |
| | 20 | 25.04 | 28.46 | 35.68 |
| | 30 | 23.25 | 26.91 | 32.09 |
| M30 | 0 | 24.86 | 33.66 | 37.05 |
| | 10 | 25.35 | 34.27 | 38.56 |
| | 20 | 27.91 | 35.65 | 39.54 |
| | 30 | 25.03 | 33.97 | 37.35 |

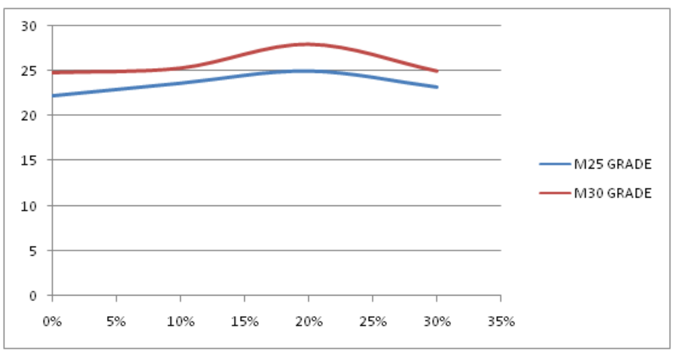
The details of the split tensile strengths of M25, and M30 grade of SCC are shown in Table 2.

| MIX | SAW DUST | SPLIT TENSILE STRENGTH MPa | | |
|---|---|---|---|---|
| | | 7 Days | 14 Days | 28 Days |
| M25 | 0 | 2.25 | 2.84 | 4.25 |
| | 10 | 2.31 | 2.97 | 4.69 |
| | 20 | 2.42 | 3.15 | 4.87 |
| | 30 | 2.28 | 2.89 | 4.31 |
| M30 | 0 | 2.7 | 2.95 | 4.75 |
| | 10 | 2.84 | 3.2 | 4.96 |
| | 20 | 2.91 | 3.48 | 5.34 |
| | 30 | 2.75 | 3.23 | 4.47 |

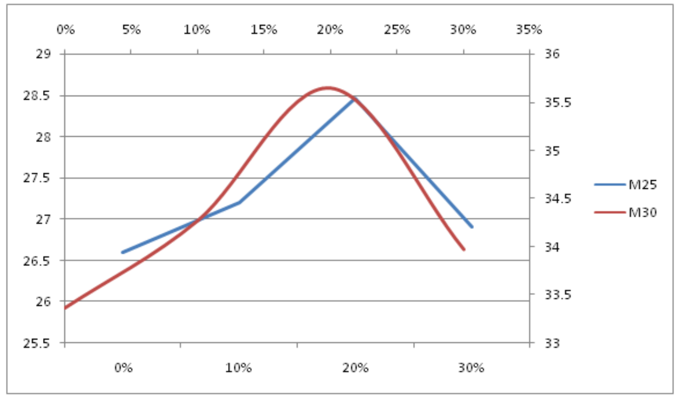
The details of the flexural strengths of M25, and M30 grade of SCC are shown in Table 3.

| MIX | SAW DUST | FLEXURAL STRENGTH MPa | | |
|---|---|---|---|---|
| | | 7 Days | 14 Days | 28 Days |
| M25 | 0 | 4.22 | 6.37 | 8.21 |
| | 10 | 4.35 | 6.48 | 8.5 |
| | 20 | 4.5 | 6.89 | 8.67 |
| | 30 | 4.25 | 6.41 | 8.44 |
| M30 | 0 | 5.35 | 7.04 | 9.08 |
| | 10 | 5.49 | 7.29 | 9.16 |
| | 20 | 5.61 | 7.46 | 9.34 |
| | 30 | 5.43 | 7.11 | 9.13 |

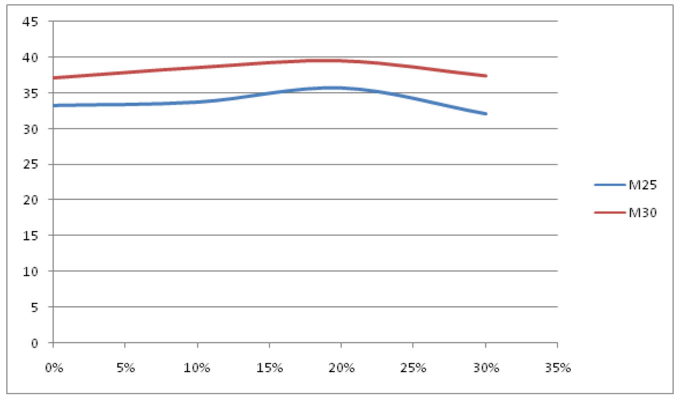
Shows the details of the Compressive strength for partial replacement 10%, 20%and 30% of saw dust for M25, and M30 grades of concrete.



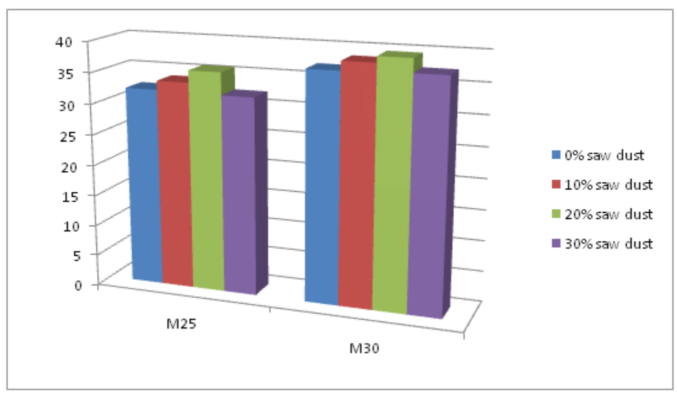

**Graph 1: 1 7 Days of Compressive strength for different Grades of Concrete**



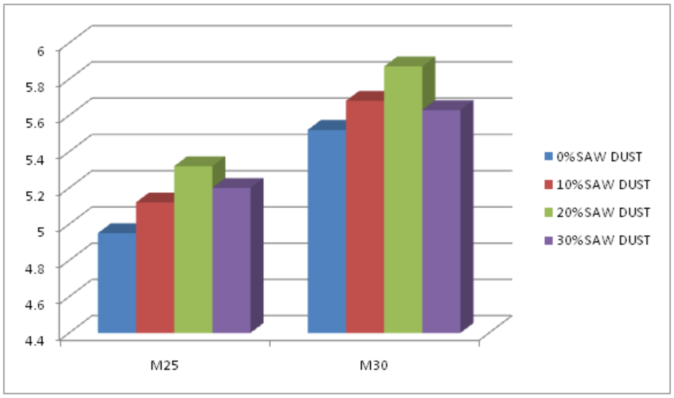

**Graph2 :14 Days of Compressive strength for different Grades of Concrete**



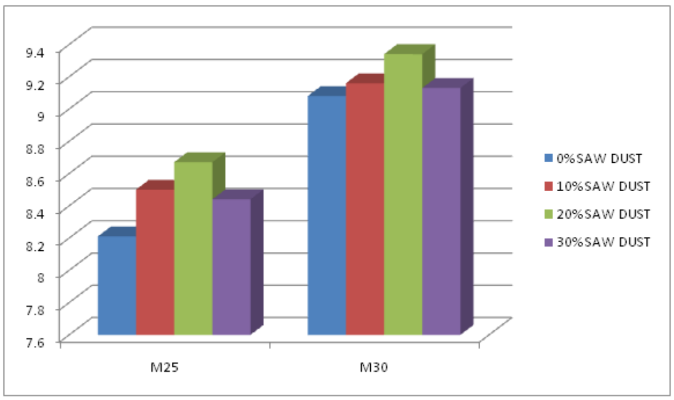

**Graph 3 :28 Days of Compressive strength for different Grades of Concrete**




**Graph: 2 Bar Diagram for 28 Days Compressive strength for partial replacement of Saw Dust for different Grades of Concrete.**




**Graph: 6 Bar Diagram for 28 Days Split Tensile strength for partial replacement of Saw Dust for different Grades of Concrete**




**Graph: 7 Bar Diagram for 28 Days flexural strength for partial replacement of Saw Dust for different Grades of Concrete.**

## IV. CONCLUSIONS

1. There is reduction in density of sawdust concrete with increase in percentage of sawdust in concrete.
2. Use of sawdust as a waste in concrete decrease the pollution which is caused after burning of sawdust.
3. The addition of saw dust in SCC mixes increases the self-compatibility characteristics like filling ability, passing ability and segregation resistance.
4. Theflowvalueincreasebyanaverageof1.30%,2.5%and5.36 %forsaw dust replacements of 10%,20%and30% respectively.
5. The V-funnel time was observed to increase by an average of 6.21%, 15% and 22.54% for saw dust contents of 10%, 20% and 30% respectively. This increase in the V-funnel time indicates increase values of relative flow time and there by the higher viscosity (resistance to flow) for the mixes
6. The L-box value was also observed to follow an increasing trend with an average variation of 1.5%, 3.2% and 5% for saw dust contents of 10%, 20% and 30% respectively.
7. The compressive strength of the mixes was observed that gradual increase with level of increase in saw dust contents. The average growth in compressive strength for all grades was around 6%, 15% and 20% for saw dust contents of 10%, 20% and 30% respectively.
8. The flexural strength soft he mixes were observed that gradual increase with level of increase in saw dust contents. The average growth in flexural strengths for all grades was around 2%, 3.7% and 6.75% for of 1.30%, 2.5% and 5.36% for saw dust replacements of 10%, 20% and 30% respectively.
9. From the above experimental results on mechanical properties for M25 and M30 grade of SCC mix, It is clear that the percentage of replacement of saw dust is increases the strength is also increases gradually.

From the above mentioned work of various researchers and our present experimental work, it is clear that saw dust can be used as are placement of fine aggregate in concrete because of its increased work ability, strength parameters

## REFERENCES

[1] Daniel Yaw Osei, Emmanuel Nana Jackson/, "Compressive strength of concrete using sawdust’s aggregate”, International Journal of scientific & engineering Research, vol.7, (2016).

[2] EFNARC. “Specification and guidelines for self-compacting concrete”, European Federation of Producers and Applicators of Specialist Products for Structures, 2

[3] EFNARC.“Specification and guidelines for self-compacting concrete”, European Federation of Producers and Applicators of Specialist Products for Structures, May 2005.

[4] Jaya Shankar R, Hemalatha T, Palanichamy. K and Santhakumar. S, “Influence of saw dust and VMA on properties of self-compacting concrete”, National Conference on Advances in materials and mechanics of concrete structures Department of Civil Engineering, IIT Madras, Chennai 12-13 August 2005, pp 25 - 32.

[5] Nan Su, Kung-Chung Hsub and His-Wan Chai. “A simple mix design method for self-compacting concrete”. Cement and Concrete Research, 2001, Vol. 31, pp1799 - 1807.

[6] Okamura H, Ozawa K. “Mix design for self-compacting concrete”. Concrete Library of Japanese Society of Civil Engineers, 1995, Vol. 25, No. 6, pp107-120.