

# Performance on Concrete by Partial Replacement of Cement with Alccofine 1203 and Fine Aggregate with Sawdust using M30 Grade of Concrete

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## Abstract

In order to change the properties of concrete, this paper investigated the use of sawdust as a waste product to replace sand and Alccofine 1203 as a partial replacement for cement. The effects of the alteration on the concrete were investigated when sand was weight for cement in the concrete mixtures. By incorporating sawdust into concrete, waste (sawdust) may be disposed of while also reducing the weight of the concrete. Alccofine 1203 is applied as an admixture to replace cement in various amounts of 0, 4, 8, 12, 16 and 20%, while sawdust is added as an admixture to supplement fine aggregate in various amounts of 3, 6, 9 and 12%. Compressive and split tensile strengths at 28, 56 and 90 days were taken into consideration for determining the test findings.

**Keywords:** Alccofine 1203, Sawdust, Compressive Strength, Split Tensile

## 1. Introduction

Concrete is a composite material made of coarse aggregate joined by fluid cement that gradually becomes harder. The most common types of concrete are those created using hydraulic cements or lime-based concretes like Portland cement concrete. Alccofine, a new generation micro-fine concrete material for high strength, is significant in terms of both workability and strength. Alccofine is very simple to use and may be mixed right in with cement. Alccofine's ultrafine particles produce a superior, smoother surface finish. Due to its adjusted particle size distribution, Alccofine offers special qualities that improve the "performance of concrete" in both the fresh and hardened stages. The construction and building business is not accustomed to using sawdust. This is either because to the fact that it is not readily accessible as sand or gravel, or it is because their use for such purposes has not been promoted. Recently, there have been requests for the building industry, particularly in developing nations, to employ local resources to reduce construction costs. As a byproduct of cutting wood into uniform, usable pieces, sawdust is described as loose particles or wood chips.

## 2. Objectives

- (a) To use cement with Alccofine 1203 in concrete as efficiently as possible.
- (b) To use fine aggregate and sawdust as efficiently as possible.

(c) To assess the concrete's split tensile and compressive strength.

### 3. Materials

The properties of cement are presented in Table 1.

Table 1: Physical Properties of Cement

Sr. No.	Property	Cement (53 Grade)
1	Specific Gravity	3.14
2	Fineness	9.75%

#### 3.1. Alccofine 1203

In this experiment, a mineral additive called Alccofine, produced by Ambuja Cements Ltd, was employed. In high performance concrete, silica fume is replaced by the product Alccofine 1203, which is an additional cementitious substance. It is derived from the raw materials used in the iron ore sector. The percentages of alumina and silica in the Alccofine's chemical makeup are greater. For a particular workability, Alccofine 1203 offers decreased water demand - even up to 70% replacement level - to meet concrete performance requirements.

#### 3.2. Sawdust

The waste product or byproduct of woodworking processes including sawing, milling, planing, routing, drilling, and sanding is sawdust. It is made of tiny wood fragments. Woodworking equipment, portable power tools, or hand tools can all be used to carry out these tasks. When wood logs are sawed into various sizes, sawdust is created as tiny, irregular chips or small pieces of wood.

### 4. Experimental Investigations

#### 4.1. Compressive Strength Results

The compressive strength conducted in compression testing machine for the cast and cured specimens and the results are furnished in tables 2 to 4.

Table 2: Compressive Strength of Concrete with Alccofine 1203

Sr. No.	Alccofine	Compressive Strength Results, N/mm <sup>2</sup>		
		28 Days	56 Days	90 Days
1	0%	39.15	42.63	45.79
2	4%	46.44	50.52	53.99
3	8%	50.29	54.64	58.71
4	12%	53.37	57.94	62.41
5	16%	56.70	61.44	66.19
6	20%	53.80	58.50	62.76

Table 3: Compressive Strength of Concrete with Sawdust

Sr. No.	Sawdust	Compressive Strength Results, N/mm <sup>2</sup>		
		28 Days	56 Days	90 Days
1	3%	39.15	42.63	45.79
2	6%	30.83	33.58	35.96
3	9%	25.66	27.94	30.01
4	12%	19.88	21.64	23.21

Table 4 : Compressive Strength of Concrete with Alccofine 1203 and Sawdust

Sr. No.	AF + SD	Compressive Strength Results, N/mm <sup>2</sup>		
		28 Days	56 Days	90 Days
1	0%	39.15	42.63	45.79
2	16% + 6%	52.55	57.25	61.43

#### 4.2. Split Tensile Strength Results

The split tensile strength conducted in compression testing machine for the cast and cured specimens and the results are furnished in tables 5 to 7.

Table 5: Split Tensile Strength of Concrete with Alccofine 1203

Sr. No.	Alccofine	Split Tensile Strength Results, N/mm <sup>2</sup>		
		28 Days	56 Days	90 Days
1	0%	3.59	3.91	4.19
2	4%	4.59	4.98	5.34
3	8%	4.87	5.30	5.68
4	12%	5.25	5.71	6.14
5	16%	6.12	6.66	7.14
6	20%	5.19	5.65	6.06

Table 6: Split Tensile Strength of Concrete with Sawdust

Sr. No.	Sawdust	Split Tensile Strength Results, N/mm <sup>2</sup>		
		28 Days	56 Days	90 Days
1	3%	3.59	3.91	4.19
2	6%	3.04	3.31	3.55
3	9%	2.49	2.70	2.91
4	12%	1.78	1.93	2.07

Table 7: Split Tensile Strength of Concrete with Alccofine and Sawdust

Sr. No.	AF + SD	Split Tensile Strength Results, N/mm <sup>2</sup>		
		28 Days	56 Days	90 Days
1	0%	3.59	3.91	4.19
2	16%+6%	3.78	4.11	4.42

**5. Conclusions**

- (1) At 16% partial replacement of Alccofine 1203 with cement the compressive strength of concrete at 28, 56 and 90 days are 56.70, 61.44 and 66.19 N/mm<sup>2</sup>.
- (2) At 16% partial replacement of Alccofine with cement the split tensile strength of concrete at 28, 56 and 90 days are 6.12, 6.66 and 7.14 N/mm<sup>2</sup>.
- (3) At 6% partial replacement of sawdust with fine aggregate the compressive strength of concrete at 28, 56 and 90 days are 30.83, 33.58 and 35.96 N/mm<sup>2</sup>.
- (4) At 6% partial replacement of sawdust with fine aggregate the split tensile strength of concrete at 28, 56 and 90 days are 3.04, 3.31 and 3.55 N/mm<sup>2</sup>.
- (5) By the combination of 16% Alccofine + 6% Sawdust with cement and fine aggregate, the compressive strength of concrete at 28, 56 and 90 days are 52.55, 57.25 and 61.43 N/mm<sup>2</sup>.
- (6) By the combination of 16% Alccofine + 6% Sawdust with cement and fine aggregate, the split tensile strength of concrete at 28, 56 and 90 days are 3.78, 4.11 and 4.42 N/mm<sup>2</sup>.

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