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EFFECT OF STEEL FIBERS ON MECHANICAL PROPERTIES OF CONCRETE

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Abstract – The concept of rein forcing concrète with discontinuous fibres in the volume is a variant of the concept of using fibres to improve the mechanical behaviour of brittle materials in order to maintain the stability of the structure. This variant, known in the field of construction materials as fibre concrete, has been the subject of growing interest in industrial countries over the last few decades, going well beyond the stage of mere technical curiosity, over the last few decades in industrial countries, has been the subject of growing interest, which has gone far beyond the stage of mere technical curiosity, and has been the subject of studies focusing more and more on the analysis and modelling of this elementary combination in order to reach the stage of standardised, simplified and safe use. As part of this research, we need to study the mechanical characteristics of concrete, in particular compressive strength and tensile strength, in order to ensure the durability and longevity of structures under the effect of différent stresses. We need to improve these mechanical performances by incorporating steel fibres.

Keywords: Concrete – Steel Fiber-Durability-Compressive Strength-Tensile Strength

I. INTRODUCTION

Concrete is the most widely used material in all areas of construction, on every continent and at every latitude, but unreinforced concrete is still a brittle material under the effect of excessive stress, breaking rather suddenly, without warning, through prior cracking and without significant deformation.

To avoid this phenomenon of failure, and to compensate for its low tensile strength and contain stable macro-cracking in tensile zones, concrete must in most cases be reinforced with rebar.

This reinforcement is an important step in the history of this material and has contributed to the development of structural applications, by ensuring good safety.

the fibers can support the concrete in areas subject to less severe stresses, such as those caused by shear stress. In these zones, the presence of fibers can play two roles:

- deferring cracking of the concrete beyond the structure's service conditions, thus avoiding the need to install costly reinforced concrete type reinforcement.
- Limit its opening and maintain durability with or without the presence of transverse reinforcement once cracking has begun.

The purpose of this work is to study the behaviour of a concrete made from metal fibres obtained from the roll of binding wire. This is cut into straight pieces 5cm long. The percentage of fibres is also considered in order to obtain the best variant. Cylindrical specimens were made for tensile and compression tests. All the results of the various tests are presented in the form of tables, curves and graphs.

II. MATERIALS AND METHOD

A. *Cement*

The type of cement used for both ordinary concrete and polypropylene fiber concrete is made by is Djebel Rsass cement company (Tunisia). [1]

B. Aggregates

All the concrete was made with aggregates (sand and gravel).

Identification of aggregates intended for the manufacture of concrete

Quarry sand from Sotramat (Boulhafdir) Tebessa, Algeria.

Gravel: 3/8– 8/15 from the quarry of Sotramat (Boulhafdir) Tebessa, Algeria

C. Superplasticizer

The superplasticizer used in this testing program is the VISCOCRETE TEMPO 12 type high water reducer, marketed by the Algerian company Sika El-DJAZAIR, and complies with NF EN 934-2, French standardization, with a recommended range of use from 0.2 to 3% of binder or cement weight depending on fluidity[2]

D. Water

The mixing water used in this study is potable water from the laboratory tap. The conditions imposed on this mixing water are subject to the NF EN 1008 standard, once again a French standardization. This water must be clean and free from organic substances. [3]

E. Steel Fibers

Steel fibres are metal fibers used to reinforce concrete. They are obtained by shearing and shaping cold-drawn steel wire.

Fig 1. Fiber steel

An example of the table is given below.

III. Mix Proportions

Fiber-free concrete composition is obtained using the Dreux-Gorisse formulation method [4]. The adjuvant dosage is adjusted by execution of preliminary tests to get a mixture that ensures good handling. The consistency class of the concrete obtained is characterized by a subsidence to the Abrams cone Between 75 and 50mm for concrete reinforced with polypropylene fibers, the percentage of fibers relative to the total weight of the concrete was set at three values: 0.055–0.11 and 0.17%. The composition detail is shown in Table 1:

Table 1 . Concrete composition

Matériels	**Poids en (Kg/m^3)**			
Cement	400	400	400	400
steel fiber	0.00	0.5	1	1,5
Water	180	180	180	180
Superplasticize (%)	1	2	2,1	2,2
Superplasticizer kg	4	8	8,40	8,80
Coarse aggregate	1131	1131	1131	1131
Fine aggregate	654	654	654	654

IV MIXING, CASTING AND CURING PROCEDURES

The tests are carried out on twelve (10×10×10) cm cubic specimens to determine the compressive strength at 28 days. The ends of the test tubes are rectified by surfacing with Sulphur in accordance

V. RESULTS

F. Compressive Strength

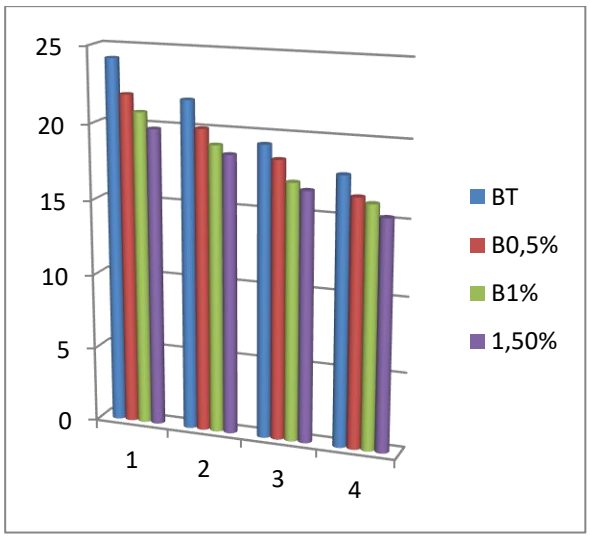

Fig 2. variation of compressive strength

G.Tensile Strength

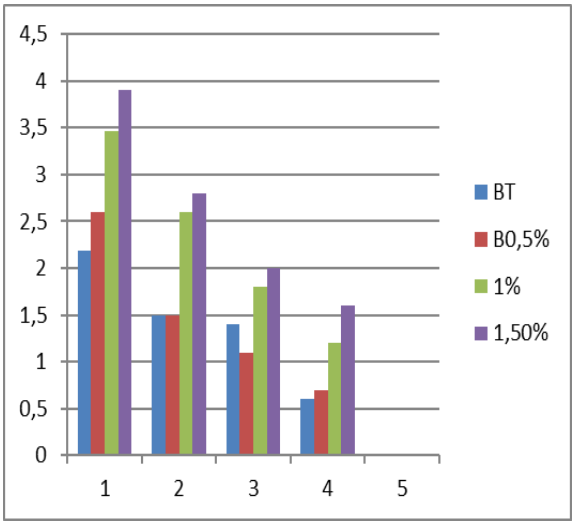

Fig 3. variation of compressive strength

VI. DISCUSSION

From the curve in fig 2 of compressive strength, we can see that the fibre-reinforced concretes follow the same curve as the control concrete, but at lower strengths. This observation shows that the dosage is not significant in terms of the target strength. Due to the lightness of these fibres, which require a large volume to be introduced into the matrix, this results in a greater density of voids than in the case of control concrete, and therefore a drop in strength through the existence of these pores, which weaken our concrete matrix. We can also see concluded that the compressive strength of concrete is lower than that of non-fibrous concrete [5].

From the curve in fig 3 of tensile strength, we can see that concrete with 1,5% fibres has higher flexural tensile strengths than control concrete and concrete dosed with 0.5%. This is due to the tensile strength of the steel fibres, which varies between 1000 and 3000 MPA.0.5% is due to the tensile strength of the steel fibres, which varies between 1000 and 3000 MPA. According to a synthesis of studies carried out at CEBTP, the results found showed a very significant improvement in the material's load-bearing capacity in the plastic phaseplastic phase, after the first cracking [6]

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