ABSTRACT

The development of self-compacting concrete (SCC), has recently been one of the most important discovery in the construction industry. Knowing that by incorporating fiber, crack resistance and ductility improves. The latest research involves inteërerssent and much bioosourcés new materials that meet environmental impact. Vegetable fibers are increasingly used as reinforcing materials in the constructions. They are indeed a renewable resource naturally biodegradable, and have many mechanical and hydric quality. Among these fibers, hemp or cannabis, from an annual plant with rapid growth in Asia and Europe. Featuring a high tensile strength and are advantageous for use in a number of products such as paper, textiles and fibers reinforced concrete [Rabah Hamzaoui 2013].

The aim of this work is to achieve an eco-composite materials self-compacting concrete combined with hemp and chenevotte fiber while considering the role and the influence of these reinforcements on the performance of these concretes. For this purpose, a comparative study was conducted on a SCC without fiber (SCC-T), SCC with polypropylene fibers (SCC-PP), SCC with hemp fiber (SCC-HE) and SCC with chênevotte (SCC-CT). The rheological properties were determined using the slump flow tests, slump flow time T_{500}, L-box, J-ring, V-funnel, entrained air percentage and wet density percentage. The mechanical properties include compressive strength, tensile strength at 3, 7, 14, 28 and 90 days and the elastic modulus at 7 and 28 days and capillary porosity. The results show that it is possible to use the CV and CT fibers as a reinforcing element in the production of fiber reinforced self compacting concrete. They showed good strength and a slight decrease in the workability of self-compacting concrete.

Keywords: self-compacting concrete, plant fibers, hemp fiber, chenevotte fiber, rheological properties, mechanical performance.

INTRODUCTION

The compacting concrete (SCC) is a concrete from a recent innovation in recent years is considerable aucupe an important place in the concrete because of the benefits it offers industry requiring no vibrationn, with a flow under its own weight, even in melieux dense reinforcement.

SCC have been developed in Japan in the 1980 for use mainly for highly reinforced structures. Recently, this concrete has gained wide use in many countries for different applications and structural configurations.
The inclusion of fibers in the SCC will extend its advantages. These benefits would be to delay the propagation of cracks in structures and improve the tensile strength and flexural strength and toughness of the hardened concrete. Therefore, the use of fibers can increase the scope of application of SCC. [Liberato Ferrara 2012] [Sabry A. Ahmed 2013]

Plant materials are a source of renewable products used in recent decades in buildings. One way to achieve an industry more sustainable construction and more adequate to environment. While proceeding to the consumption of materials in reduction of raw materials by adding byproducts or biosourced materials.

Given that the plant fibers are characterized by a higher water absorption value; in which the question arises, can we achieve self-compacting concrete containing vetageles fibers with acceptable workability without touching the mechanical and physical performance?

This study examines and quantifies how the addition of different types of plant and synthetic fibers affect the flow characteristics of self-compacting concrete, mechanical and physical properties. Experimental studies were performed on concrete mixes several times in order to achieve a workability of BAP according to the type and amount of fiber.

**RESULTS AND DISCUSSION**

**Property fresh**

The results of the characterization in the fresh state are shown in Table 1.

<table>
<thead>
<tr>
<th>Test</th>
<th>SCC-T</th>
<th>SCC-CV</th>
<th>SCC-CT</th>
<th>SCC-PP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slump flow diameter</td>
<td>73</td>
<td>65,5</td>
<td>71,75</td>
<td>60,5</td>
</tr>
<tr>
<td>T50</td>
<td>2</td>
<td>2,4</td>
<td>2,07</td>
<td>2,62</td>
</tr>
<tr>
<td>J-Ring</td>
<td>0,15</td>
<td>1,35</td>
<td>1</td>
<td>5,05</td>
</tr>
<tr>
<td>DJ</td>
<td>71,5</td>
<td>62,5</td>
<td>71,85</td>
<td>47,5</td>
</tr>
<tr>
<td>V-funele</td>
<td>10,73</td>
<td>9,39</td>
<td>10,47</td>
<td>8,44</td>
</tr>
<tr>
<td>L-BOX</td>
<td>0,91</td>
<td>0,86</td>
<td>0,9</td>
<td>0,45</td>
</tr>
<tr>
<td>Stability sieve</td>
<td>15,4</td>
<td>2,48</td>
<td>13,88</td>
<td>4,043</td>
</tr>
<tr>
<td>Air content</td>
<td>1,9</td>
<td>2,1</td>
<td>1,45</td>
<td>1,27</td>
</tr>
<tr>
<td>Density</td>
<td>2,34</td>
<td>2,32</td>
<td>2,33</td>
<td>2,31</td>
</tr>
</tbody>
</table>

The content of the fibers we chose caused a slight negative impact on handling and compacting characteristics of SCC. For polypropylene fibers the diameter of the spread was significantly reduced from 73 to 60 cm. In addition, other features such as J-ring and and V funnel increased but remain within the required ranges compacting concrete EFNARC BAP. [EFNARC 2002]
Hardened property

Resistance to compression and traction

The results of the compressive strength and tensile bending are shown in Figure 1.

![Figure 1](image1)

![Figure 1](image2)

From these figure it can be seen that the inclusion of vegetable and synthetic fiber systematically reduces the compressive strength and tensile bending. We also note that the kinetics of evolution of resistance between the fibers and the light is different. As an example for the compressive strength in three days there is a difference of about 31 to 42% relative to control. But at the age of 28 days the gap has narrowed to 12 and 14%. By cons for the flexural tensile strength at the young age there is a difference of 31%. However, at 28 days the percentage is reduced by about 7.5%.

Modulus of elasticity

Figure 2 shows the evolution of the elastic modulus with temp according to the nature of the fibers. From this figure it can be seen that the modulus increases with time. But it is different from one fiber to another with a variance of 20 and 33.33 PM has seven days and 29.7 to
44.44 GP to 28 days. We also note that the BAP with fibers giving lower values than the control with a percentage varying between 11.11% and 40% at 7 days and to 13.37% and 33.17% at 28 days. BAP with plant fibers showed better results than polypropylenes.

**Capillary porosity**

Results of porosity to water different BAP F in the hardened state are given graphically in Figure 3.
The values in this figure show increased absorption according to time, and the latter for all mixtures. Note that the SCC-HE is one that has the smallest absorption coefficient. But most of the mixtures are analogous results.

CONCLUSION

The study in this paper aims to contribute to better understand the effects of plant and synthetic fiber type on the réhologique behavior, physical and chemical performance and temperature evaluation. Three fibers (hemp, chennevotte and polypropylene) and a fixed dosage of 2 kg / m3 were studied. The following conclusions are drawn based on the results of the various tests and analyzes:

- The introduction of plant fiber in the concrete, leads to a virtual increase of water. Since the fibers tend to water absorption.

- However, the compactness of SCCF decreases consistently view the empty created by these fibers.

- The evolution of the workability of SCC bundles decreases over time, especially in confined areas.

- The SCC bundles provide compressive strengths with a slight decrease in the non-fiber BAP. However fluctuation results in the same range as a structural concrete.

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REFERENCES

