

# STUDY OF DEGRADATION OF FIBRE – CEMENT PLATES WITH DIFFERENT TYPES OF NON – METALIC FIBRES

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## 1. Introduction

Results from series of tests carried out on nine mixture formulas are the main data set. Asbestos-free plates bonded by hydro-silicate matrix and reinforced by organic fibers were produced from these mixture formulas. Within the scope of this project, the following activities were carried out: finding out the dimensional and weight characteristics of the plates, bending strength under normal conditions, the influence of frost on bending strength, the influence of putting the plates into hot water on bending strength, the impermeability of plates and measurement of change of length in the direction along and across the fibers.

## 2. Test Devices – Test description

All of the following tests in addition to shrinkage were performed according to standard ČSN EN 12467 [1]. The following tests in addition to shrinkage were performed using to the Klokner Institute method. Three-point bending test (fig. 1) was performed on the test device Instron 250 kN. Each board was tested in two directions: parallel of fibers and perpendicular to the direction of fibers. Test boards were burdened so that a rupture occurred in 10 to 30 seconds, support distance was 200 mm. Before each test, the plates were measured and weighted.

## 3. The procedure of monitoring the hot water test

The testing plates were divided into two sets. After conditioning, the first set was tested for tensile strength when bending. The second set of testing plates was put into water with the temperature of  $60 \pm 2$  °C for 56 days in climatic chamber. After this time and conditioning, the

testing samples were tested for tensile strength when bending. The test was conducted according to the above – mentioned standard.



**Fig. 1:** Sample of test: Three-point test of submission to bending for plate at Instron 250 kN instrument

## 4. The procedure of monitoring the saturation – desiccation test

After conditioning, the first set was tested for tensile strength when bending. The second set was subjected to cycling – 18 hours water with the temperature  $20 \pm 2$  °C and 6 hours of drying in a ventilated drying kiln, with the temperature  $60 \pm 2$  °C. After the required number of 50 cycles, the testing samples were stored in a laboratory for 7 days with the laboratory conditions – temperature  $20 \pm 2$  °C and humidity 50 – 60 %. After the conditioning of the second set, the bending test was conducted.

## 5. The procedure of monitoring the frost resistance test

The testing plates were divided into two sets. After conditioning, the first set was tested for

tensile strength when bending. The second set was subjected to cycling – 2 hours freezing in water (ice) with the temperature  $-20 \pm 4$  °C and 2 hours of defrosting in water with the temperature  $20 \pm 4$  °C. The cycling was done automatically in a freezing chamber. After the required number of 100 cycles, the testing samples were conditioned. Subsequently, the bending test was carried out (fig. 2).



**Fig. 2:** Sample of results: The ratio of tensile strength when bending the testing samples (of both sets 1+2) direction across the fibers

## 6. The procedure of monitoring the impermeability test

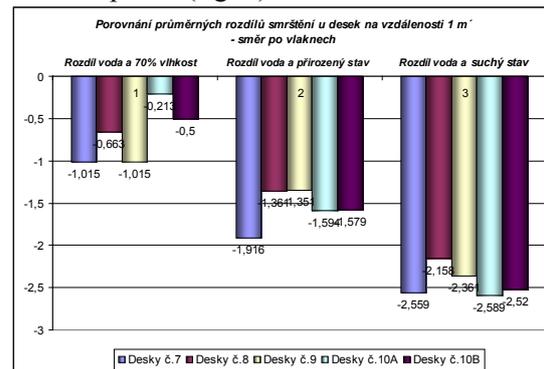
The purpose of testing was to monitor the bottom surfaces of the testing plates, so that it would not be possible water to move them. The test took 24 hours. After this time, the bottom surface was checked.

## 7. The following tests in addition to shrinkage

The aims of the tests were comparison of material length change values in predefined settings: dried-up plate, real condition after placing in laboratory and air humidity 70%, temperature 20°C.

In the first step were measured dimensions and weight of plates. In the second step were stuck on into each corner of plate gauging disc through use of two-pack paste. These measuring points were marked A, B, C, D. Due to positions of discs were possible measured length change both in direction

and in vertically direction of stiffening organic fibres in plates (fig. 3).



**Fig. 3:** Sample of results: Shrinkage of samples direction along the fibers

## 8. Experimental Results

Exclude the procedure of monitoring the hot water test the all others tests have very good results. We can see from measurements that the new selected recipes demonstrate more good results. Also – we can confirm that there are not big difference between tensile strengths of both sets.

The individual calculations, tables, individual graphs, photos from realization of the test and further documentation are available at the leader of the project because of the limited size of this article.

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## References

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