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Preparation and properties of PVA fiber cement board with different titers and different tenacities

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01

Preparation and properties of PVA fiber cement board with different titers

Research Background

- There were some customers in China who asked if we have PVA fibers with a diameter greater than 2dtex, so we produced PVA fibers with larger diameters. To understand the difference between these PVA fibers, we did this research work.

The Experimental Raw Material

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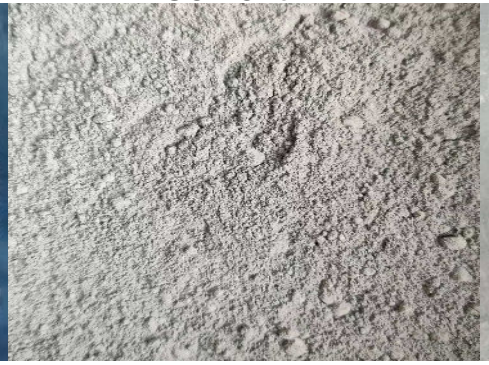
Raw material

Cement

Limestone

PVA fiber



Microsilica

Pulp

The Experimental Raw Material

Table 1 Analysis results of PVA fiber with different titers

Type	Grades	Titer (dtex)	Tenacity (cN/dtex)	E-Modulus (cN/dtex)	Elongation (%)
2dtex fiber(6mm)	SX1	2.20	13.16	324.07	6.16
7dtex fiber(6mm)	SX7t	7.48	10.63	269.29	7.83
9dtex fiber(6mm)	SX9t	9.44	9.52	250.59	7.82

Table 2 Specification of SX1, SX7t, SX9t

Grades	Titer (dtex)	Tenacity (cN/dtex)	E-Modulus (cN/dtex)	Elongation (%)
SX1	2.0±0.25	≥12.8	≥300	≤7.0
SX7t	7.0±1.0	≥10.5	≥250	≤8.0
SX9t	10.0±1.0	≥9.5	≥230	≤9.0

The Experimental Raw Material

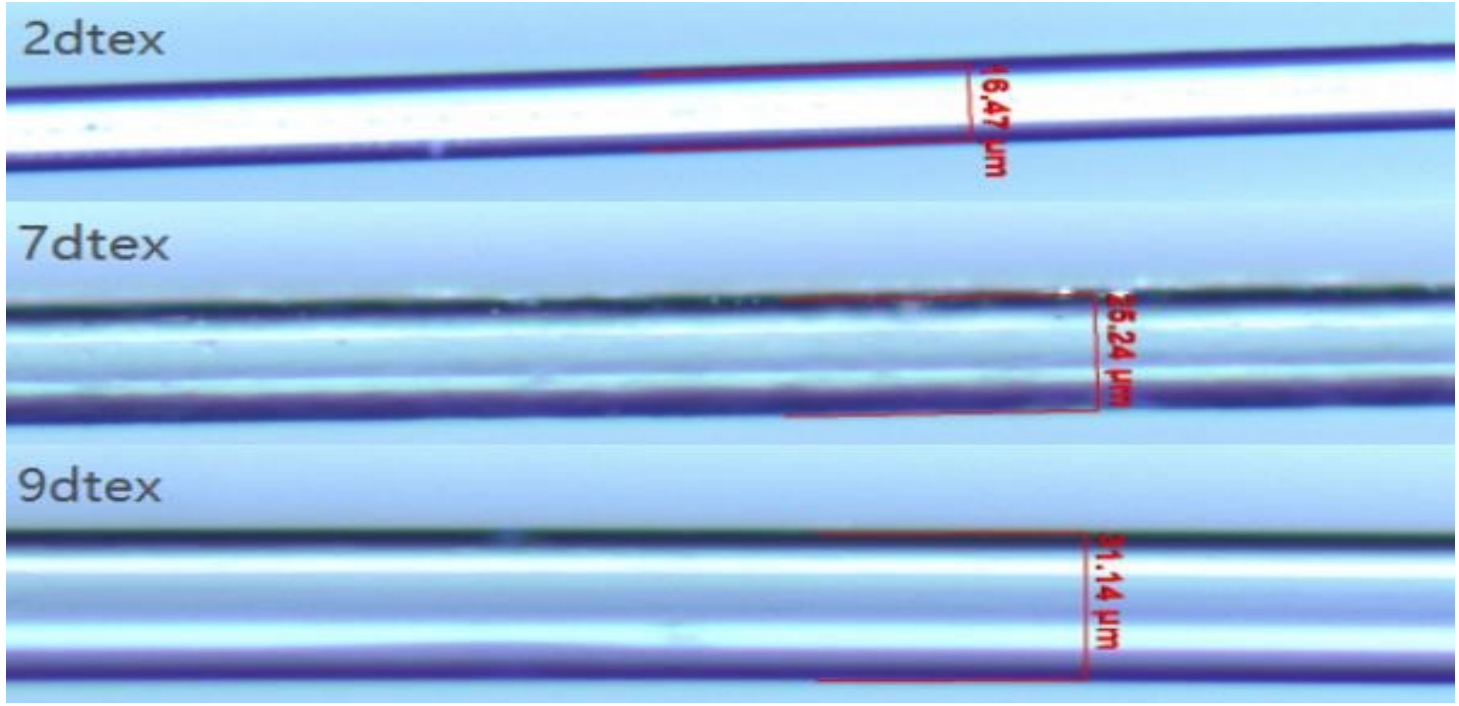


Figure.1 Polarized microscope photograph of PVA fibers with 2dtex, 7dtex and 9dtex

The Experimental Method

Table 3 Experimental formulation of PVA fiber cement board with different titer

Sample	PVA fiber (%)	Cement (%)	Pulp (%)	Microsilica powder(%)	Limestone powder(%)	Remark
1	0.0	81.5	3.5	5.0	10.0	The board preparation experiment was carried out according to the 8 different addition amounts, and three parallel experiments were conducted for each formulation.
2	0.8	80.7	3.5	5.0	10.0	
3	1.0	80.5	3.5	5.0	10.0	
4	1.2	80.3	3.5	5.0	10.0	
5	1.5	80.0	3.5	5.0	10.0	
6	1.8	79.7	3.5	5.0	10.0	
7	2.0	79.5	3.5	5.0	10.0	
8	2.2	79.3	3.5	5.0	10.0	

The Experimental Method

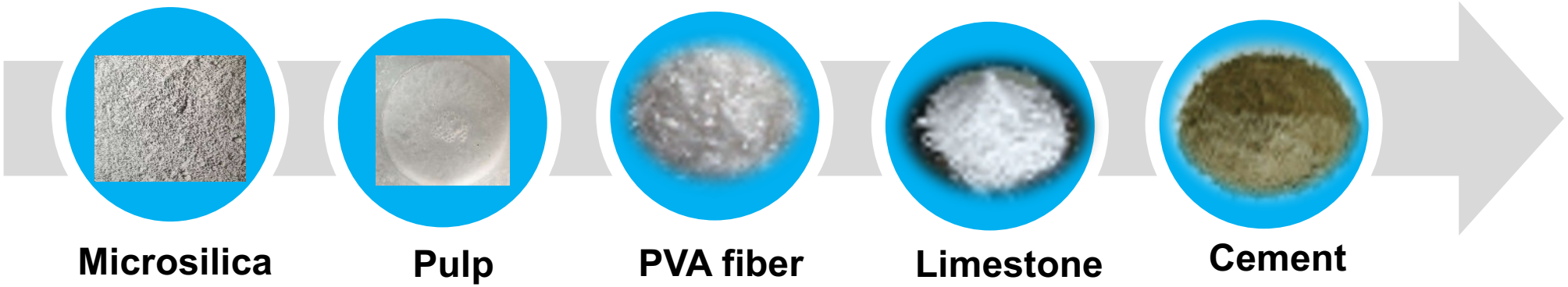


Figure. 2 The feeding sequenc of experiment

The Experimental Method

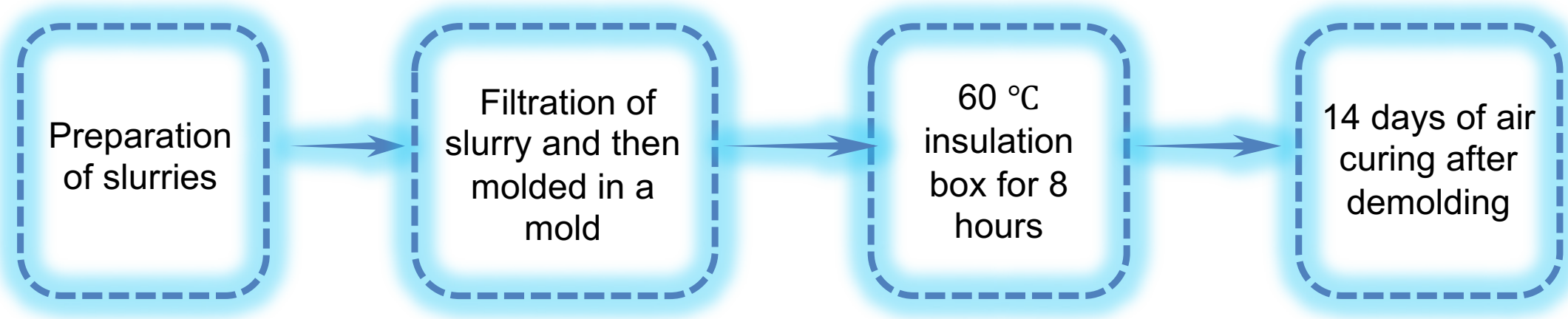


Figure. 3 Experimental steps of PVA fiber cement board with different titers

The Experimental Method

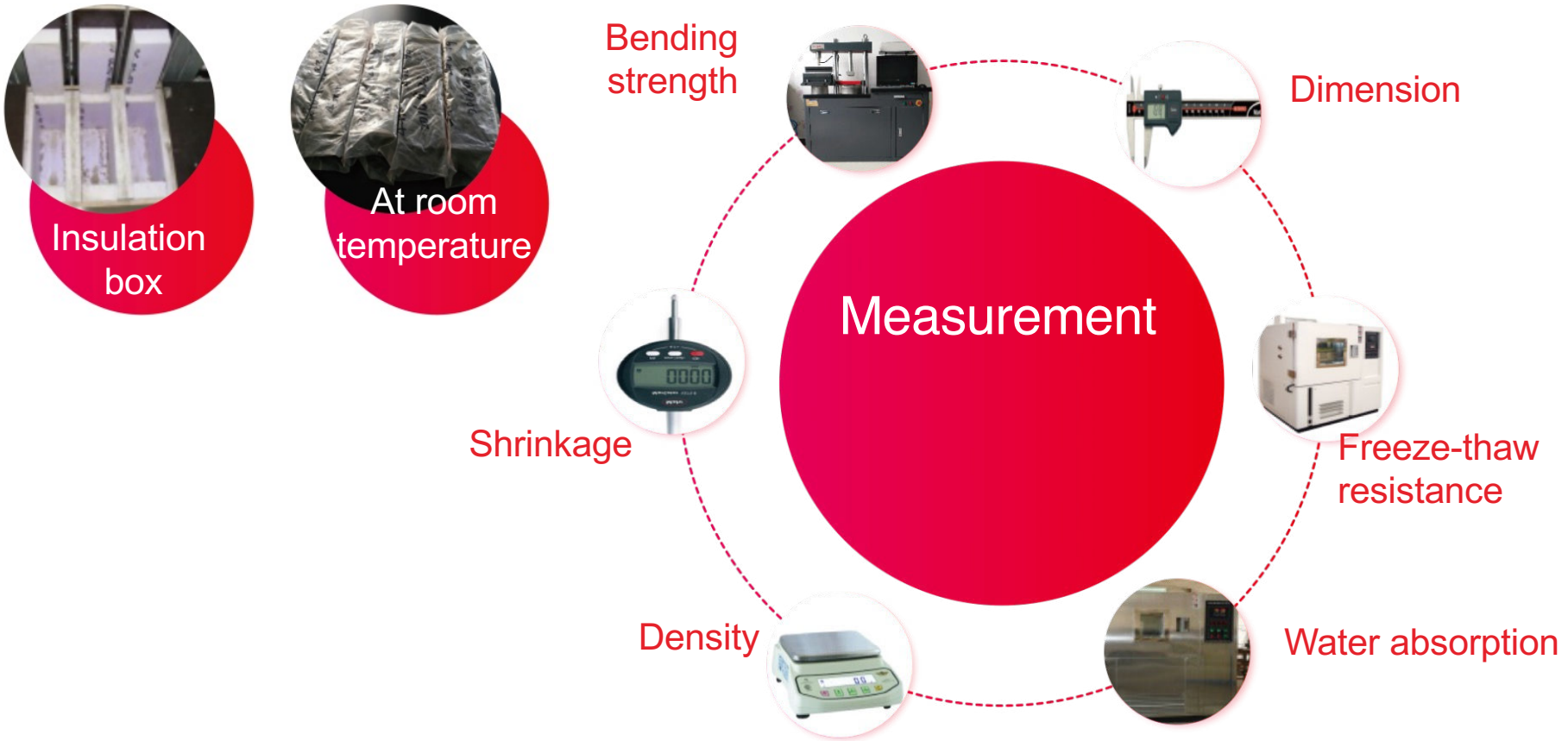


Figure. 4 Performance testing of PVA fiber cement board

The Experimental Method

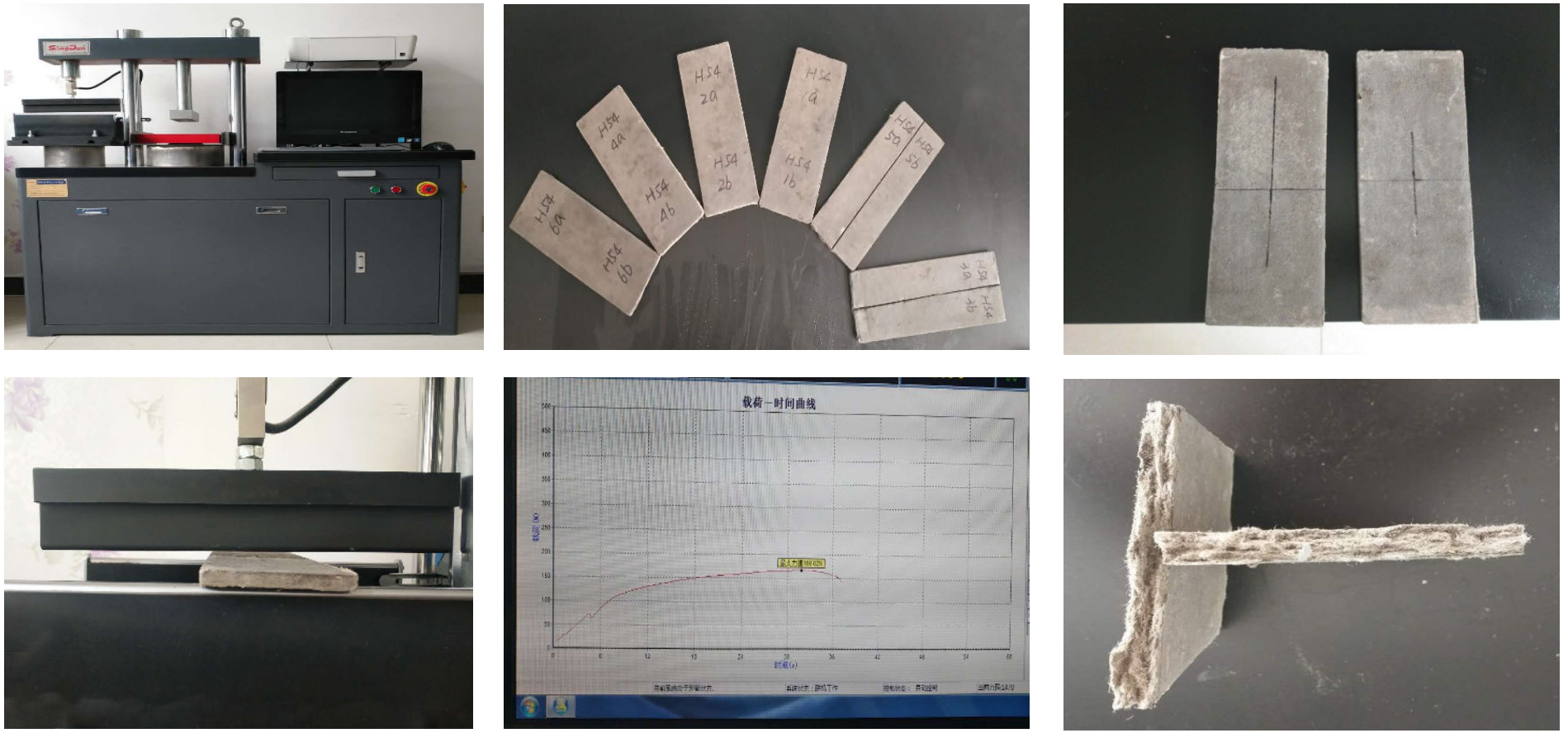


Figure. 5 The bending strength test and pictures of fiber cement board

The Experimental Results

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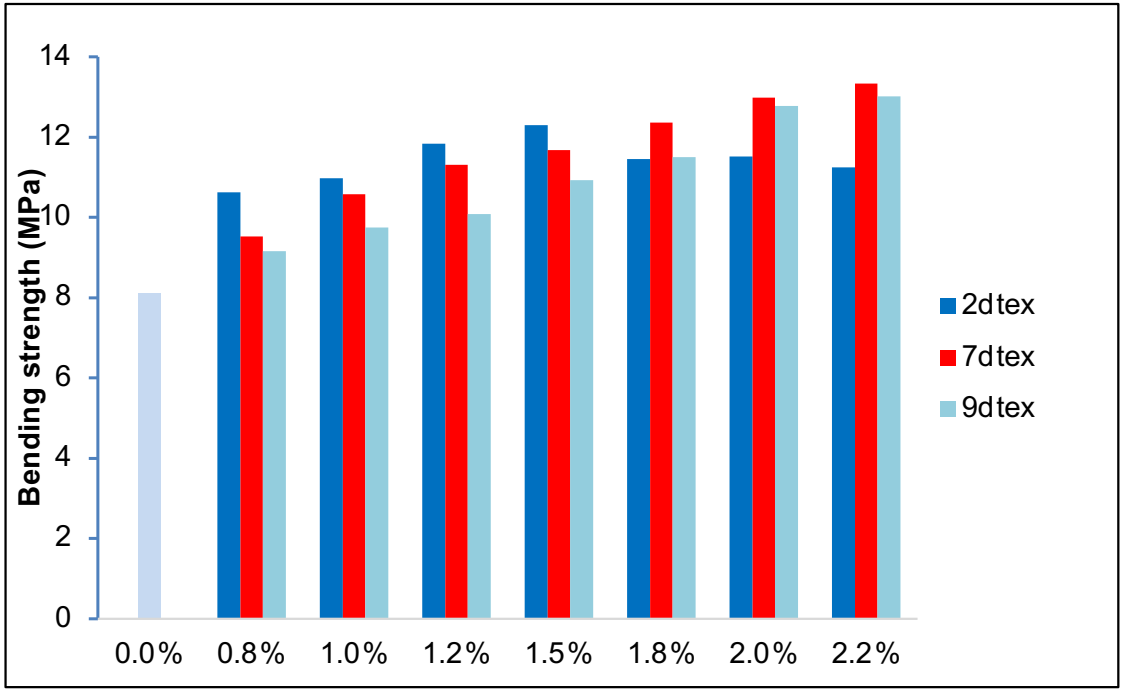
Bending strength



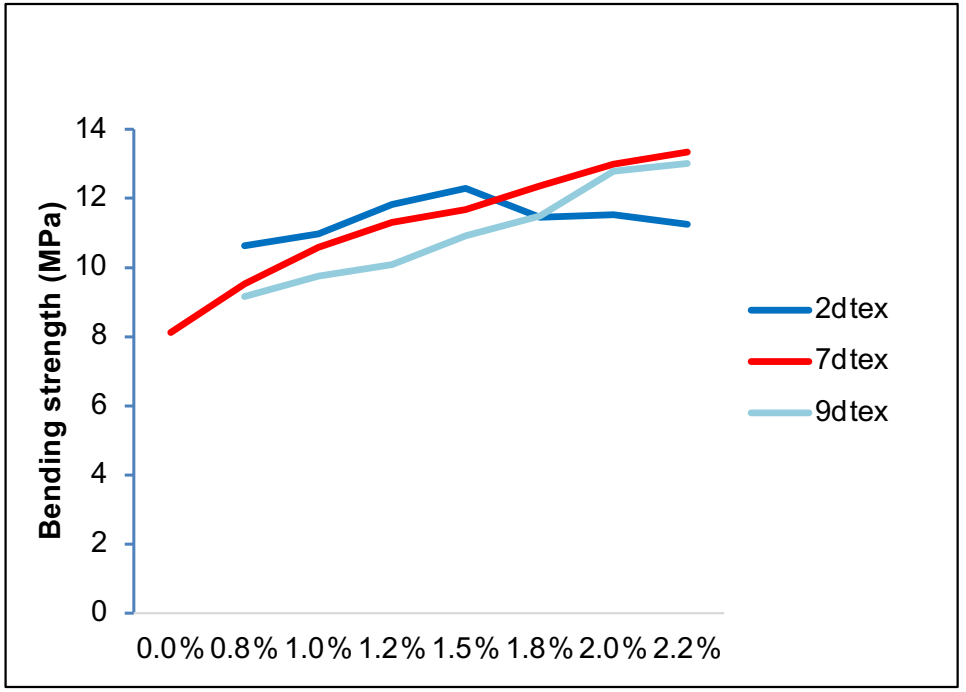


Figure. 6 The bending strength of fiber cement boards prepared using 2dtex, 7dtex and 9dtex fibers

The Experimental Results

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Dry and wet density

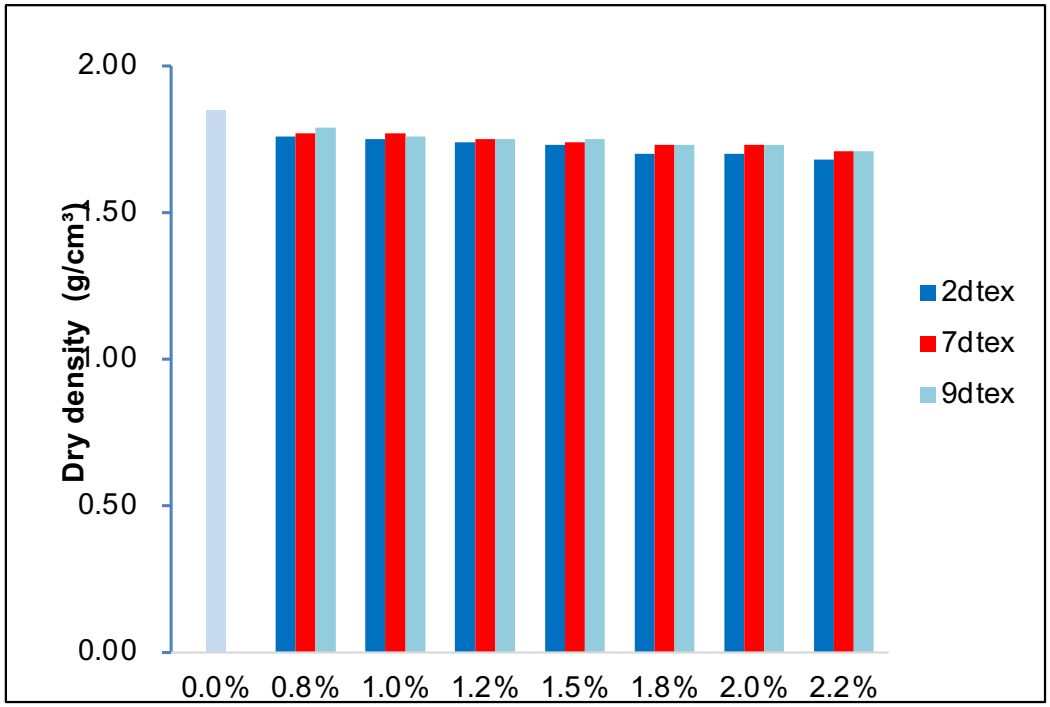

Figure. 7 Dry density of fiber cement board using 2dtex, 7dtex and 9dtex fibers

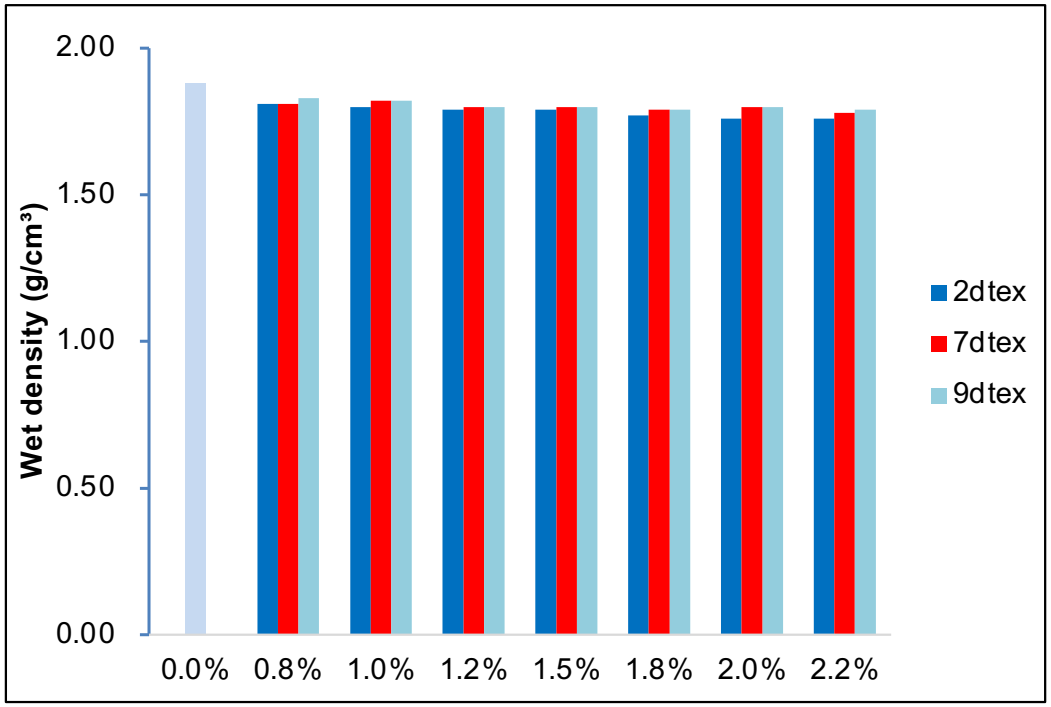

Figure. 8 Wet density of fiber cement board using 2dtex, 7dtex and 9dtex fibers

The Experimental Results

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Water absorption

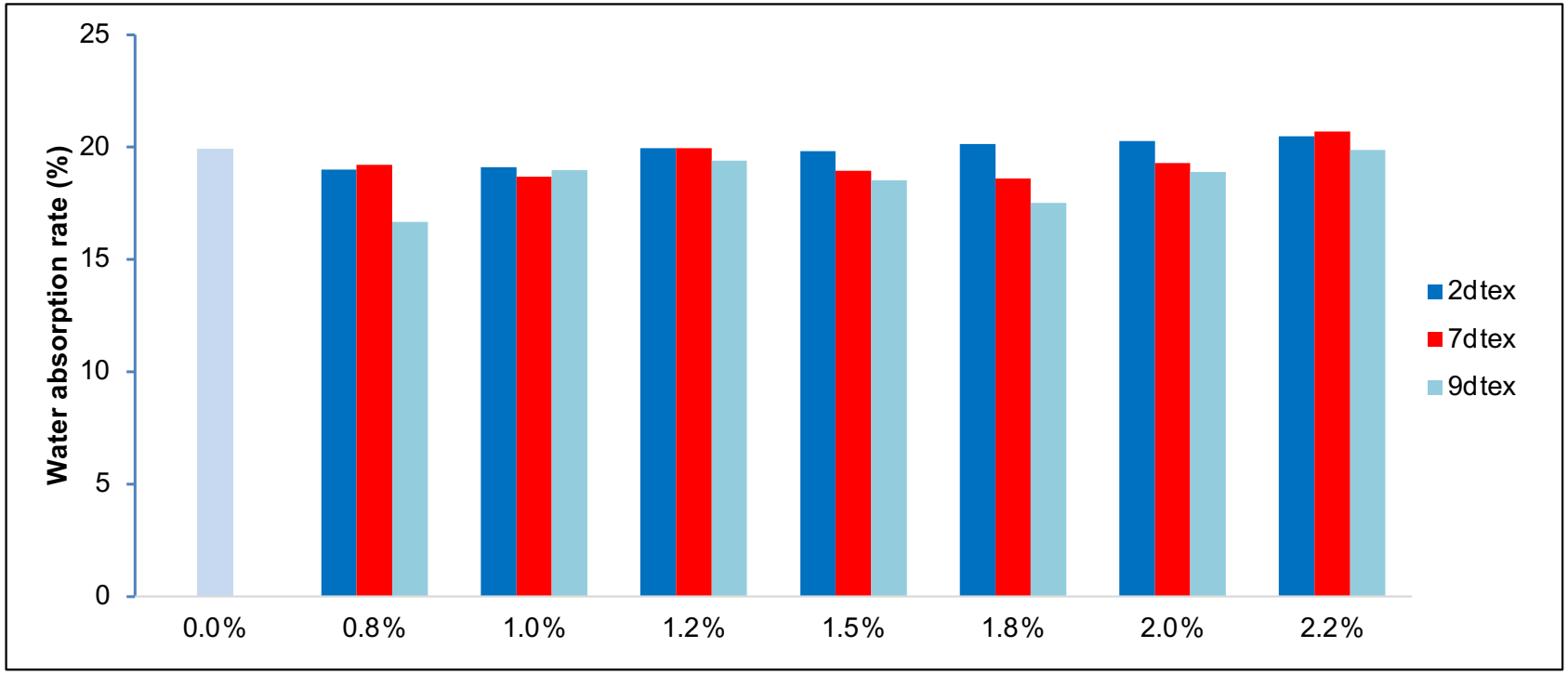

Figure. 9 Water absorption rate of fiber cement board using 2dtex, 7dtex and 9dtex fibers

The Experimental Results

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Dry and wet shrinkage

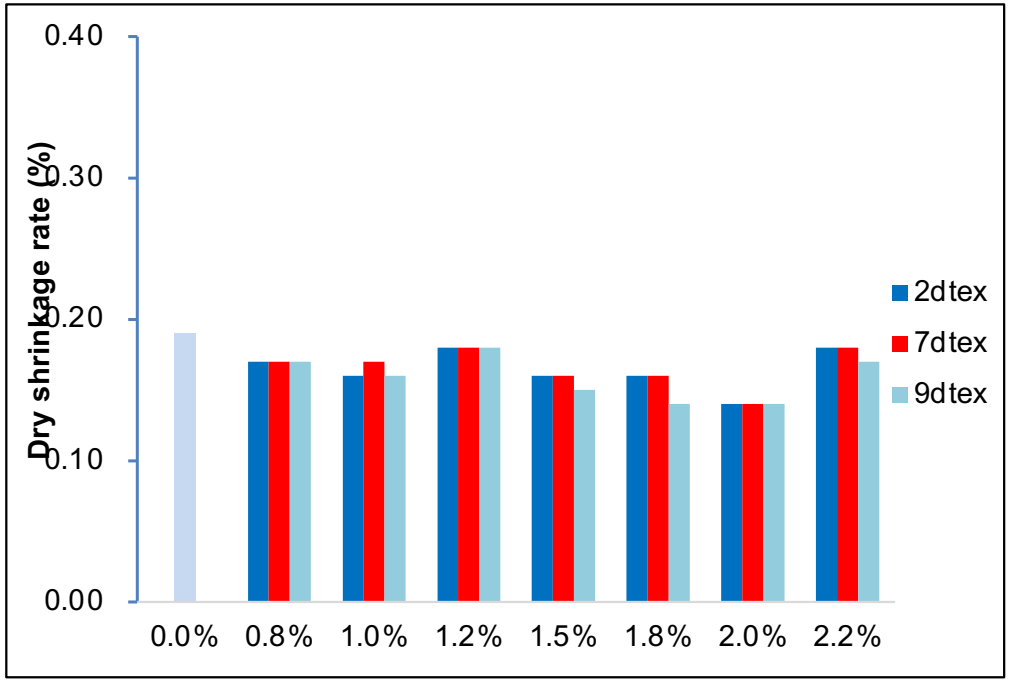

Figure. 10 Dry shrinkage rate of fiber cement board using 2dtex, 7dtex and 9dtex fibers

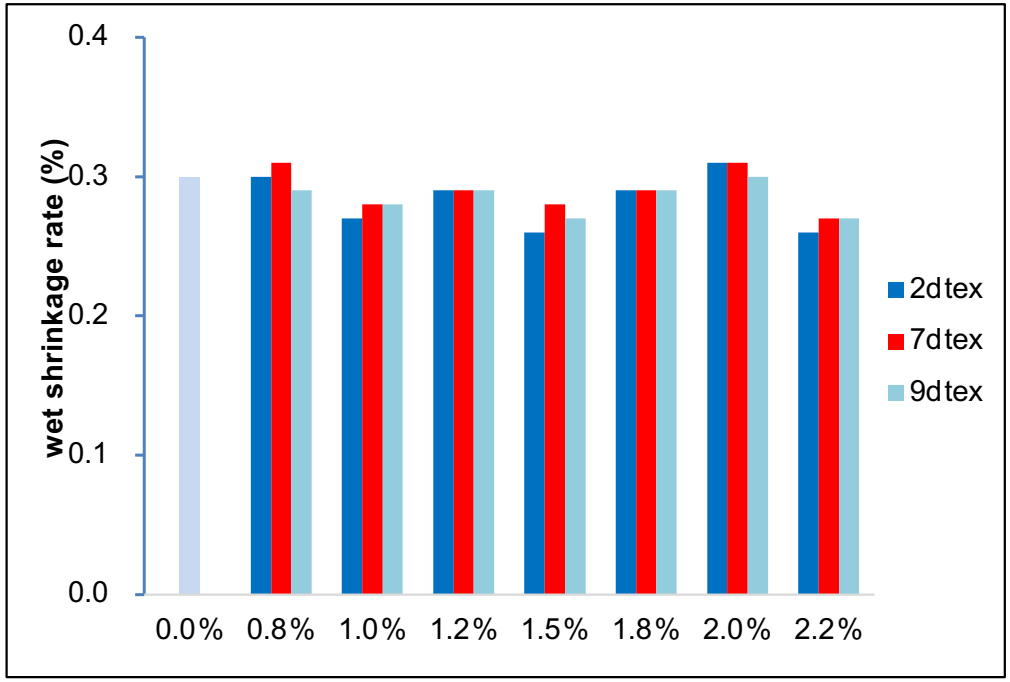

Figure. 11 Wet shrinkage rate of fiber cement board using 2dtex, 7dtex and 9dtex fibers

The Experimental Results

- The bending strength of the fiber cement board with 2dtex fiber is greater than that with 7dtex fiber and 7dtex fiber is greater than 9dtex fiber when the addition amount is the same
- The bending strength increases when the addition ratio increases
- Within the range of 0.0 to 2.2% of fiber addition of the experiment, the bending strength increases when fiber addition ratio increases for 7dtex and 9dtex fibers. The diameters of 7dtex and 9dtex fibers are larger, when adding the same amount, the number of fiber is comparatively less, so the fibers are evenly distributed
- As the increase of fiber addition amount, the dry and wet density of the fiber cement board prepared using 2dtex, 7dtex and 9dtex fibers decreased
- There is no obvious difference in the water absorption rate, the dry and wet shrinkage rate of the fiber cement board for 2dtex, 7dtex, and 9dtex fibers

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02

Preparation and properties of PVA fiber cement board with different tenacities

The Experimental Raw Material

Table 4 Analysis results of PVA fiber with different tenacities

Type	Grades	Titer (dtex)	Tenacity (cN/dtex)	E-Modulus (cN/dtex)	Elongation (%)	Visual classification of dispersion (6 classes)
2dtex Fiber-1	SX1	2.02	12.94	310.53	6.20	1
2dtex Fiber-2	SSX1	2.16	13.89	322.18	6.21	1

Table 5 Specification of SX1 and SSX1

Grades	Titer (dtex)	Tenacity (cN/dtex)	E-Modulus (cN/dtex)	Elongation (%)	Visual classification of dispersion (6 classes)
SX1	2.0±0.25	≥12.8	≥300	≤7.0	1
SSX1	2.0±0.25	≥13.5	≥320	≤7.0	1

The Experimental Raw Material

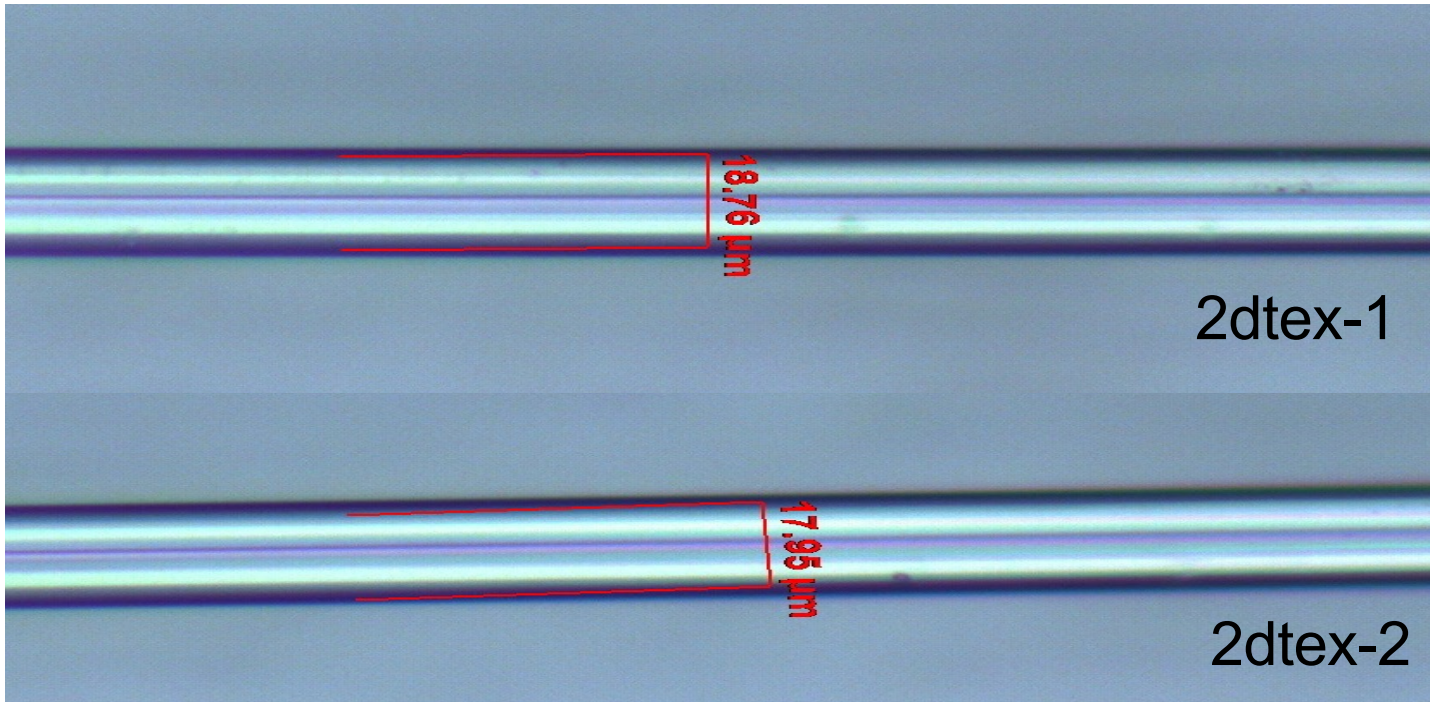

Figure. 12 Polarized microscope photograph of PVA fibers with with 2dtex-1 and 2dtex-2

The Experimental Raw Material

Table 6 Experimental formulation of PVA fiber cement board with different tenacities

Sample	PVA fiber (%)	Cement (%)	Pulp (%)	Microsilica powder(%)	Limestone powder(%)	Remark
1	0.0	81.5	3.5	5.0	10.0	The board preparation experiment was carried out according to the 8 different addition amounts, and three parallel experiments were conducted for each formulation.
2	0.8	80.7	3.5	5.0	10.0	
3	1.0	80.5	3.5	5.0	10.0	
4	1.2	80.3	3.5	5.0	10.0	
5	1.5	80.0	3.5	5.0	10.0	
6	1.8	79.7	3.5	5.0	10.0	
7	2.0	79.5	3.5	5.0	10.0	
8	2.2	79.3	3.5	5.0	10.0	

The Experimental Results

Bending strength

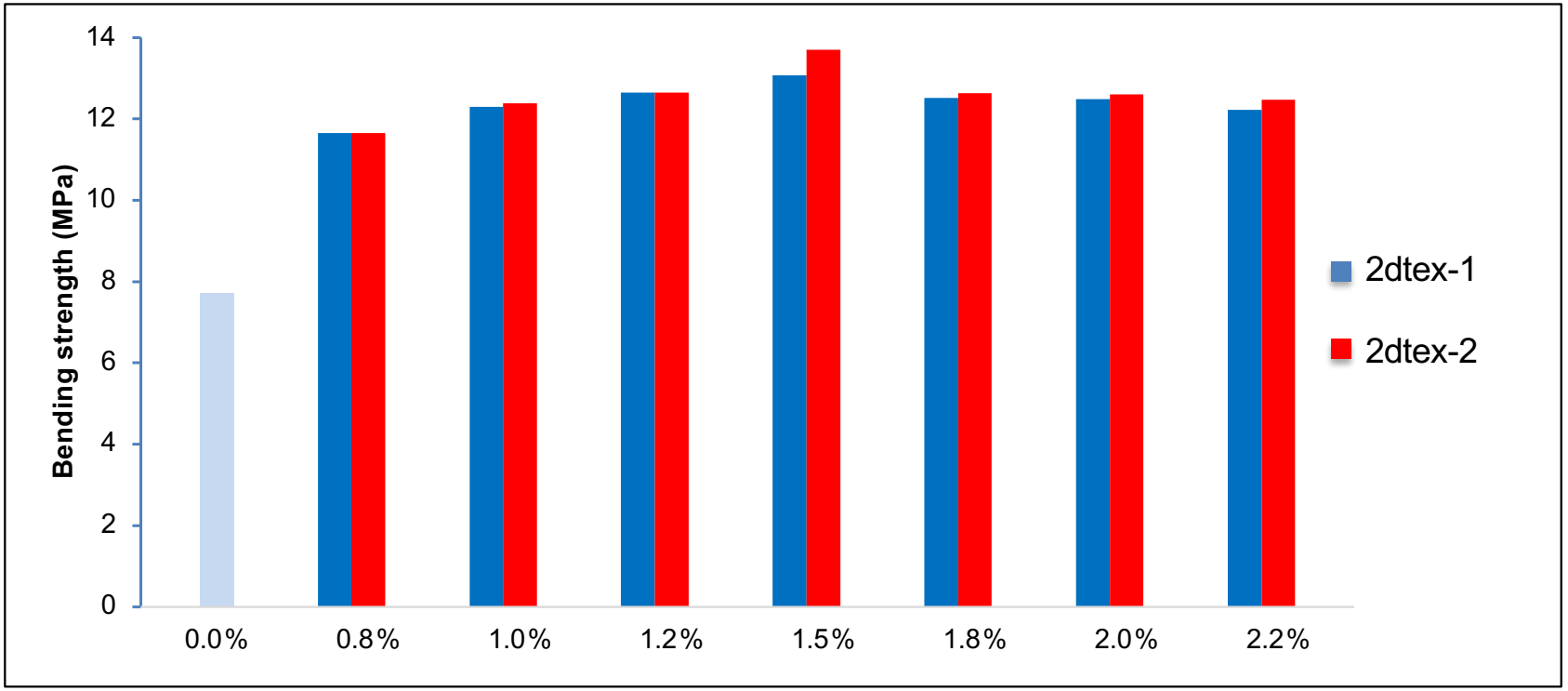

Figure. 13 Bending strength of fiber cement board using 2dtex-1 and 2dtex-2

The Experimental Results

Dry and wet density

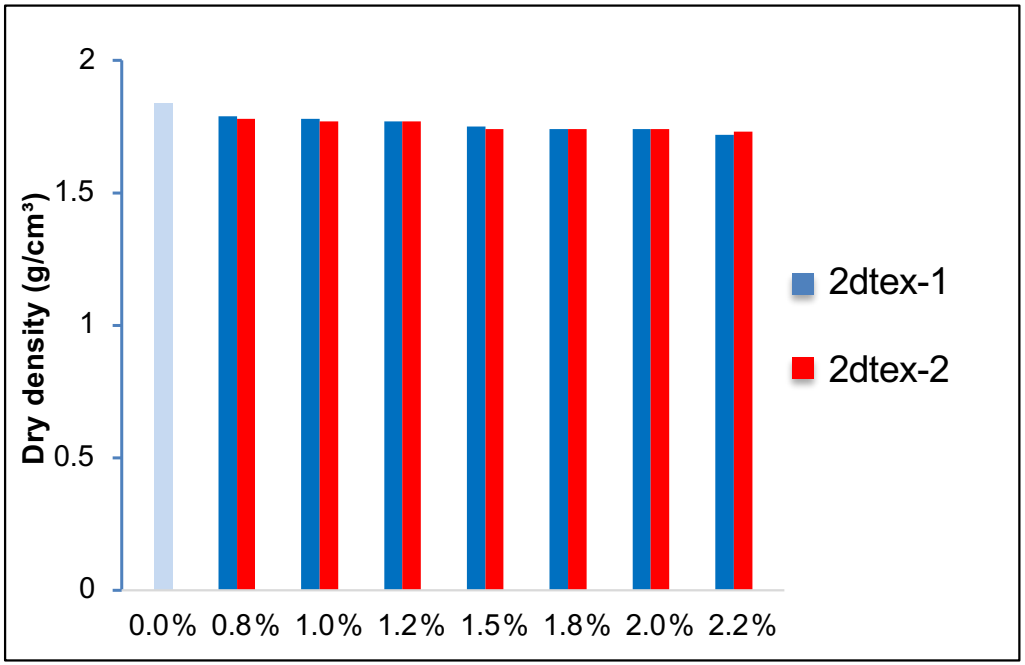

Figure. 14 Dry density of fiber cement board prepared using 2dtex-1 and 2dtex-2

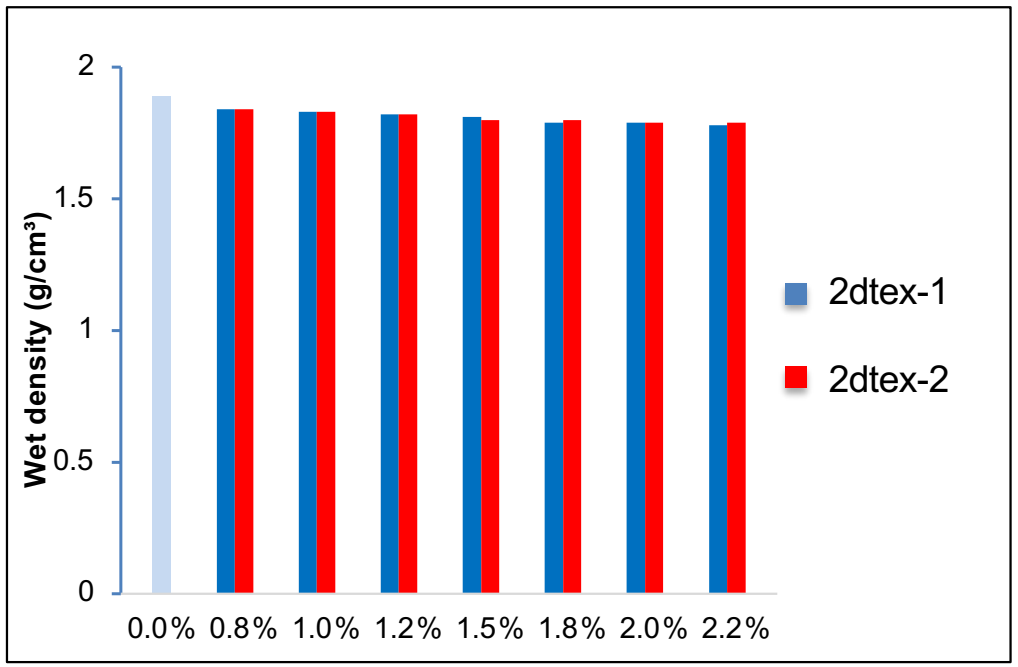

Figure. 15 Wet density of fiber cement board prepared using 2dtex-1 and 2dtex-2

The Experimental Results

Water absorption

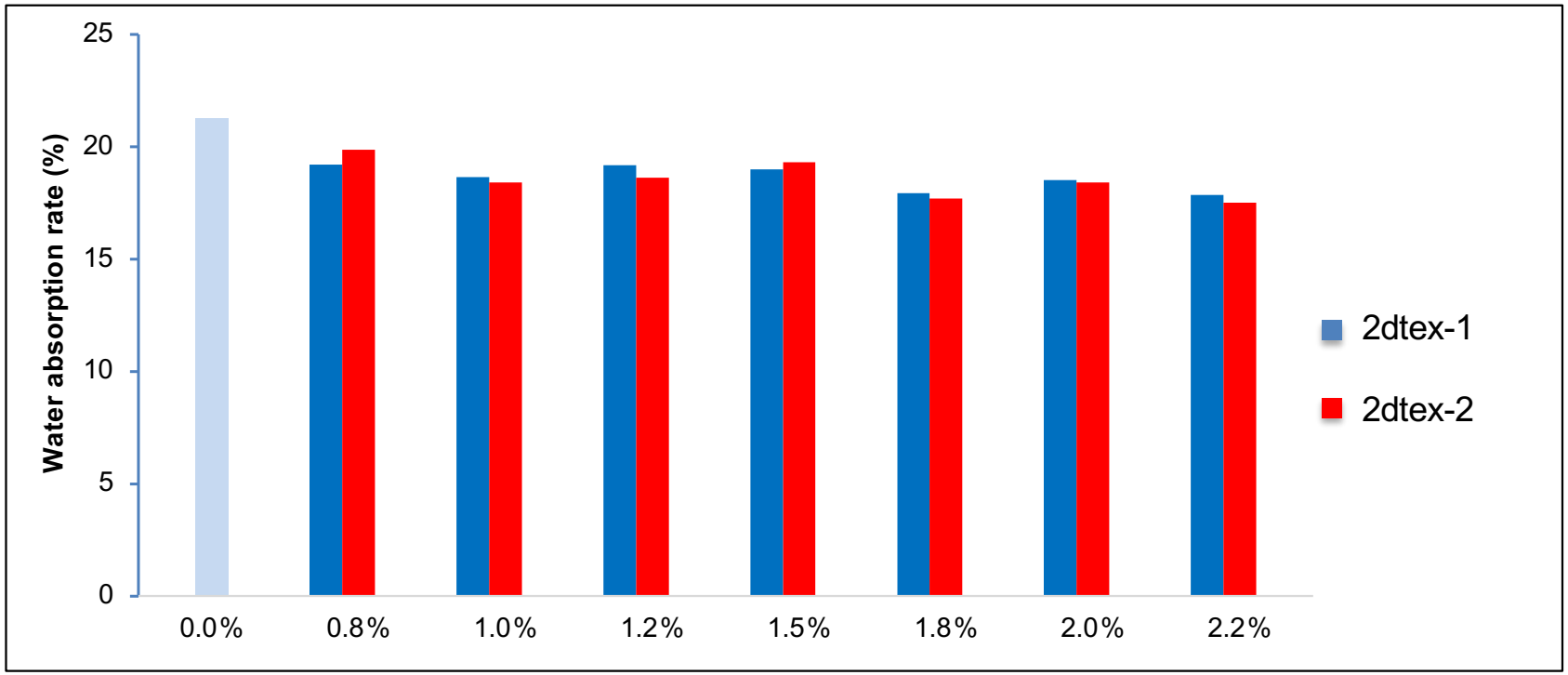

Figure. 16 Water absorption rate of fiber cement board prepared using 2dtex-1 and 2dtex-2

The Experimental Results

Dry and wet shrinkage

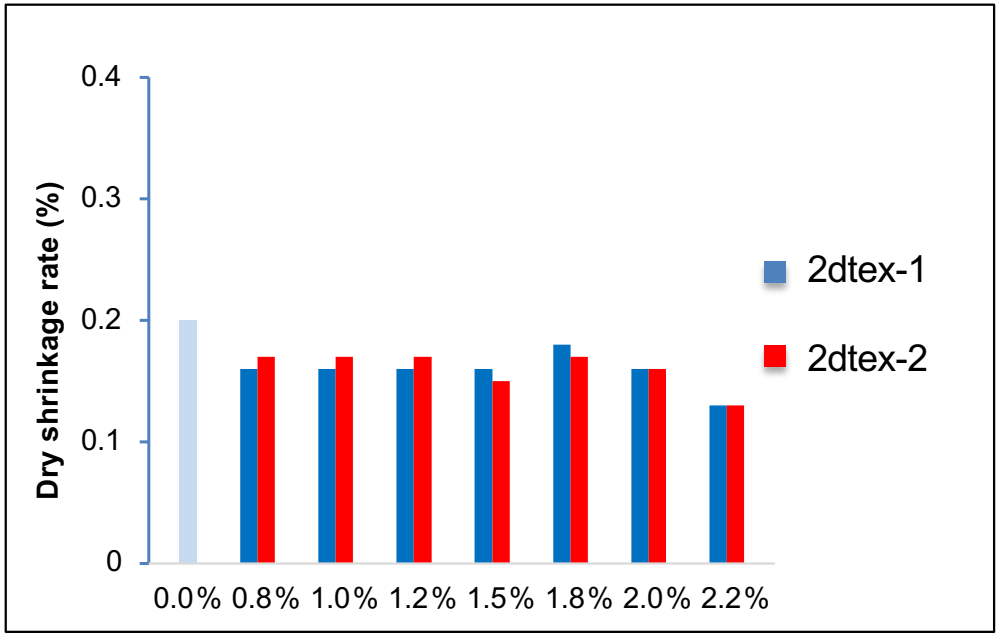

Figure.17 Dry shrinkage rate of fiber cement board prepared using 2dtex-1 and 2dtex-2

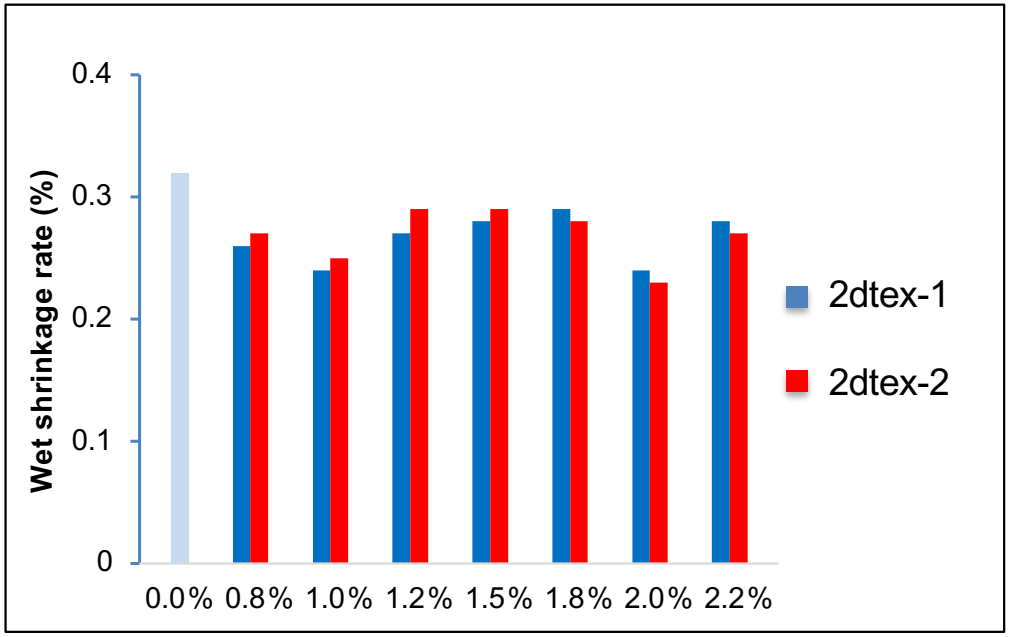

Figure. 18 Wet shrinkage rate of fiber cement board prepared using 2dtex-1 and 2dtex-2

The Experimental Results

- The bending strength of fiber cement board using 2dtex-2 is greater than that of 2dtex-1
- The bending strength increases when the addition amount increases
- As the fiber addition ratio increases, the dry and wet densities of fiber cement board using 2dtex-1 and 2dtex-2 fibers reduced
- There is no significant difference in the water absorption, dry shrinkage, wet shrinkage of the fiber cement board using 2dtex-1 and 2dtex-2 fibers

Summary

- Within the range of 0.0 to 2.2% of fiber addition of the experiment, the bending strength has a maximum value, so there is an optimal addition ratio for 2dtex fiber. The optimal amount of PVA fiber added on the actual production line needs to be determined through production testing
- The bending strength of 7dtex and 9 dtex fibers increases when the amount of addition increase, which is the same rule as 2 dtex fiber
- The greater the tenacity of PVA fiber, the greater the bending strength of PVA fiber cement board

R&D Team Members

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THANKS FOR YOUR ATTENTION!

Sincerely Look Forward to Cooperation with you!

Contact Us

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