REPORT

TEST DATA FOR PHYSICAL PROPERTIES OF THERMO TREATED WOOD COMPARED WITH NON-TREATED WOOD (AHS, OAK, POPLAR, PINE)

Provided by:
WESTWOOD Heat Treated Lumber Corporation and
Keim Lumber Company
at the facility of Keim Lumber Company, Charm, OH, 44617

Tests provided: October, 2007/September, 2008

USA, 2008

Experiment # 1.
Shrinkage of wood in Thermo-treatment process.

The research method.
Measurements of thickness and width of the boards before and after treatment.
For each species 20-30 samples was used.

Test Results (October, 2007).

Species	Size, in	Thickness decrease	Width decrease	Volume decrease factor
Pine	1x12	2,1%	2,1%	95,8%
Pine	1x6	1,8%	2,1%	96,1%
Yellow Pine	1x6	1,8%	2,7%	95,5%
Eastern White Pine	2x8	0,9%	1,4%	97,7%
Cedar	1x6	0,7%	2,3%	97,0%
Atlantic White Cedar	1x6	1,2%	1,6%	97,2%
Poplar	1x6	2,1%	3,7%	94,3%
Poplar	5/4x6	2,3%	3,4%	94,4%
Poplar	2x8	2,1%	2,4%	95,6%
Hard Maple	1x6	2,9%	4,6%	92,6%
Hard Maple	2x6	1,7%	2,7%	95,6%
Soft Maple	1x8	2,3%	3,4%	94,4%
Soft Maple	5/4x6	1,4%	3,7%	95,0%
Cherry	1x6	1,9%	3,2%	95,0%
Hickory	1x8	2,4%	3,1%	94,6%
Sawn Red Oak	1x6	4,7%	2,4%	93,0%
Red Oak	1x8	3,2%	4,6%	92,3%
Sawn White Oak	1x6	2,9%	1,9%	95,3%
White Oak	1x6	1,8%	2,8%	95,5%
E.W.P.	1x10	1,6%	2,2%	96,2%
Mahogany	1x8	1,9%	2,2%	95,9%
Ash	1x8	2,6%	3,7%	93,8%
Walnut	1x6	1,1%	1,7%	97,2%

Results.

1. **The shrinkage in average 2% in thickness and 3% in width.**

2. **The average volume decrease factor is 0,95 (5% loss). It reduced in proportion to the equilibrium moisture reduction of thermo-treated material.**

Experiment # 2
Weight loss in Thermo-treatment process.

The research method.
Measurements of weight of the boards before and after treatment.
For each species 4-5 samples was used.

Test Results.

# of sample	Species	Before, lb	After, lb	Weight loss, lb	Weight loss in %	Average for species	Weight decrease factor	Density decrease factor
1	pine	23,680	19,567	4,113	17,4%	18,7%	81,3%	84,8%
2	pine	23,170	18,814	4,356	18,8%			
3	pine	28,290	22,742	5,548	19,6%			
4	pine	26,870	21,406	5,464	20,3%			
5	pine	24,650	20,392	4,258	17,3%			
11	oak	25,430	19,774	5,656	22,2%	22,6%	77,4%	83,9%
12	oak	16,125	12,500	3,625	22,5%			
13	oak	32,500	25,095	7,405	22,8%			
14	oak	27,279	20,890	6,389	23,4%			
15	oak	18,510	14,462	4,048	21,9%			
21	ash	20,611	16,306	4,305	20,9%	22,4%	77,6%	82,7%
22	ash	18,079	14,010	4,069	22,5%			
23	ash	16,171	12,554	3,617	22,4%			
24	ash	28,037	21,360	6,677	23,8%			
25	ash	30,211	23,418	6,793	22,5%			
32	poplar	18,110	13,810	4,300	23,7%	23,2%	76,8%	81,5%
33	poplar	28,500	21,824	6,676	23,4%			
34	poplar	16,260	12,548	3,712	22,8%			
35	poplar	12,540	9,700	2,840	22,6%			

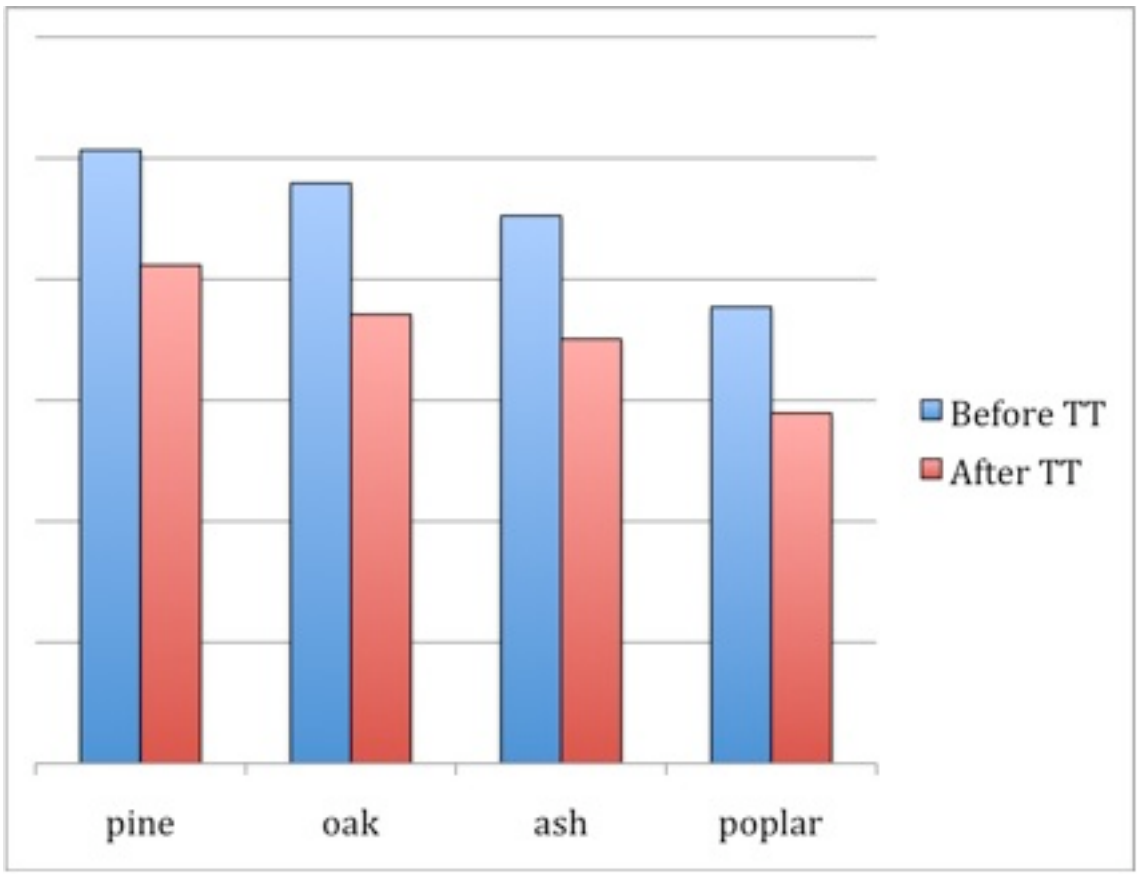
Results.

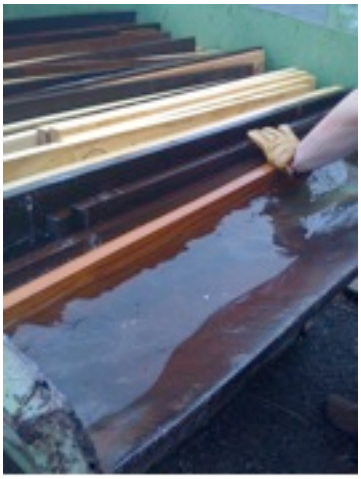
The significant weight loss factor is caused by two reasons:

1. Equilibrium moisture decreases (at least 2 times, compared with non-treated wood). This decreases the weight on factor 4-5%.
2. The wood elements emission while treated (15-18%).

Because we know from Experiment # 1 the Volume decrease factor for each species, we can easily calculate the **Density decrease factor** (see results in the Table).

The strength loss factor proportional to the Density decrease factor, so this data also can be used as a **Strength loss factor.**


Before TT
After TT
pine
oak
ash
poplar



Experiment # 3
Water absorption of samples with the coated ends. Short time interval (3 hours).

The research method.
Placing the samples of thermo-treated and untreated wood into the water and measuring its weight.
For each species 4-5 samples was used.

Test Results.

Specie	Width of sample, in	Srtart Weight of sample, lb	Weight after 3 hours in water, lb	Weight change, lb	Weight change, %	Weight change/Width of sample (inch), %	Average
pine	8,015	12,390	13,290	0,900	7,3%	0,91%	0,91%
pine	8,015	14,584	15,644	1,060	7,3%	0,91%	
pine	8,015	12,390	13,296	0,906	7,3%	0,91%	
pine T	**8,015**	**8,637**	**9,280**	**0,643**	**7,4%**	**0,93%**	**0,90%**
pine T	**8,015**	**10,799**	**11,558**	**0,759**	**7,0%**	**0,88%**	
pine T coated	***6,015***	***9,882***	***10,031***	***0,149***	***1,5%***	**0,25%**	**0,33%**
pine T coated	***6,020***	***7,217***	***7,397***	***0,180***	***2,5%***	**0,41%**	
oak	5,015	7,419	7,689	0,270	3,6%	0,73%	0,70%
oak	11,015	19,814	21,276	1,462	7,4%	0,67%	
oak T	**5,015**	**6,020**	**6,118**	**0,098**	**1,6%**	**0,32%**	**0,27%**
oak T	**8,000**	**9,759**	**9,940**	**0,181**	**1,9%**	**0,23%**	
oak T	**8,015**	**9,896**	**10,123**	**0,227**	**2,3%**	**0,29%**	
oak T	**10,015**	**11,480**	**11,754**	**0,274**	**2,4%**	**0,24%**	
ash	6,015	11,177	11,534	0,357	3,2%	0,53%	0,51%
ash	6,015	11,128	11,506	0,378	3,4%	0,56%	
ash	8,015	16,462	17,022	0,560	3,4%	0,42%	
ash T	**5,015**	**7,696**	**7,818**	**0,122**	**1,6%**	**0,32%**	**0,30%**
ash T	**8,015**	**10,437**	**10,681**	**0,244**	**2,3%**	**0,29%**	
poplar	7,015	8,050	8,388	0,338	4,2%	0,60%	0,73%
poplar	6,015	6,666	7,012	0,346	5,2%	0,86%	
poplar T	**6,015**	**6,390**	**6,638**	**0,248**	**3,9%**	**0,65%**	**0,59%**
poplar T	**11,015**	**9,777**	**10,351**	**0,574**	**5,9%**	**0,53%**	

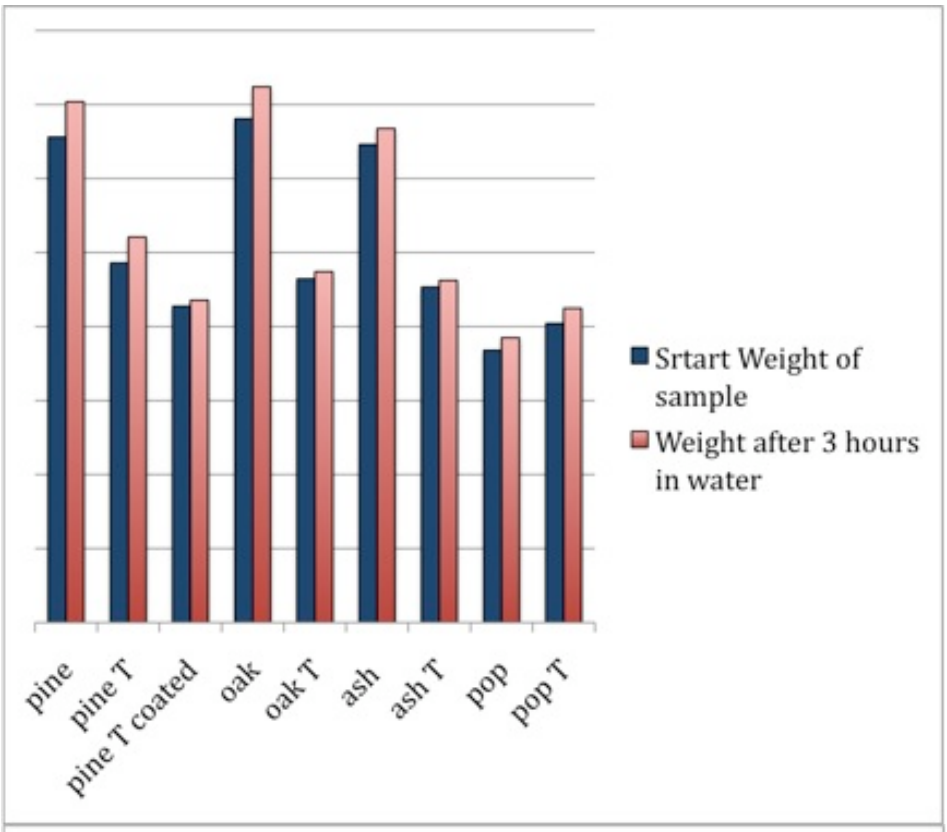
Results.

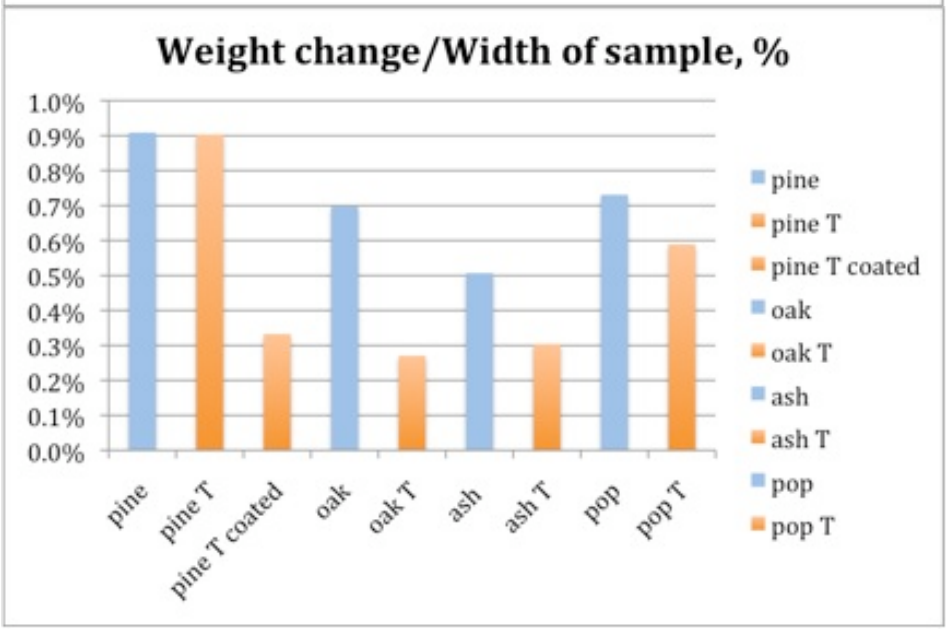
1. **We see the water absorption of Pine is almost similar with non-treated wood. For Ash and Red Oak the water absorption decreased in a factor 2 compared with un-treated wood., for poplar – in a factor 1,3.**

2. **The thermo-treated coated pine (1 coating) shows significant decrease of water absorption compared to the non-coated material (3 times less).**

For get more objective results we'll use the parameter of Weight change to one inch of the sample (to decrease the influence the factor of the samples width variety).

3. **Because of the density of thermo-treated wood decreased on 15-18%, the real water resistance to the short water treatment, caused by the thermo-treatment changes of wood at molecular level, increases in 3 times for Ash and Oak, in 2 times for Poplar and on 15% for Pine.**





Experiment # 4
Water absorption of samples with the cut (open) ends.
Short time interval (3 hours).

The research method.
Placing the samples of thermo-treated and untreated wood into the water and measuring its weight.
For each species 1-2 samples was used.

Test Results.

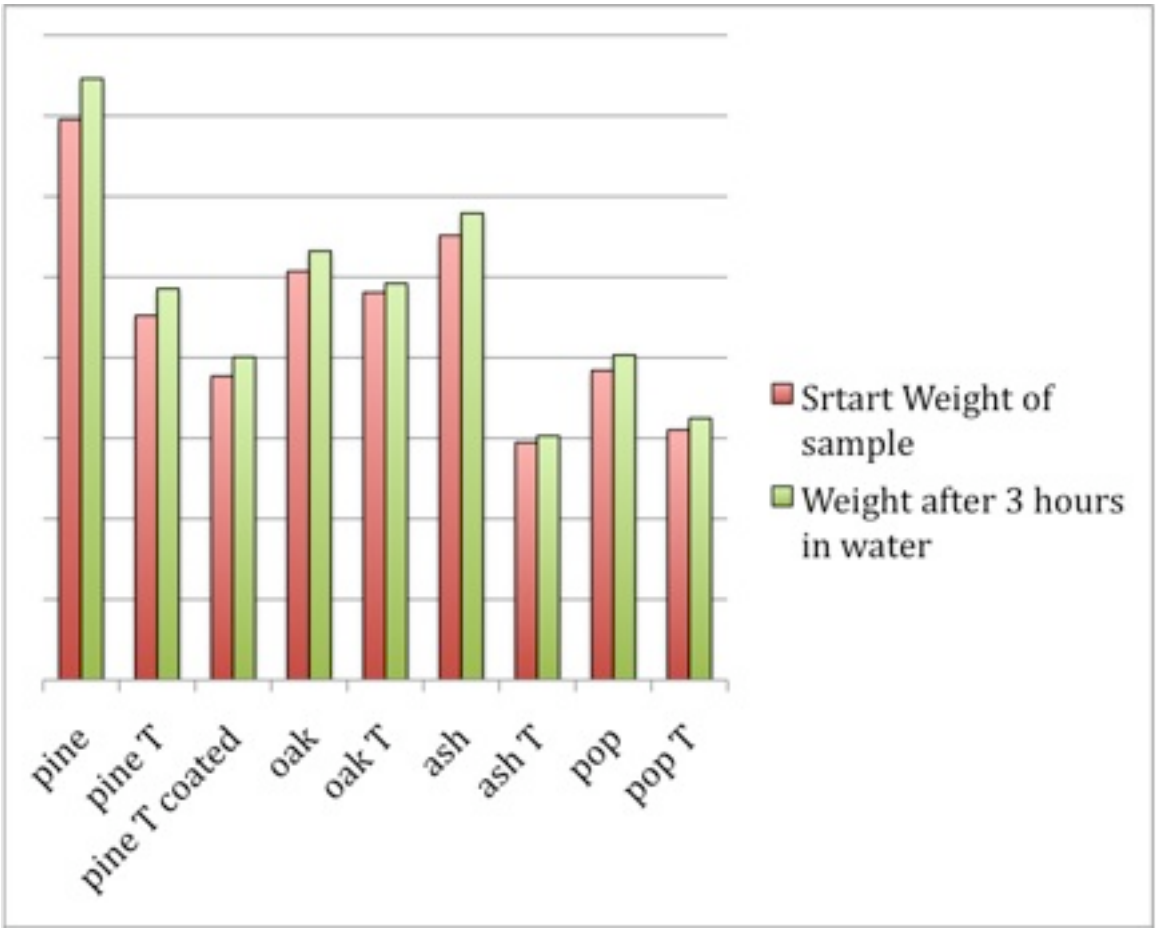
#	Species	Width of sample, in	Srtart Weight of sample	Weight after 3 hours in water	Weight change, lb	Weight change, %	Weight change/Width of sample, %, cut ends
1	pine	8,015	13,914	14,926	1,012	7,3%	0,91%
2	**pine T**	**8,015**	**9,044**	**9,701**	**0,657**	**7,3%**	**0,91%**
3	***pine T coated***	***6,015***	***7,539***	***7,945***	***0,406***	***5,4%***	***0,90%***
5	oak	7,015	10,141	10,646	0,505	5,0%	0,71%
4	**oak T**	**8,015**	**9,618**	**9,843**	**0,225**	**2,3%**	**0,29%**
6	ash	6,015	11,031	11,584	0,553	5,0%	0,83%
7	**ash T**	**5,015**	**5,893**	**6,055**	**0,162**	**2,7%**	**0,55%**
8	pop	6,015	7,684	8,065	0,381	5,0%	0,82%
9	**pop T**	**7,015**	**6,205**	**6,495**	**0,290**	**4,7%**	**0,67%**

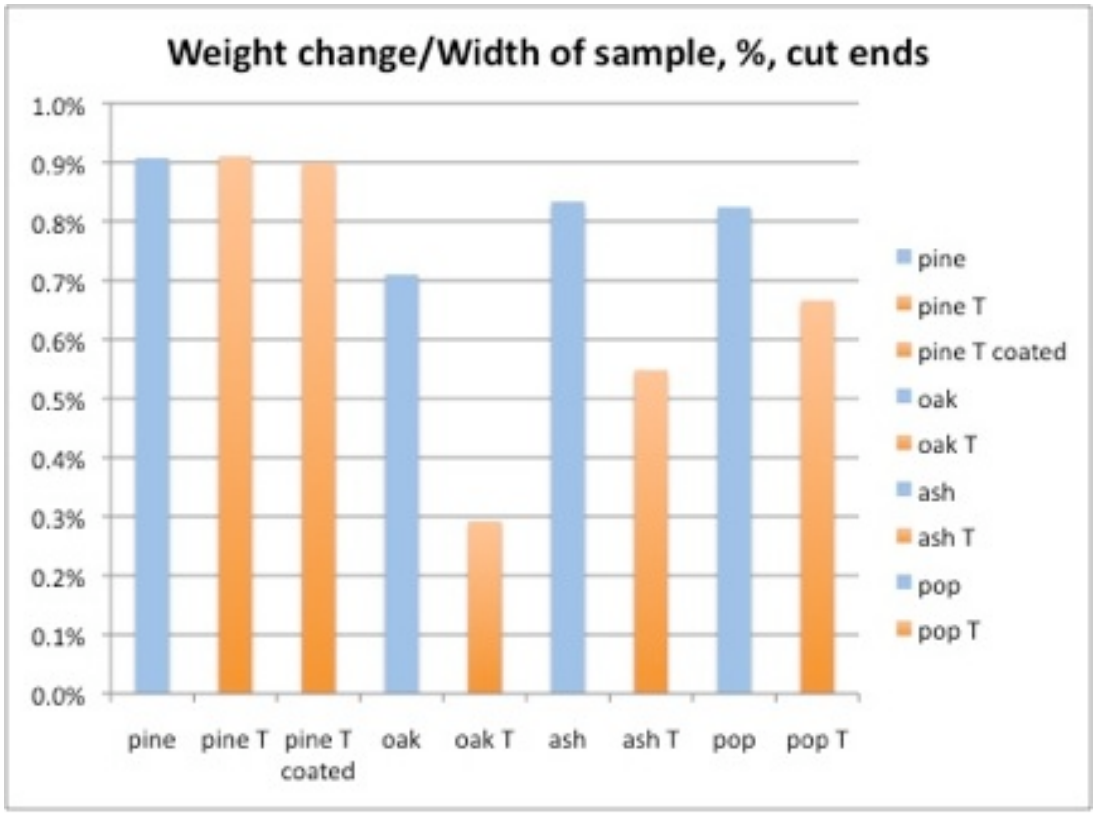
Results.

1. **We see the a little increased water absorption for all the species with approximately the same proportion between treated and non-treated wood.**

2. **The thermo-treated coated pine (1 coating) with the cut ends shows the same water absorption than non-coated and not-treated material.**

3. **This factor shows that the most of the water going inside the wood from the ends. That means critical significance of closing the ends even in treated material!**


Srtart Weight of sample
Weight after 3 hours in water
pine
pine T
pine T coated
oak
oak T
ash
ash T
pop
pop T


Weight change/Width of sample, %, cut ends
1.0%
0.9%
0.8%
0.7%
0.6%
0.5%
0.4%
0.3%
0.2%
0.1%
0.0%
pine
pine T
pine T coated
oak
oak T
ash
ash T
pop
pop T

Experiment # 5
Swelling of samples with the coated ends.
Short time interval (3 hours).

The research method.
Placing the samples of thermo-treated and untreated wood into the water and measuring its width.
For each species 4-5 samples was used.

Test Results.

Specie	Srtart Width of sample, in	Width after 3 hours in water, in
pine	8,015	no change
pine	8,015	no change
pine	8,015	no change
pine T	**8,015**	**no change**
pine T	**8,015**	**no change**
pine T coated	***6,015***	***no change***
pine T coated	***6,020***	***no change***
oak	5,015	no change
oak	11,015	no change
oak T	**5,015**	**no change**
oak T	**8,000**	**no change**
oak T	**8,015**	**no change**
oak T	**10,015**	**no change**
ash	6,015	no change
ash	6,015	no change
ash	8,015	no change
ash T	**5,015**	**no change**
ash T	**8,015**	**no change**
poplar	7,015	no change
poplar	6,015	no change
poplar T	**6,015**	**no change**
poplar T	**11,015**	**no change**

Results.

The short time interval like 3 hours not enough for case the swelling of the wood even treated and non-treated.

Experiment # 6
Water absorption of samples with the coated ends. Long time interval (18 hours).

The research method.
Placing the samples of thermo-treated and untreated wood into the water and measuring its weight.
For each species 4-5 samples was used.

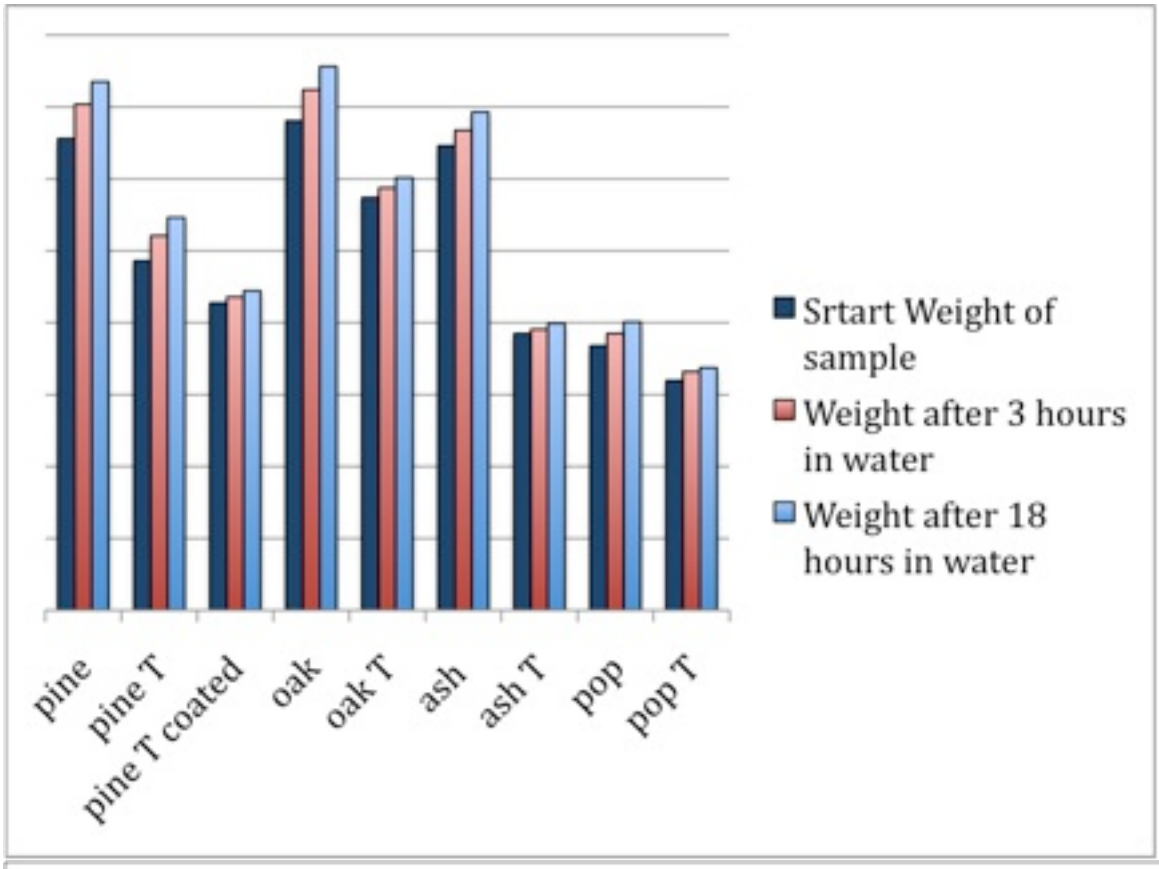
Test Results.

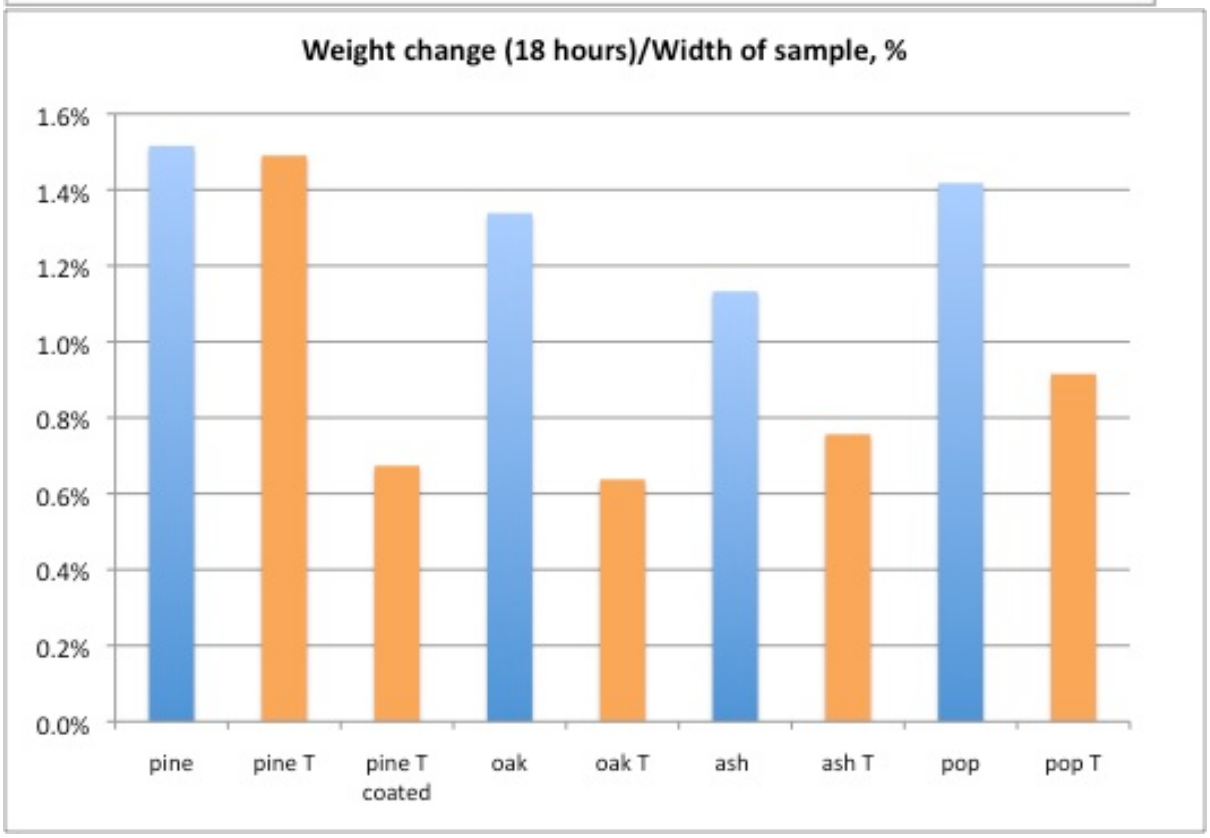
Specie	Width of sample, in	Srtart Weight of sample, lb	Weight after 18 hours in water, lb	Weight change, lb	Weight change, %	Weight change/Width of sample (inch), %	Average
pine	8,015	12,390	13,890	1,500	12,1%	1,51%	1,52%
pine	8,015	14,584	16,142	1,558	10,7%	1,33%	
pine	8,015	12,390	14,082	1,692	13,7%	1,70%	
pine T	**8,015**	**8,637**	**9,650**	**1,013**	**11,7%**	**1,46%**	**1,49%**
pine T	**8,015**	**10,799**	**12,106**	**1,307**	**12,1%**	**1,51%**	
pine T coated	***6,015***	***9,882***	***10,220***	***0,338***	***3,4%***	**0,57%**	**0,67%**
pine T coated	***6,020***	***7,217***	***7,555***	***0,338***	***4,7%***	**0,78%**	
oak	5,015	7,419	7,998	0,579	7,8%	1,56%	1,34%
oak	11,015	19,814	22,260	2,446	12,3%	1,12%	
oak T	**5,015**	**6,020**	**6,220**	**0,200**	**3,3%**	**0,66%**	**0,64%**
oak T	**8,000**	**9,759**	**10,290**	**0,531**	**5,4%**	**0,68%**	
oak T	**8,015**	**9,896**	**10,470**	**0,574**	**5,8%**	**0,72%**	
oak T	**10,015**	**11,480**	**12,036**	**0,556**	**4,8%**	**0,48%**	
ash	6,015	11,177	12,110	0,933	8,3%	1,39%	1,13%
ash	6,015	11,128	11,920	0,792	7,1%	1,18%	
ash	8,015	16,462	17,552	1,090	6,6%	0,83%	
ash T	**5,015**	**7,696**	**7,985**	**0,289**	**3,8%**	**0,75%**	**0,76%**
ash T	**8,015**	**10,437**	**11,076**	**0,639**	**6,1%**	**0,76%**	
poplar	7,015	8,050	8,730	0,680	8,4%	1,20%	1,42%
poplar	6,015	6,666	7,320	0,654	9,8%	1,63%	
poplar T	**6,015**	**6,390**	**6,750**	**0,360**	**5,6%**	**0,94%**	**0,92%**
poplar T	**11,015**	**9,777**	**10,740**	**0,963**	**9,8%**	**0,89%**	

Results.

The water absorption for treated wood slowed up comparing with non-treated wood and Experiment # 3 for 3 hours. For non-treated wood we see the same dynamic of water absorption.

So, the dynamic of water absorption depends on the time of water treatment.


Srtart Weight of sample
Weight after 3 hours in water
Weight after 18 hours in water
pine
pine T
pine T coated
oak
oak T
ash
ash T
pop
pop T


Weight change (18 hours)/Width of sample, %
1.6%
1.4%
1.2%
1.0%
0.8%
0.6%
0.4%
0.2%
0.0%
pine
pine T
pine T coated
oak
oak T
ash
ash T
pop
pop T

Experiment # 7
Swelling of samples with the coated ends.
Long time interval (18 hours).

The research method.
Placing the samples of thermo-treated and untreated wood into the water and measuring its width.
For each species 4-5 samples was used.

Test Results.

Specie	Srtart Width of sample, in	Width after 3 hours in water, in	Width after 18 hours in water, in	Width change, in	Width change, %	Width change/Width of sample (inch), %	Average
pine	8,015	no change	8,219	0,204	2,5%	0,32%	0,29%
pine	8,015	no change	8,219	0,204	2,5%	0,32%	
pine	8,015	no change	8,158	0,143	1,8%	0,22%	
pine T	**8,015**	**no change**	**8,158**	**0,143**	**1,8%**	**0,22%**	**0,28%**
pine T	**8,015**	**no change**	**8,238**	**0,223**	**2,8%**	**0,35%**	
pine T coated	***6,015***	***no change***	***6,025***	***0,010***	***0,2%***	**0,03%**	**0,04%**
pine T coated	***6,020***	***no change***	***6,040***	***0,020***	***0,3%***	**0,06%**	
oak	5,015	no change	5,050	0,035	0,7%	0,14%	0,12%
oak	11,015	no change	11,135	0,120	1,1%	0,10%	
oak T	**5,015**	**no change**	**5,027**	**0,012**	**0,2%**	**0,05%**	**0,05%**
oak T	**8,000**	**no change**	**8,028**	**0,028**	**0,4%**	**0,04%**	
oak T	**8,015**	**no change**	**8,039**	**0,024**	**0,3%**	**0,04%**	
oak T	**10,015**	**no change**	**10,079**	**0,064**	**0,6%**	**0,06%**	
ash	6,015	no change	6,055	0,040	0,7%	0,11%	0,13%
ash	6,015	no change	6,055	0,040	0,7%	0,11%	
ash	8,015	no change	8,119	0,104	1,3%	0,16%	
ash T	**5,015**	**no change**	**5,030**	**0,015**	**0,3%**	**0,06%**	**0,06%**
ash T	**8,015**	**no change**	**8,049**	**0,034**	**0,4%**	**0,05%**	
poplar	7,015	no change	7,119	0,104	1,5%	0,21%	0,17%
poplar	6,015	no change	6,065	0,050	0,8%	0,14%	
poplar T	**6,015**	**no change**	**6,050**	**0,035**	**0,6%**	**0,10%**	**0,09%**
poplar T	**11,045**	**no change**	**11,158**	**0,113**	**1,0%**	**0,09%**	

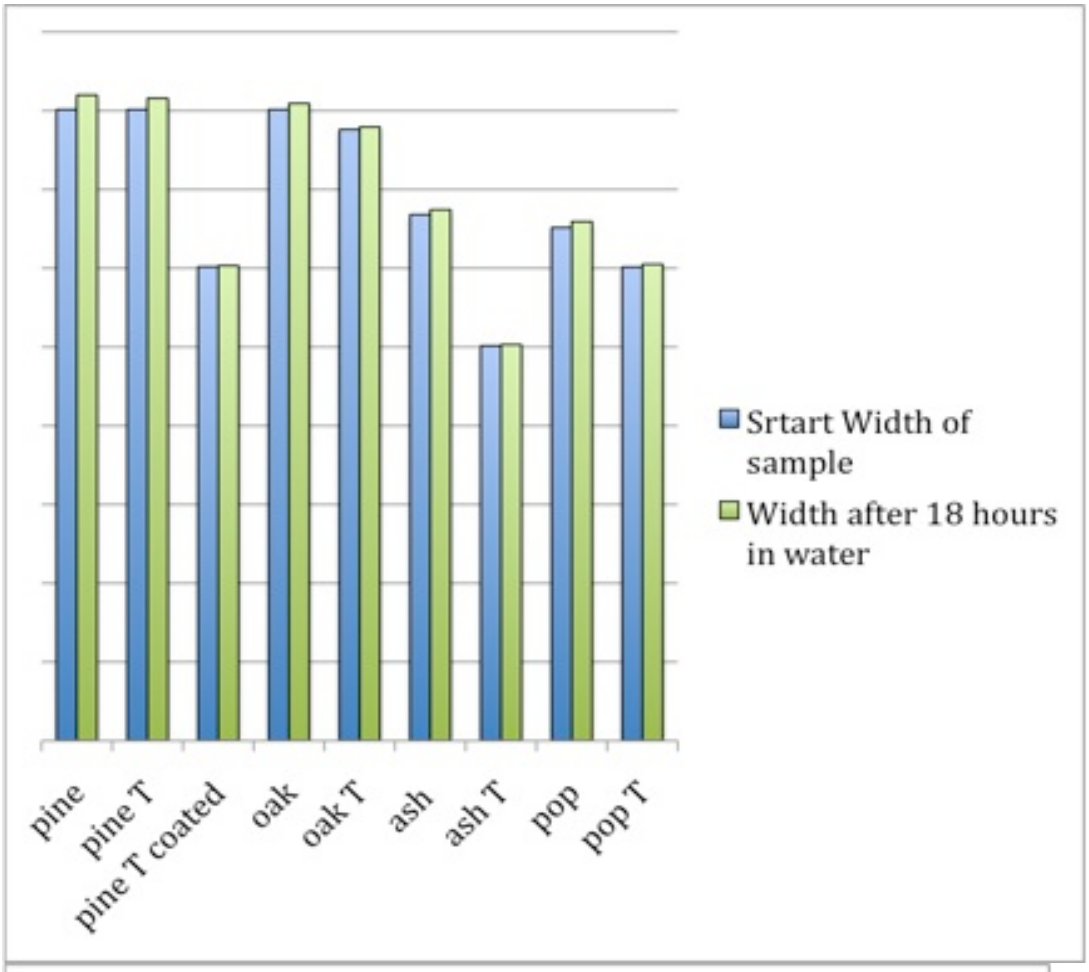
Results.

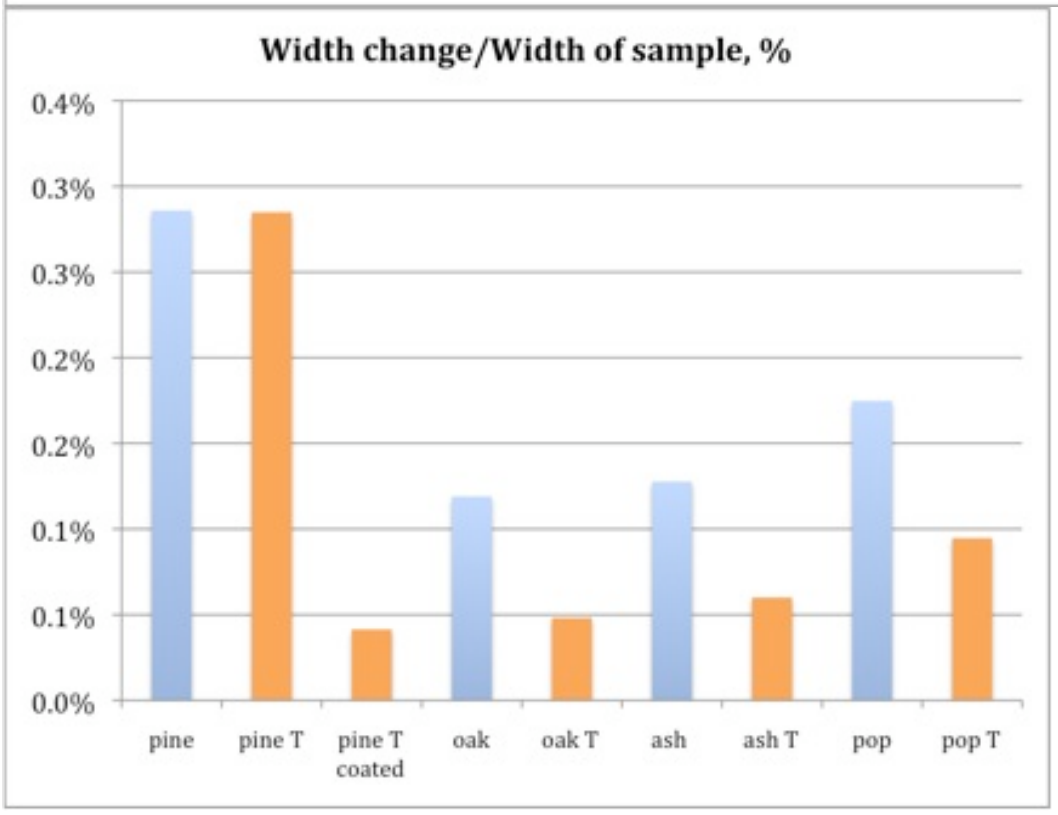
1. **The swelling of thermo-treated wood after 18 hours under water is around 0,3-0,4% for Oak and Ash, around 0,7% for Poplar and around 2% for Pine.**

2. **The swelling of thermo-treated material was reduced approximately at the same proportion as the water absorption been reduced of thermo-treated samples, compared with non-treated. (See results of Experiments # 3 and # 6).**

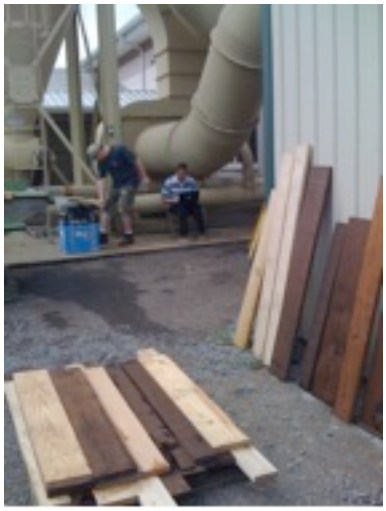
3. **The coating of wood significantly (10 times!) reduces the swelling of thermo-treated wood.**

4. **Compared with non-treated wood the swelling for treated wood reduced at the factor 2-3 for the long time of water treatment. The following experiments with 5 days of water treatment shows reduce of water absorption factor for thermo-treated wood to 4-5. (see test data at the end of Report).**


Srtart Width of sample
Width after 18 hours in water
pine
pine T
pine T coated
oak
oak T
ash
ash T
pop
pop T


Width change/Width of sample, %
0.4%
0.3%
0.3%
0.2%
0.2%
0.1%
0.1%
0.0%
pine
pine T
pine T coated
oak
oak T
ash
ash T
pop
pop T

Experiment # 8
Water loss of samples with the coated ends.
Time interval 7 hours.



The research method.
Placing the samples of thermo-treated and untreated wood at open air and measuring its weight.
For each species 4-5 samples was used.

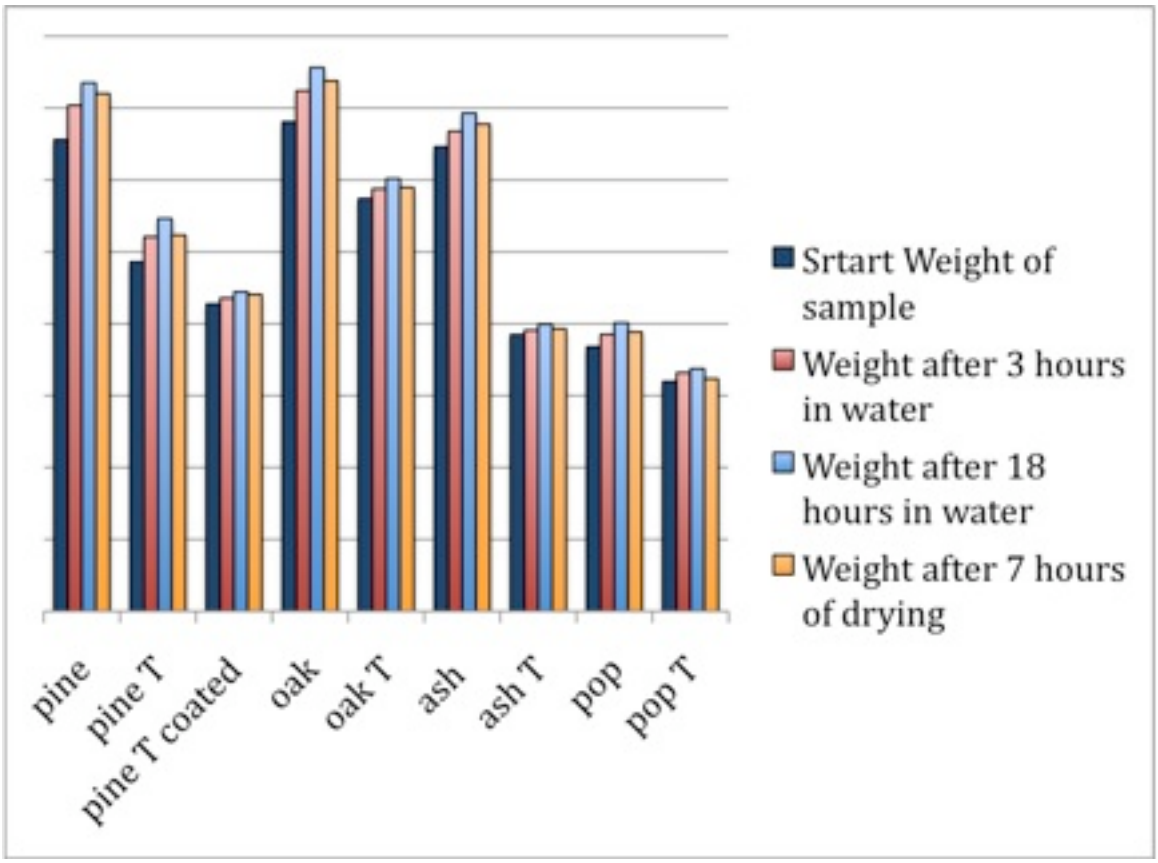
Test Results.

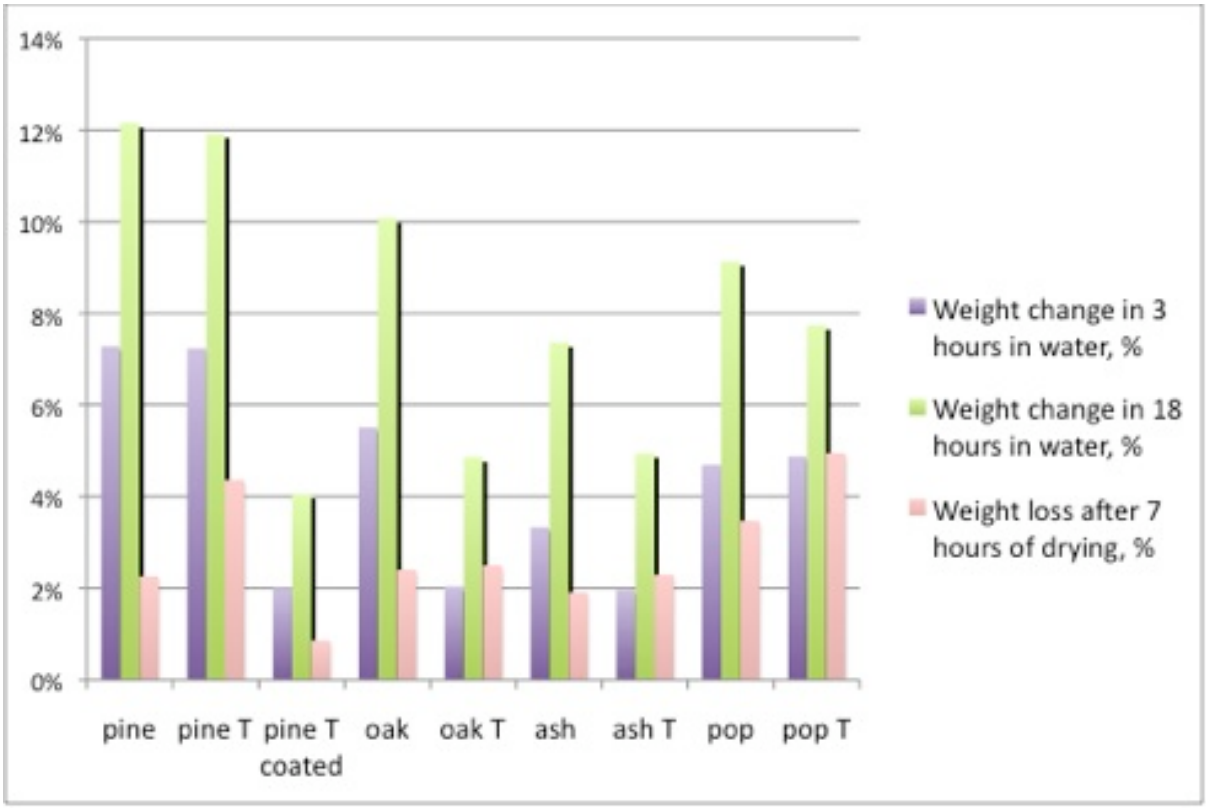
Specie	Width of sample, in	Srtart Weight of sample, lb	Weight after 3 hours in water, lb	Weight after 18 hours in water, lb	Weight after 7 hours of drying, lb	Vaporized water/Absorbed water, %	Average
pine	8,015	12,390	13,290	13,890	13,596	19,6%	18,84%
pine	8,015	14,584	15,644	16,142	15,808	21,4%	
pine	8,015	12,390	13,296	14,082	13,820	15,5%	
pine T	**8,015**	**8,637**	**9,280**	**9,650**	**9,175**	**46,9%**	**39,37%**
pine T	**8,015**	**10,799**	**11,558**	**12,206**	**11,758**	**31,8%**	
pine T coated	***6,015***	***9,882***	***10,031***	***10,220***	***10,135***	**25,1%**	**21,75%**
pine T coated	***6,020***	***7,217***	***7,397***	***7,555***	***7,493***	**18,3%**	
oak	5,015	7,419	7,689	7,998	7,870	22,1%	23,52%
oak	11,015	19,814	21,276	22,260	21,650	24,9%	
oak T	**5,015**	**6,020**	**6,118**	**6,220**	**6,100**	**60,0%**	**52,15%**
oak T	**8,000**	**9,759**	**9,940**	**10,290**	**9,980**	**58,4%**	
oak T	**8,015**	**9,896**	**10,123**	**10,470**	**10,204**	**46,3%**	
oak T	**10,015**	**11,480**	**11,754**	**12,036**	**11,792**	**43,9%**	
ash	6,015	11,177	11,534	12,110	11,854	27,4%	25,74%
ash	6,015	11,128	11,506	11,920	11,700	27,8%	
ash	8,015	16,462	17,022	17,552	17,312	22,0%	
ash T	**5,015**	**7,696**	**7,818**	**7,985**	**7,862**	**42,6%**	**45,69%**
ash T	**8,015**	**10,437**	**10,681**	**11,076**	**10,764**	**48,8%**	
poplar	7,015	8,050	8,388	8,730	8,443	42,2%	38,30%
poplar	6,015	6,666	7,012	7,320	7,095	34,4%	
poplar T	**6,015**	**6,390**	**6,638**	**6,750**	**6,472**	**77,2%**	**66,75%**
poplar T	**11,015**	**9,777**	**10,351**	**10,740**	**10,198**	**56,3%**	

Results.

For getting more objective results we used the proportion of Vaporized and Absorbed water after 7 hours of drying in open air.

The water loss of thermo-treated material approximately at the inverted proportion to the water absorption (the thermo-treated material loosed 2 times more absorbed before water, compared with non-treated). (See also results of Experiments # 3 and # 6).


Srtart Weight of sample
Weight after 3 hours in water
Weight after 18 hours in water
Weight after 7 hours of drying
pine
pine T
pine T coated
oak
oak T
ash
ash T
pop
pop T


14%
12%
10%
8%
6%
4%
2%
0%
Weight change in 3 hours in water, %
Weight change in 18 hours in water, %
Weight loss after 7 hours of drying, %
pine
pine T
pine T coated
oak
oak T
ash
ash T
pop
pop T

Experiment # 9
Swelling of samples with the coated ends after drying.
Time interval 7 hours.

The research method.
Placing the samples of thermo-treated and untreated wood open air and measuring its width.
For each species 4-5 samples was used.

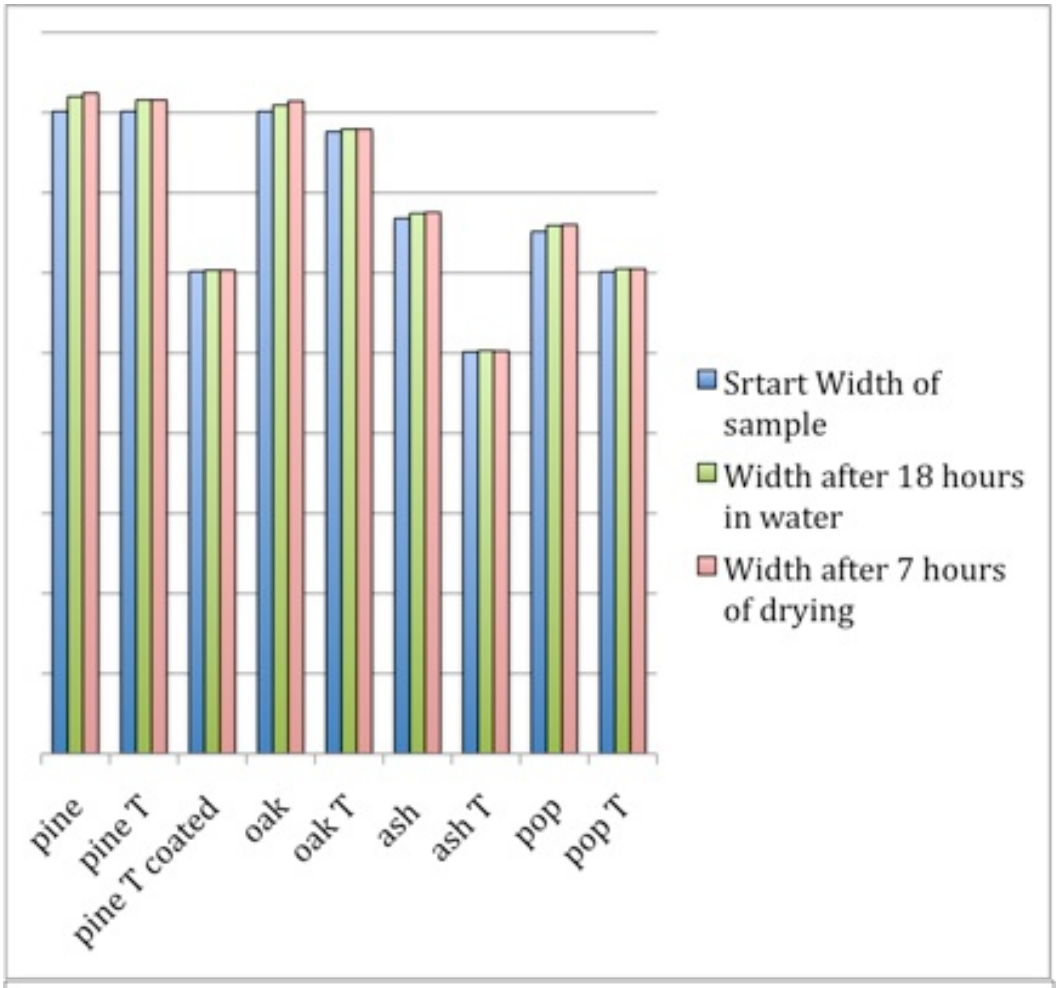
Test Results.

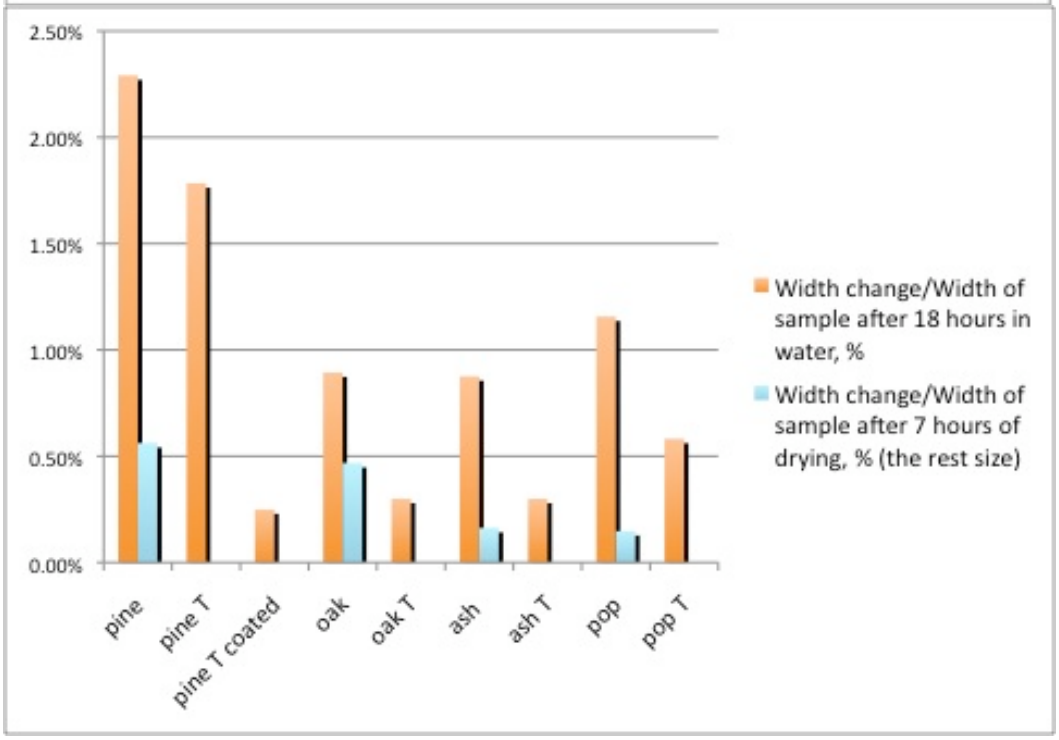
Specie	Width of sample, in	Srtart Weight of sample, lb	Weight after 3 hours in water, lb	Weight after 18 hours in water, lb	Weight after 7 hours of drying, lb	Vaporized water/Absorbed water, %	Average
pine	8,015	12,390	13,290	13,890	13,596	19,6%	18,84%
pine	8,015	14,584	15,644	16,142	15,808	21,4%	
pine	8,015	12,390	13,296	14,082	13,820	15,5%	
pine T	**8,015**	**8,637**	**9,280**	**9,650**	**9,175**	**46,9%**	**39,37%**
pine T	**8,015**	**10,799**	**11,558**	**12,206**	**11,758**	**31,8%**	
pine T coated	***6,015***	***9,882***	***10,031***	***10,220***	***10,135***	**25,1%**	**21,75%**
pine T coated	***6,020***	***7,217***	***7,397***	***7,555***	***7,493***	**18,3%**	
oak	5,015	7,419	7,689	7,998	7,870	22,1%	23,52%
oak	11,015	19,814	21,276	22,260	21,650	24,9%	
oak T	**5,015**	**6,020**	**6,118**	**6,220**	**6,100**	**60,0%**	**52,15%**
oak T	**8,000**	**9,759**	**9,940**	**10,290**	**9,980**	**58,4%**	
oak T	**8,015**	**9,896**	**10,123**	**10,470**	**10,204**	**46,3%**	
oak T	**10,015**	**11,480**	**11,754**	**12,036**	**11,792**	**43,9%**	
ash	6,015	11,177	11,534	12,110	11,854	27,4%	25,74%
ash	6,015	11,128	11,506	11,920	11,700	27,8%	
ash	8,015	16,462	17,022	17,552	17,312	22,0%	
ash T	**5,015**	**7,696**	**7,818**	**7,985**	**7,862**	**42,6%**	**45,69%**
ash T	**8,015**	**10,437**	**10,681**	**11,076**	**10,764**	**48,8%**	
poplar	7,015	8,050	8,388	8,730	8,443	42,2%	38,30%
poplar	6,015	6,666	7,012	7,320	7,095	34,4%	
poplar T	**6,015**	**6,390**	**6,638**	**6,750**	**6,472**	**77,2%**	**66,75%**
poplar T	**11,015**	**9,777**	**10,351**	**10,740**	**10,198**	**56,3%**	

Results.

1. **Non-treated wood continue to swell (instead of expected shrinkage) – in average 0,5%.**

2. **Treated wood stayed at the same size, achieved after 18 hours in water.**


Srtart Width of sample
Width after 18 hours in water
Width after 7 hours of drying
pine
pine T
pine T coated
oak
oak T
ash
ash T
pop
pop T


2.50%
2.00%
1.50%
1.00%
0.50%
0.00%
Width change/Width of sample after 18 hours in water, %
Width change/Width of sample after 7 hours of drying, % (the rest size)
pine
pine T
pine T coated
oak
oak T
ash
ash T
pop
pop T

Experiment # 10 (Data Analysis).
Comparing of additional (between 3 and 18 hours) water absorption and water loss after 7 hours of drying.

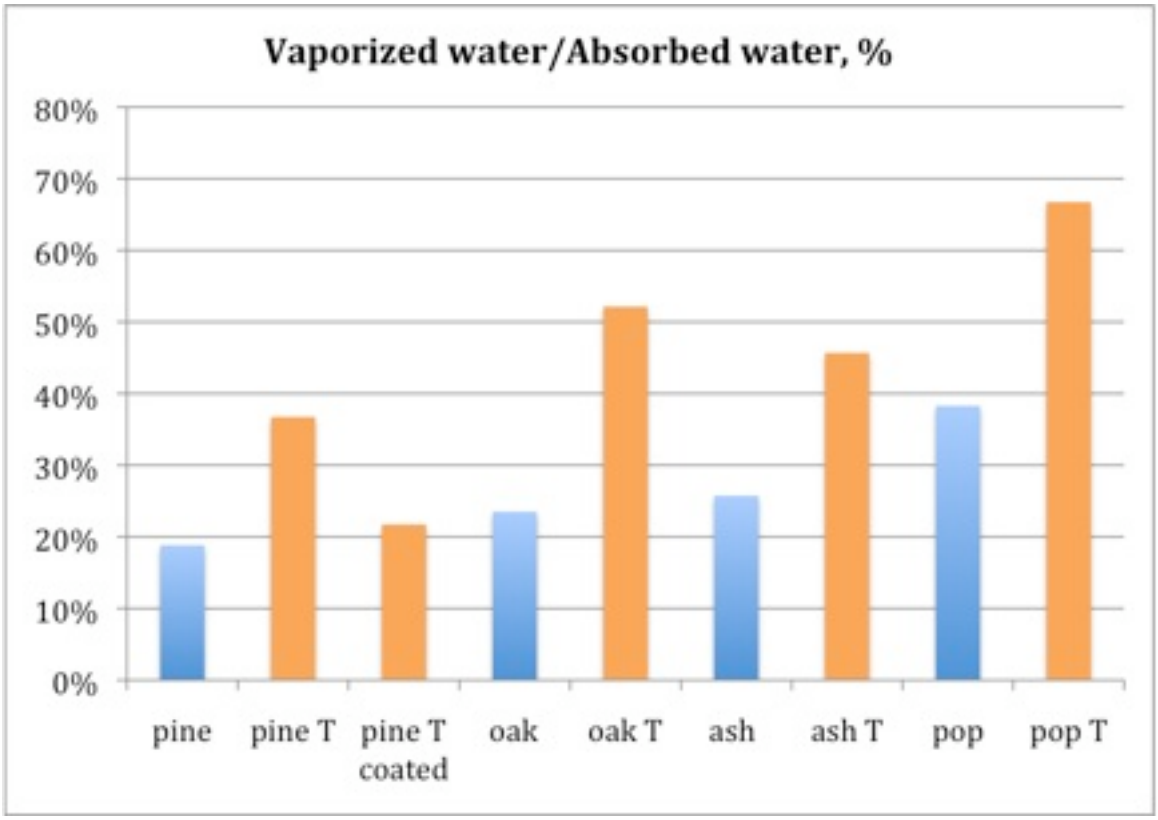
The research method.
Calculation the percentage of vaporized water, compared with absorbed.

Calculations Results.

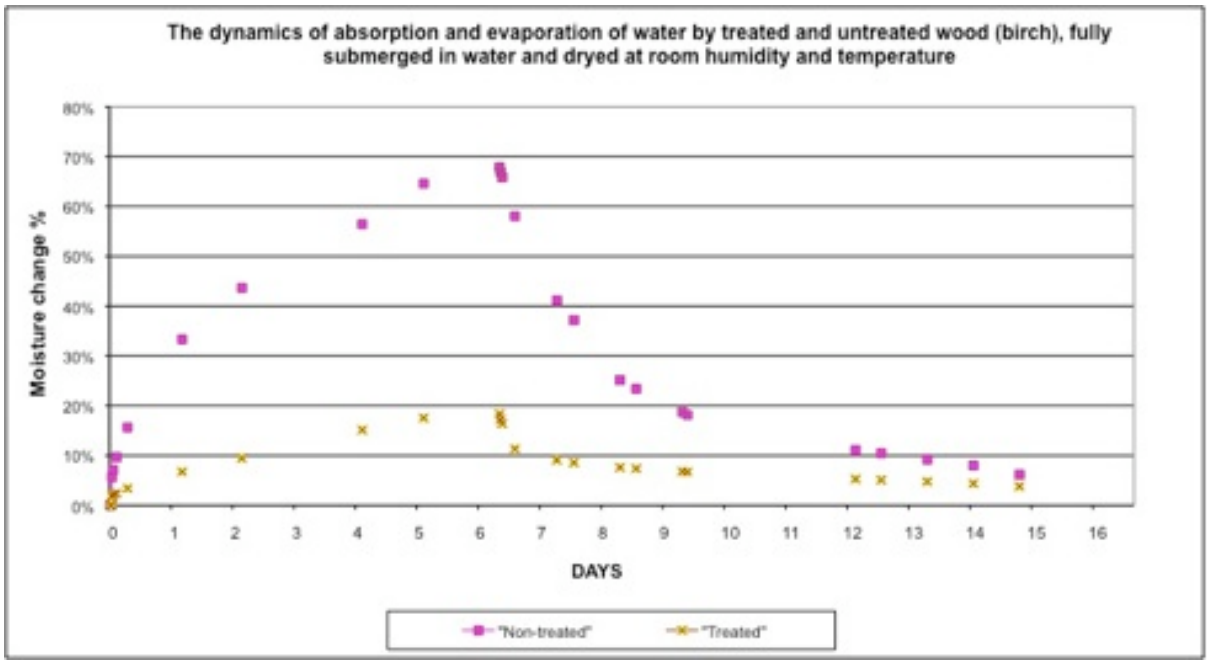
Specie	Width of sample, in	Weight after 3 hours in water, lb	Weight after 18 hours in water, lb	Weight after 7 hours of drying, lb	Vaporized water/Absorbed water, %	Water, absorbed after 3 hours, lb	Vaporized water/Absorbed water, %
pine	8,015	13,290	13,890	13,596	18,84%	0,600	49,80%
pine	8,015	15,644	16,142	15,808		0,498	
pine	8,015	13,296	14,082	13,820		0,786	
pine T	**8,015**	**9,280**	**9,650**	**9,175**	**36,76%**	**0,370**	**95,94%**
pine T	**8,015**	**11,858**	**12,106**	**11,758**		**0,548**	
pine T coated	***6,015***	***10,031***	***10,220***	***10,135***	**21,75%**	***0,189***	**42,11%**
pine T coated	***6,020***	***7,397***	***7,555***	***7,493***		***0,158***	
oak	5,015	7,689	7,998	7,870	23,52%	0,309	51,71%
oak	11,015	21,276	22,260	21,650		0,984	
oak T	**5,015**	**6,118**	**6,220**	**6,100**	**52,15%**	**0,102**	**92,35%**
oak T	**8,000**	**9,940**	**10,290**	**9,980**		**0,350**	
oak T	**8,015**	**10,123**	**10,470**	**10,204**		**0,347**	
oak T	**10,015**	**11,754**	**12,036**	**11,792**		**0,282**	
ash	6,015	11,534	12,110	11,854	25,74%	0,576	47,62%
ash	6,015	11,506	11,920	11,700		0,414	
ash	8,015	17,022	17,552	17,312		0,530	
ash T	**5,015**	**7,818**	**7,985**	**7,862**	**45,69%**	**0,167**	**76,32%**
ash T	**8,015**	**10,681**	**11,076**	**10,764**		**0,395**	
poplar	7,015	8,388	8,730	8,443	38,30%	0,342	78,49%
poplar	6,015	7,012	7,320	7,095		0,308	
poplar T	**6,015**	**6,638**	**6,750**	**6,472**	**66,75%**	**0,112**	**193,77%**
poplar T	**11,015**	**10,351**	**10,740**	**10,198**		**0,389**	

Results.

Non-treated wood has loss approximately 50% of additional water, compared with treated wood, looses 100% and more previously absorbed water.



Long term water treatment for Birch treated samples compeared with non-treated samples.



GENERAL NOTES.

1. Tests have confirmed a lot of well-known properties of thermo-treated wood, researched in Europe (the decreasing of swelling and water absorption in 1,5-2 times with direct water contact, the increasing of water loss for thermo-treated wood, the weight loss (18-23%), volume (5%) and density (15-18%), caused also the corresponding loss of strength).

2. Tests show the significant improvement of all the properties of thermo-treated wood after applying the surface coating, especially to the ends of boards.

3. The mentioned above most critical for work with thermo-treated softwood and soft (less density) hardwoods like poplar.

4. The first absorption of water by thermo-treated wood (restore the moistening) causes the swelling of wood of around 0,3-0,4% for Ash and Oak), and around 0,7% for Poplar and around 2% for Pine. BUT! The drying and next absorption doesn't shrink and swell the samples and additional absorbed water easily vaporizes at the open air without changing the sizes of wood. (The additional experiments shows: the dimensions achieved after first moistening of thermo-treated wood at the cooling stage at the treatment process and after first moistening rest stable after the next cycles of moistening and drying of treated wood).

5. This factors more significant for treated softwood, than for treated hardwoods. The results show the significant improvement of physical properties for thermo-treatment of hardwoods, than softwoods.