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TREATMENT OF WOOD

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This invention relates to the treatment of wood and more particularly to the chemical seasoning of wood.

In the lumber industry, one of the most serious problems has been that of checking and cracking of wood during its storage and drying after cutting of the timber. This checking and cracking of wood is due, primarily, to the shrinkage resulting from drying of the outer area or portions of green wood at a more rapid rate than the interior portions. As a consequence of this uneven shrinkage, surface strains and stresses are set up which cause extensive cracking, checking or splitting of the green lumber, being most apparent at the ends and along the surface of the lumber in the central portions of the flat grain cuts.

Various proposals have been made to overcome these problems but heretofore none have proven commercially practicable.

It is an object of this invention to overcome the drying problem in the lumber industry and to provide a new and improved method for treating or seasoning lumber.

Other objects and advantages of this invention will be apparent from the following specification in which its preferred embodiments and details are described.

We have found that the checking and cracking of wood may be greatly reduced by treating wood with a urea solution of such concentration, at the particular temperature employed, that at the wood surface the urea solution is completely saturated. Preferably the wood temperature is at a temperature in the range of 5 to 15° C. below the temperature of the urea solution, and the urea solution is saturated at the temperature at which it is utilized.

The process of this invention is applicable to wood generally, whether unseasoned or partly seasoned or, in fact, if the wood contains any moisture which it is desired to remove. Thus, for example, the water content of green wood, based upon the dry weight of the wood, may vary from about 30 to 200% or more. Such unseasoned wood may be stored, however, and consequently air-dried, prior to the treatment of this invention so that its moisture content may be reduced to as low as 15 to 20%. In the case of such partly seasoned wood our process may be applied to remove the greater proportion of the remaining water content. This is followed, preferably, by kiln drying. In normal operation, however, the original water content of wood is reduced by treatment with urea, followed by air or kiln drying of the urea-treated wood.

The amount of urea absorbed on the wood surface by the process of this invention is increased greatly over what would be expected, based upon the urea concentration. Upon removal of wood from the saturated urea solution a mat of urea in the form of a fine, intertwined, closely adhering precipitate of crystalline urea is formed upon the surface of the wood encasing relatively large amounts of urea solution contiguous to the wood surface. The crystallized urea mat adheres so strongly to the wood that it is not readily removed by brushing or chipping from rough cut lumber. This mat of urea subsequently dissolves in the water content of the wood, thus further impregnating the wood surfaces.

Although the dipping of the wood may vary over a wide time interval we have found that about 5 to 30 seconds treatment is highly effective, with a period of 10 to 15 seconds being the preferred time interval.

By the process of this invention, wood surfaces are maintained pervious to the passage of moisture from within the wood so that the interior moisture may continuously be drawn to and evaporate from the outer surfaces. As a result, the surface of lumber treated according to this invention remains relatively moist while drying proceeds, water inside the wood travels to the outside, thus drying from the inside out rather than from the outside in, and the surface strains and stresses ordinarily present are reduced to an extent that no appreciable checking or honeycombing occurs. Lumber treated according to this invention exhibits no deleterious characteristics such as corrosion of wood working tools or metallic parts with which it comes in contact.

When wood is dipped with urea solutions, saturated or unsaturated, near room temperature, the amount of urea absorbed on the wood is roughly proportional to the concentration of urea in the dipping solution. That is also true for under-saturated urea solutions at temperatures above atmospheric where concentration is not greater than about 50% (the saturation amount at approximately 20° C.). However, when the temperature of the wood is at least 5 to 15° C. below the temperature of the saturated urea solution, the amount of urea absorbed on the wood surface is greatly increased over what would be expected. The action of urea solutions would indicate that hot saturated water solutions of many other materials which are more

soluble at temperatures above atmospheric than at atmospheric pressure would behave in the same manner. However, testing of a number of such materials which would be expected to act similarly to urea, showed that the behavior of urea to be outstanding. Small differences could be expected due to differences in density, wetting characteristics and viscosity but the amount of chemical absorbed would be expected to be roughly directly proportional to the concentration of the chemical. On the basis of these considerations, the pounds of chemical absorbed per 1000 board feet of a given cross section per weight per cent. of chemical in the dipping solution should be roughly constant for all materials and at all temperatures.

Experimental evidence shows, however, that for less than saturated solutions, variation from the average for the above ratio is about plus or minus 32%. Experimental results on saturated solutions of the same substances fall in line with the results on less than saturated solutions except for urea. Absorption of urea from saturated solution at 60° C. was 730% greater than would be expected from its absorption at 20° C. In contrast increase in absorption for the other salts showed 12% for sodium chloride and 19% for potassium formate. These generalities are specifically set forth in the following Tables 1 and 2.

In carrying out the experiments recorded in Tables 1 and 2, green oak blocks 1" x 5" x 10", at ordinary temperature (25° C.), were immersed for 5 seconds in a tank of the indicated chemical solution at 20, 40 and 60° C. as indicated in the tables. The blocks were then removed from the solutions in a horizontal position, allowed to drain 5 seconds at an angle of 30° and then placed horizontally to finish draining. The weight of each block was determined after 5 minutes and the increase in weight taken as the amount of solution absorbed.

TABLE 1

Absorption of chemical solutions on oak

	Conditions					
Percent complete sat'n. of chemical in solution	90	90	90	100	100	100
Temperature of solution	°C. 20	°C. 40	°C. 60	°C. 20	°C. 40	°C. 60
Chemical	Lbs. chemical absorbed per 1000 board feet of 2" x 12"					
Sodium chloride	8	7	8	9	9	10
Potassium formate	36	46	39	45	48	57
Urea	17	22	29	20	34	230
	Conditions					
Percent sat'n. of chemical in solution	90	90	90	100	100	100
Temperature in solution	°C. 20	°C. 40	°C. 60	°C. 20	°C. 40	°C. 60
Chemical	Wt. percent chemical in dipping solution					
Sodium chloride	24	24	24	27	27	27
Potassium formate	69	72	74	77	80	82
Urea	46	56	64	51	62	71

TABLE 2

Absorption of chemical solutions in oak

		Conditions					
Percent sat'n. of chemical in solution		90	90	90	100	100	100
Temperature of solution		°C. 20	°C. 40	°C. 60	°C. 20	°C. 40	°C. 60
Chemical	Increase in solubility 20° C. to 60° C.	Lbs. chemical absorbed per 1000 board feet/wt. per cent of chemical in dipping solution					
Sodium chloride	Zero	0.33	0.29	0.33	0.33	0.33	0.37
Potassium formate	7%	0.52	0.65	0.53	0.59	0.61	0.70
Urea	39	0.37	0.39	0.45	0.39	0.55	3.24

From the above tables and considering the extensive experimental work which we have carried on in treatment of wood according to the process of this invention it appears that the magnitude of the urea deposition and absorption effect is approximately directly related to the temperature difference between the wood and the solution and that this process is not greatly affected by the moisture content of the wood.

Various changes may be made in the preferred embodiments and details of this invention without departing therefrom or sacrificing the advantages thereof.

We claim:

1. In a process for seasoning moisture-containing wood, the step which comprises bringing the outer surface of such wood into contact with a saturated urea solution, the wood being at a temperature at least 5° C. below that of the saturated urea solution.

2. In a process for seasoning moisture-containing wood, the step which comprises bringing the outer surface of such wood into contact with a saturated urea solution, the wood being at a temperature 5–15° C. below that of the urea solution.

3. In a process for seasoning moisture-containing wood the step which comprises bringing the outer surface of such wood into contact for 5 to 30 seconds with a saturated urea solution, the wood being at a temperature 5 to 15° C. below that of the urea solution.

4. In a process for seasoning moisture-containing wood, the step which comprises bringing the outer surface of such wood into contact with a saturated urea solution, the wood being at a temperature below that of the saturated urea solution, and thereafter drying the treated wood.

5. In a process for seasoning moisture-containing wood, the step which comprises bringing the outer surface of such wood into contact with a saturated urea solution, the wood being at a temperature at least 5° C. below that of the saturated urea solution, and thereafter air drying the treated wood.

6. In a process for seasoning moisture-containing wood, the step which comprises bringing the outer surface of such wood into contact with a saturated urea solution, the wood being at a temperature at least 5° C. below that of the saturated urea solution, and thereafter kiln drying the treated wood.

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