XVII. ON THE TREATMENT OF CELLULOSE FIBRES AND WOOD WITH CARBON DISULPHIDE AND ALKALI.

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IN working with the swelling test [Fleming and Thaysen, 1921] it has frequently been observed that treated cotton fibres from which admixed alkali has been removed by repeated washing with distilled water continue to give off alkali when stored wet. The rate at which this alkali is given off is not very considerable, but it is continued for a prolonged time, suggesting that a steady breakdown of some compound formed during swelling is taking place on wet storage.

Table I. *The fibres were swelled by 15 % NaOH — CS₂, then washed free from adhering alkali, and placed in bottles filled with distilled water.*

Kept in distilled water.. Each horizontal line represents a fresh change of water.					
Bottle 1		Bottle 2	Bottle 1		Bottle 2
Days	Change of p_H	Change of p_H	Days	Change of p_H	Change of p_H
1	5.2-8.0	—	2	Water not changed	5.2-6.3
1	5.2-8.4	5.2-8.5	1	for 75 days	5.2-6.4
1	5.2-8.4	5.2-8.4	2	"	5.2-7.2
1	Water not changed	5.2-8.5	1	"	5.2-6.0
1	for 75 days	5.2-8.4	1	"	5.2-6.0
2	"	5.2-8.6	1	"	5.2-6.0
2	"	5.2-8.6	1	"	5.2-6.0
1	"	5.2-8.6	24	"	5.2-7.7
1	"	5.2-8.4	7	5.2-7.8 } ¹	5.2-6.9
1	"	5.2-8.6	7	5.6-8.2 }	5.6-7.4
2	"	5.2-8.5	7	5.2-7.8	5.2-6.9
1	"	5.2-8.4	7	5.2-7.7	5.2-6.9
1	"	5.2-8.3	5	5.2-7.8	5.2-6.4
1	"	5.2-7.3	7	5.2-7.5	5.2-6.4
4	"	5.2-6.3	7	5.2-7.4	5.2-6.5
7	"	5.3-8.0	7	5.2-7.7	5.2-6.6
1	"	5.3-7.4	7	5.2-7.3	5.2-6.3
1	"	5.3-7.4	19	5.2-7.3	5.2-6.9
1	"	5.3-8.0	9	5.2-5.8	5.2-6.1
2	"	5.2-7.4	6	5.2-5.8	5.2-6.1
3	"	5.2-8.2	12	5.1-5.6	5.1-6.2
1	"	5.2-7.2			

¹ 75, 6 days.

Table I shows the rate of this decomposition. Every care was taken in these cases to exclude the possibility of an increase in the hydroxyl ions through the breakdown of the glass containers in which the fibres were kept. This was done by coating the containers with paraffin wax. The fibres were kept in water which was renewed at frequent intervals. The figures given in the table represent the p_H of the water after contact with the fibres during the time stated¹.

As will be seen the fibres continued to give off alkali even after 177 days of wet storage. Table II, which was a control experiment, shows that cotton fibres treated with 15 % NaOH alone did not give off alkali to any appreciable extent.

Table II.

Sample	Stored with tap water. Each column represents a fresh change of water.			
	1 day Changed p_H from	4 days Changed p_H from	6 days Changed p_H from	12 days Changed p_H from
III	7.5-7.6	7.4-7.5	7.3-7.1	7.2-7.1

The importance of this breakdown from the point of view of the protection of cellulose fibres against destruction by microorganisms is now being investigated, and will be reported on in due course. In view of certain observations made by Harrington [1921] however, it was thought of interest to extend the investigation to the examination of samples of wood which had been treated with the swelling liquor and to report immediately on the results obtained in this direction.

Working with the larva of the shipworm (*Teredo norvegica*) Harrington found that it possesses marked positive chemotropic properties towards dilute acids. According to Harrington, such acids are normally given off from wood, and his paper suggests that their production may be responsible for the attraction of the teredo larva and of the consequent destruction of timber by the shipworm. From the figures given by Harrington it would appear that it is the increase in hydrogen ions which is responsible for the attraction rather than the chemical nature of the acid itself. It was thought, therefore, that a method which would ensure a steady evolution of alkali from the wood, at least sufficient to neutralise any acid given off, might be useful in the protection of timber against destruction by the shipworm.

Some of the experiments carried out in this direction are quoted in Tables III and IV. The pieces of wood, one of which was an oak slab, and the other a piece of spruce, were impregnated as efficiently as possible with swelling liquors and then washed free from the adhering alkali. After this treatment the wood was placed in paraffin coated bottles filled with tap water. The proportion of water to wood was about 500 g. to 10 g.

As control, Table IV, pieces of untreated hard and soft wood were kept in tap water in the same proportions as those of the treated samples.

It will be seen that the treatment with swelling liquors has had a considerable effect and that, in the case of the hard wood in particular, the

¹ All p_H determinations were made by the colorimetric method.

Table III.

Wood stored with tap water. Each horizontal line represents a fresh change of water.

Days	Hard wood treated Change of p_H	Soft wood treated Change of p_H	Days	Hard wood treated Change of p_H	Soft wood treated Change of p_H
1	7.2-8.1	7.2-7.9	19	7.5-8.0	7.5-8.0
1	7.2-7.4	7.2-7.4	1	7.5-7.8	7.5-7.8
2	7.2-7.5	7.2-7.4	4	7.6-7.7	7.4-7.7
1	7.2-7.4	7.2-7.3	4	7.4-7.4	7.6-7.4
1	7.2-7.4	7.2-7.3	10	7.4-7.6	7.4-7.7
1	7.2-7.4	7.2-7.3	5	7.5-7.6	7.5-7.5
2	7.3-7.4	7.3-7.4	14	7.6-7.3	7.6-7.6
3	7.3-7.7	7.2-7.4	7	7.6-7.5	7.6-7.3
1	7.4-7.4	7.4-7.4	—	—	7.6-7.1 ¹
2	7.4-7.7	7.4-7.5	—	—	7.6-7.2
1	7.4-7.5	7.4-7.6	21	7.6-7.4	7.3-7.2
2	7.4-7.5	7.4-7.6	19	7.2-7.3	7.2-7.3
1	7.7-7.7	7.7-7.6	9	7.6-7.4	7.6-7.2
1	7.7-7.6	7.7-7.5	6	7.3-7.5	7.3-7.2
1	7.7-7.6	7.7-7.5	11	7.2-7.3	7.2-7.3
1	7.5-7.6	7.5-7.5			

¹ 7, 7, 7 days.

Table IV.

Days	Hard wood untreated Change of p_H	Soft wood untreated Change of p_H	Days	Hard wood untreated Change of p_H	Soft wood untreated Change of p_H
1	7.8-7.0	7.8-7.6	7	7.6-7.2	7.6-7.7
1	7.6-7.3	7.6-7.5	7	7.6-7.0	7.6-7.8
3	7.6-7.1	7.6-7.6	7	7.3-7.0	7.3-7.5
5	7.5-6.7	7.5-7.4	19	7.2-7.0	7.2-7.6
7	7.6-6.9	7.6-7.5	9	7.6-7.1	7.6-7.8
7	7.6-6.9	7.6-7.6	6	7.3-7.1	7.3-7.8
7	7.6-7.1	7.6-7.8	11	7.2-7.1	7.2-7.6

liberation of acid has been more than counteracted by the constant breakdown, accompanied by formation of alkali, of the xanthates formed during swelling. The effect on the woods has not been as marked as on the cellulose fibres. This is not surprising in view of the difference in the physical condition of the two materials. There is little doubt that had a more intimate incorporation of the swelling liquor been possible in the case of the wood samples, a more marked effect would have been obtained.

CONCLUSIONS.

It has been shown that it is possible to treat wood in such a manner that the normal tendency of this material to exude acids is reversed or at least neutralised. The effect of the treatment appears to last for a very considerable time.

In view of observations made by Harrington it is suggested that this treatment might possibly assist in the protection of timbers against destruction by the shipworm.

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