

SAPSTAIN IN WOOD AND ITS CONTROL

S. R. DASGUPTA

M. A. LATIF

It is often seen on the surface of wood a number of blue-black or blue-grey patches which were originally absent but developed later if the wood is kept unseasoned in warm, humid and unventilated places. Sometimes this colour may be brownish or purple accompanied by smell. This colour or stain is technically termed as "Sapstain" as it is more frequent in sapwood than in heartwood. Initially the stain appears as a tiny blue spot or a small patch or streak on the freshly cut surface or the end of a log (1). It gradually and rapidly spreads and becomes deep-seated if some preventive measure is not taken. Sapstain does not necessarily weaken the wood appreciably but it spoils the appearance and thus reduces the market value. With dark coloured wood, it is not as serious a problem as with light coloured wood where the distinguishable blue colour of the sapstain mars the beauty of the white or light brown colour of the wood. Except for a few species (e.g., teak and sal) nearly all our indigenous species are susceptible to attack by sapstain to a greater or lesser degree any time between a tree is felled and the converted timbers are seasoned. It is observed that light coloured wood is more prone to the attack of sapstain and as such it is common with satian (*Alstonia scholaris*), narikeli (*pterygota alata*), chundul (*tetrameles nudiflora*), pitali (*trewia nudiflora*), kadam (*anthocephalus kadam- ba*), am (*Mengifera indica*), uriam (*Mengifera sylvatica*), civit (*swintonia floribunda*), etc. Most of these species are industrially important and are used in Bangladesh for the manufacture of safety match, veneer, tea-chest plywood and battens, doors and windows etc. As such proper understanding of the causes and preventive measures of sapstain are essential to preserve and optimally utilize our scarce timber resources.

Sapstain is caused by minute thread like organisms known as fungi. Sapstain fungi may attack the trunk of a tree soon after it is felled. The fungi grow readily in the sapwood regions of the cut ends of the freshly felled logs, which are rich in food materials suitable for them (8). The intensity and extent of stain in the wood depend on the species of the staining fungi, the species of wood, and the environmental conditions of the place where the wood is stored. Certain woods have inherent characteristics of resistance to insect and fungal attack. This is attributed to the fact that these woods contain varying amount of phenolic and polyphenolic types of extractives which have strong inhibitory activity against the growth of sapstain fungi. The resistance of wood to sapstain is also dependent on the environmental conditions (4).

action on microbial growth in wood. The growth and the activity of the staining fungi are most severe and the stain formation is heavy in wood with high moisture content and under warm and damp atmospheric conditions (4).

In order to control the attack of fungi in wood, it is necessary to create conditions unfavourable for their growth. In this paper only salient features of control measures which are practicable have been discussed. The stain resulting from fungus growth in wood although prevented by impregnation with the acknowledged preservatives, must often be forestalled by other means because of cost, time of use limitation. This can be done by giving proper care and using necessary precautions.

The felled logs should be removed from the forests as soon as possible so that the fungi in the area are not able to establish themselves on the cut surfaces. In case, this is not possible, measures of protection may be taken by painting the ends of the logs with protective coatings (5). Coal-tar may be used for painting as it is cheaper and readily available. The logs may be protected from serious staining for 3 to 4 months by suitable chemical spray treatment, provided intensity of attack is not high.

The best method of preventing stain and decay in logs is to saw them into lumber as soon as possible after the trees are felled. If immediate sawing is not possible, the logs may be stored under water or continuously sprinkled with water. Wetting of the logs has stain-retarding effect in that it limits movement of air into the logs, which is most essential for the growth of fungi (3). Care must be taken to see that logs are completely immersed under water all the time while in storage and should never come in contact with air before it is ready for sawing or peeling. It should be kept in mind that wood having simultaneous contact with water and air is the best ground for microbial growth. However, complete submersion of logs during transportation in rafts is not always possible. Such transportation of logs, therefore, should preferably be made as swift as possible. It has been observed that, in most cases, infestation occurs during transporting the logs in rafts.

Certain anaerobic fermentation occur while the logs are in water during transportation or storage. It has been observed that odour in lumber or plywood panels sometimes occur when made from such logs in hot and humid atmosphere. The odour is due to some volatile fatty acids, such as butyric, valeric and caproic acids mainly and traces of other acids which are the product of anaerobic microbial fermentation where certain carbohydrates in the wood (such as starch)

are broken down (1). However, in subsequent stages of conversion as in lumber or veneer, aerobic fermentation accompanied by colour and odour occurs if the process of drying is slow. This can be prevented if the lumber or veneer are kiln dried, In case of veneer for use in packaging foodstuff additional heating for 1 to 2 hours may be required to ensure the complete removal of the odour forming acid and also the killing of sapstain micro-organism. Moisture content of veneer, plywood, batten, etc., should preferably be below 16 per cent (2). Where kiln drying facility is not available, operation of the veneer and plywood mill should be suspended or reduced in monsoon seasons when high relative humidity and warm weather help the attack of sapstain fungi. Careful inspection of veneer sheet at this stage is very important since initial attack or dormant sporulation stage of fungi escape the detection but may reappear in the tea chests kept in storage. It is not very uncommon that sapstain (often termed by tea traders as discolouration) occurring in the veneer panels is a source of odour responsible for tainting of tea (2).

Piles, fence posts, etc., should be peeled off the bark to facilitate drying and stacked for seasoning under hygienic conditions. Debarking decreases the susceptibility of the wood to fungal attack since it hastens the escape of moisture from the wood. Care should be taken to avoid accumulation of all off-cuts and other debris in the seasoning and storage yards as these form breeding grounds for fungi. The piles should be about 12 to 24 inches above the ground. The foundation piers should be made of cement concrete works (5). If wood is used as piers it should be treated with suitable preservatives like creosote.

During the warm tropical weather condition when the attack and development of sapstain fungi become vigorous, the above preventive measures may not be sufficient. If chemical treatment is required to control stain successfully, it is essential that the timber and veneer should be given some light chemical treatment immediately after conversion. Brush coating or dipping the timber or veneer for 2 - 5 minutes in a preservative solution may serve the purpose. Experience has shown that in two days' time the fungi sometimes penetrate freshly sawn boards so deep that anti-stain chemicals applied at that time cannot reach them. In warm weather a 2-day delay may allow interior stain, however, in cold weather a delay of as much as 4 or 5 days may be permissible (6).

In small saw mills or veneer and plywood mills, where the quantity of the timber to be treated is not very great, the timber and veneer can be given dip treatment manually

but at large mills a mechanical dipping tank is more convenient. Care must be taken to maintain the correct concentrations of chemicals in the tank.

Chemicals found to be successful in controlling sapstain are given below:-

Sl. No.	Chemicals	Per cent of Solution.
1.	Sodium pentachlorophenate (7) (santobrite)	2 percent solution in water.
2.	Sodium Tetrachlorophenate (7)	3 percent solution in water.
3.	Sodium Pentachlorophenate (7) plus Borax	2 percent Sodium Penta + 1 percent Borax in water.
4.	Benzene Hexachloride plus Pentachlorophenol in fuel oil	5 percent Borax in water. Hexachloride in fuel oil.
5.	Pentachlorophenol plus DDT in fuel oil.	5 percent Penta + 1/2 percent DDT in fuel oil.
*6.	Boric acid (2)	1.25 percent hot solution in water (200 to 212°F.).
*7.	Borax (2)	1.9 percent solution in water for 10 to 40 minutes.

*Packing cases used for food-stuff such as tea chest only Boric acid or Borax should be used for treatment with minimum retention of 0.15 to 0.20 lbs. per cubic feet. A heavier treatment for batten is required. Batten should preferably be treated by dipping in a hot solution (140°F) of 6% Zinc chloride, boric acid or borax for two hours followed by subsequent immersion in a cold solution of the same chemicals (2).

To make it more effective, the treatment must be applied to the ends and bark-free surface of the logs as soon as possible after the trees are felled, preferably on the same date of felling.

Application of chemicals to the surface of logs and sawn timber stock, of course, provides no permanent protection. Preservative treatment is effective for long periods only

when considerably more chemicals go into the wood and deeper penetration is obtained than is accomplished by dipping or spraying (2). As such in order to protect wood, additional treatment under pressure is needed which provides chemicals and penetrations adequate for the purpose. Prevention of sapstain will, no doubt, benefit the wood working industries in the form of a lesser conversion cost and reduced wastage. It is felt that a proper understanding of this problem will help our timber industries from serious losses due to staining (8).

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SUMMARY

The purpose of this paper is to realise the importance of damages caused to wood by sapstain fungi generally overlooked by producers and consumers of wood. Wood may be attacked by sapstain fungi any time between the felling of tree and seasoning of the wood and in cases where the moisture content of wood is above 16 per cent. It is felt that people of all stages of wood industry need to be motivated to make a concerted effort for taking appropriate measures timely to check the attack so that a little additional care may help saving a great amount of timber and money.

সারসংক্ষেপ

সাধারণতঃ কাঠ ব্যবসায়ী এবং ব্যবহারকারীরা ছত্রকজনিত পলদাগ দ্বারা যে অপূরণীয় ক্ষতির সম্মুখীন হন তাহার সম্বন্ধে উপলব্ধির অভাবই এই বিষয়ের অবতারণা। বৃক্ষ কাটান হইতে পুরু করিয়া কাঠকে পতকরা ১৬তাগ আর্দ্রতার পরিধানে পুষ্টিবহন পর্যন্ত যে কোন সময়ে বা ব্যবস্থায় কাঠ ছত্রকজনিত পলদাগ দ্বারা আক্রমণ হইতে পারে। কাঠ শিল্পে নিয়াজিত সর্বস্তরের ব্যক্তিগণ এই বিষয়ে সজাগ দৃষ্টি দিজে এবং সময়ে সময়ে ব্যবস্থা গ্রহণ করিজে, প্রচুর পরিমাণে ক্ষয় হাত হইতে রক্ষা করা সম্ভব।