

## INDUCTION OF DISCOLOURED WOOD IN SAMANEA SAMAN

by

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**Summary**

Injection of ethephon or distilled water through boreholes into the sapwood of *Samanea saman* causes heartwood-like colouration. The causative factor for such colouration is injury during the treatment. Discoloured wood shows reduced starch; high lipid, protein and extractive contents; and high peroxidase and succinate dehydrogenase activities.

**Introduction**

In recent years attempts have been made to induce heartwood, most of which involve injury to the wood tissue. Injury affects many of the same metabolic activities occurring during heartwood formation (Nelson, 1978), and brings about the formation of a heartwood-like colouration in wood: discolouration (Shigo, 1975a, b; Shigo & Hillis, 1973). According to Shigo (1967), the similarity in colour between the discoloured wood and the heartwood has caused serious confusion leading to loose usage of terms like 'heartwood' or 'false heartwood' in some publications. The present communication is aimed at the histochemical examination of the heartwood-like colouration in *Samanea saman* induced by injecting ethephon into wood through boreholes.

**Material and Methods**

0.5 percent aqueous solution of ethephon (2-chloroethyl phosphonic acid) was injected into the branches of *Samanea saman* through increment boreholes. The selected branches, as confirmed by boring up to the pith, had no heartwood at the time of ethephon administration. Controls consisted of injection of distilled water through similar boreholes. The holes were sealed with wax after the treatment. The treatments were repeated after every week for one month. After the last treatment the boreholes were left sealed for two months. At the end of this period the wood samples were collected both from the treated and control sites. 15–20 micron thick sections obtained from the fresh material were used for the following histochemical tests:  $I_2KI$  - for starch (Johansen, 1940); sudan black 'B' - for lipids (Gomori, 1952); mercuric bromophenol blue and acid

fuchsin - for proteins (Mazia et al., 1953 and Ling-Lee et al., 1977 respectively); benzidine method - for enzyme peroxidase (Molner & Lacroix, 1972); tetrazolium method - for enzyme succinate dehydrogenase (Jensen, 1962); and 10% aq.  $FeCl_3$  - for extractives (Ling-Lee et al., 1977). Observations were made at comparable radial distance from the cambial zone.

**Results and Discussion**

Transverse discs cut from both treated (Fig. 1A) and control borehole sites were found to have brown discoloured wood. Discoloured wood of treated and control samples is identical in its structure and histochemistry. Normal sapwood surrounding the discoloured wood contains abundant starch stored in its axial parenchyma cells, whereas the discoloured wood shows very little or no starch content. Lipids in the normal wood are minute globules evenly distributed in parenchyma cells and living fibres. The discoloured wood stores irregular masses of fused lipid bodies. The discoloured wood shows a little higher protein content in its cells than the normal wood. Peroxidase activity is usually found in the ray cells in normal sapwood (Fig. 1B). Intense peroxidase activity is found in the ray cells, and sometimes also in the axial parenchyma cells of the discoloured wood (Fig. 1C). Succinate dehydrogenase activity (SDH) is hardly detectable in the normal wood, while its activity is found in the parenchyma of discoloured wood (Fig. 1D). The peripheral part of the discoloured wood shows higher SDH activity (Fig. 1D) than the inner regions.

The parenchyma cells and vessels in the discoloured wood are heavily packed with extractive substances (Fig. 1E). At the boundary of the discoloured wood even fibre lumina show a dense accumulation of extractives. The parenchyma cells of discoloured wood show the presence of spherical nuclei which are larger than those in the normal wood.

Formation of heartwood-like colouration (discoloured wood) both at the treated and the control sites clearly indicates that it is due to the borehole injury during the treatment.

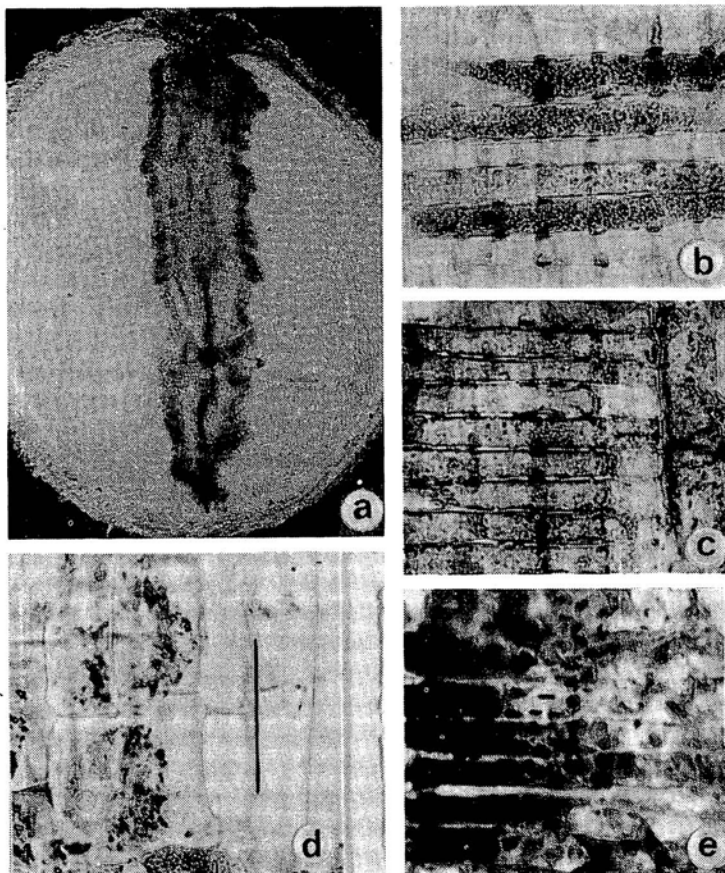


Fig. 1. — A: Transverse disc showing discolouration. — B, C: Peroxidase activity in B, normal wood, C, discoloured wood. — D: SDH activity in discoloured wood. — E: Extractives in parenchyma cells. Scale represents 2.6 cm in A, and 50 microns in B—E.

Therefore, we believe that the role of ethephon in bringing about the discoloured wood (or 'heartwood', 'false heartwood' etc.) is rather insignificant. Heartwood was found to be formed at the site of ethephon administration in *Azadirachta indica* by Shah et al. (1981). It showed disappearance of starch, presence of high lipid and phenolic contents; and the cells at the site (where the 'heartwood' is found) and a little away from it, showed the stimulation of enzymes like acid phosphatase, lipase, ATPase and Succinate dehydrogenase. However, we feel that the changes in colour of wood occurring due to the bore and/or ethephon should not be considered as heartwood;

it is the discolouration process only. The zone of inner layers of wood, which, in the growing tree, has ceased to contain living cells and in which the reserve materials (i.e., starch) have been removed or converted into heartwood substances is defined as heartwood. Hillis (1975) induced a yellow coloured zone in the wood of *Rhus* and *Acacia* by injecting ethephon into the sapwood. However, this zone has not been termed heartwood in spite of its similarity with heartwood in the composition of extractives. Therefore, we believe that care should be taken while designating the injury-altered wood as heartwood since the advanced stages of discolouration are known to resemble

the heartwood in many respects. However, it is an established fact that the heartwood is age-altered wood and the discoloured wood is injury-altered wood (Shigo, 1975a). Thus, both of them differ from each other in terms of their development also.

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