a medicament drunk after confinement (Skeat, *Mal. Magic*, 1900, p. 346). The ashes, with vinegar only, may be rubbed on the body (Ridley, in *Journ. Straits Med. Assoc.*, 1897, 5, p. 138). In the *Medical Book of Malayan Medicine* (*Gardens Bull.*, S.S., 1930, 6), the ash of coconut shell is prescribed in applications for swellings, pain in the stomach, and rheumatism; it enters also into a gargle. In no case is its presence anything but empirical, and in the treatment of swellings, the use of the eye-end of the shell suggests magic."

It is indeed difficult to see what effect the acetates formed by dissolving the ash in vinegar can have other than as a mild diuretic due to salt action.

17. Child, R., "Coconut Shells as an Industrial Raw Material. I. Composition of Shells", *Current Science*, 1943, **12**, 292–94. See this article for references 1–16, which have occasionally been re-quoted in the subsequent articles. 18. Robert Knox, *An Historical Relation of Ceylon*, etc. (Quoted from the edition published in 1911 by MacLehose & Sons, Glasgow, p. 420). 19. Bennett, J. W., *Ceylon and Its Capabilities* (London), 1843, pp. 87 & 103. 20. Burkill, I. H., *A Dictionary of the Economic Products of the Malay Peninsula* (Crown Agents for the Colonies, London, 1935), Part I, p 609. 21. Grisard, J., and Vanden-Berghe, M., *Les Palmiers Utiles* (Paris, 1889), p. 68. 22. Charles Regnaud, *Histoire Naturelle, Hygienique et Économique du Cocotier* (*Cocos nucifera*, Linn.), Paris, 1856, p 125. This little-known work was presented by its author, a native of Mauritius, to the Faculty of Medicine of Paris as his Thesis for a Doctorate. It is an interesting little volume, full of curious information, which deserves to be better known. 23. Shortt, J., *A Monograph on the Coconut Palm or Cocos nucifera*, 1885, Madras Govt, Press, 1888, Plates Nos. 5 & 6. 24. Hamel Smith, H., and Pape, F. A. G., *Coconuts: The Consols of the East*, "Tropical Life," Publishing Dept., London, 1914 (2nd edition), p. 350. 25. Pieris, W. V. D., *On the Uses of the Coconut Palm, with an Illustrated Guide to Coconuts* (Coconut Resesrch Scheme, Ceylon, 1936), p. 7 and Plates 37–40. 26. Little, R., "A Further Use for the Coconut," *Agric. Bull. Straits and F.M.S.*, 1908, **7**, 258. 27. Cook, O. F., "History of the Coconut Palm in America," *Contribution from the U.S. National Herbarium*, 1910, **14**, Part 2, p. 288, Plate 53, Fig 1. 28. Cooke, F. C., "Investigations on Coconuts and Coconut Products," *Bull. No. 8 (General Science)*, *Dept. of Agric., S.S. & F.M.S.*, 1932, pp. 22–33. 29. Pieris, W. V. D., *Methods of Copra Curing*, Illustrated leaflet, p. 8, issued by the Ceylon Coconut Board, Colombo, 1940. 30. Watt, G., *Dictionary of the Economic Products of India* (Govt. Press, Calcutta, 1889), **2**, 455, *et seq.*

RECENT WORK ON WOOD PRESERVATION AND IMPROVEMENT AT THE FOREST RESEARCH INSTITUTE, DEHRA DUN*

THE importance of protecting wood against destruction by fungi, termites, borers, marine organisms and fire needs no emphasis. The losses due to these agencies are enormous and the importance of wood preservation is obvious In advanced countries wood preservation is synonymous with timber utilization and its economic importance is recognised. Further, but for the indirect influence of wood preservation on forest conservation, several million acres of forests would not be standing to-day in various parts of the world.

A proper understanding and practice of wood preservation demands a knowledge of several branches of science, *viz.*, chemical engineering, applied physics, chemistry, timber technology and a knowledge of wood destroying fungi, borers, termites and marine organisms, etc.

The foundations of wood preservation research in this country were laid by Sir Ralph Pearson of the Indian Forest Service about thirty years ago With very limited equipment at his disposal, he carried out experiments on the treatment of railway sleepers and on various types of preservatives.[1] As a result of this work the first commercial treating plant was started by the N.W. Railway. This good work was continued by later officers and among work carried out by them may be mentioned the examination of the treatment characteristics of various species of Indian timbers,[2] natural durability tests, accelerated service tests,[3] service tests on treated sleepers,[4] the development of a new specification for the treatment of coniferous sleepers,[5] which enabled the Forest Department to obtain 50 per cent. more sleepers from the same volume of timber as were obtained before, and the evolution of the preservative Ascu[6] which aroused considerable interest.

The Forest Research Institute is equipped with four pressure cylinders wherein timber, varying in length from 3 to 40 feet, can be treated by all the standard pressure processes, five open tank plants, and a laboratory where all chemical, physical and chemical engineering work connected with the experiments can be carried out.

Toxicity Tests

In co-operation with the Mycologist, experiments are in progress to find out the most suitable fungi for use in toxicity tests. The reaction of Indian fungi to the more important preservative chemicals is being investigated. Toxicity tests on a commercial sample of cashew shell oil showed that, contrary to popular belief, the oil is not sufficiently toxic to wood-destroying fungi.[7] The toxicity of various types of Indian creosotes[8] and ascu[9] to wood-destroying fungi has been studied. Tests on the natural durability of various timbers and accelerated service tests on several preservatives have been carried out in the Institute's test yards.[10]

Preservatives

An important and extended investigation, recently undertaken, deals with the most suitable quality of creosote for use in this country. Several types of creosotes, and creosote fractions, have been and are being subjected to

* Contributed at the request of the Editor, *Current Science*.

extensive studies to evaluate the toxicity, permanence and penetrating power; normal and accelerated service tests are also being carried out.[11] The variation in the quality and quantity of creosote on exposure to atmosphere of treated timber, as also when subjected to oxidation have been investigated with interesting results.[12]

Post mortem examination of several failed ascu-treated poles[13] and treated sleepers from railway lines[14] in different parts of the country after various periods of service, have been carried out with the object of ascertaining the quantity and quality of the preservative still left in them. Some special leaching tests were carried out on ascu-treated timber.[15]

In view of the extreme shortage of preservatives of any kind in the country and the urgent demand for indigenous substitutes for war purposes, oil-soluble preservatives from the copper and zinc derivatives of chir pine resin and cracked vegetable oils have been evolved and tests on them initiated.[16]

Treating Processes and Plant Design

The work on the optimum treating conditions for the more important Indian timbers has been continued. Experiments on the treatment of several species of timbers in pole form indicated that the open tank process gives more uniform penetration than the Lowry process with some species. The difficulties experienced in Assam and on the West Coast in the seasoning of sleepers without decay, prompted an investigation on the conditioning and treatment of several species of sleepers in the green condition.[17] As a result of this work, a steaming and vacuum *cum* Boulton process of conditioning green sleepers has been developed with satisfactory results.[17a]

The treatment of green bamboo army tent poles by various processes has been studied.[18] To meet the demands of the army and other departments several simple designs of open tank plants with simple methods of heating have been developed.[19]

Resistance of Wood to Charcoal

Work on the resistance of wood to corrosion[20] has been continued. Various types of linings for plywood containers have been tested and suitable coatings evolved for a variety of purposes including the storage of petrol.[21]

Resistance to Fire

Among other lines of investigation receiving special attention, may be mentioned studies on the resistance to fire of Indian timbers, both in the natural and treated states. The natural resistance to fire of 52 species of Indian timbers has been investigated.[22] Suitable apparatus was evolved for this purpose and the laws governing the burning of wood elucidated.

A fire-retardant composition, utilizing mica waste, has been evolved and the effectiveness of various compositions studied.[23] The influence of the cross-section of the member on the efficiency of fire-retardant treatments has also been studied.[23]

Thermal Properties

The thermal conductivity of over sixty species of Indian timbers in the air-dry condition has been examined.[24] Recently the specific heat of wood has also been investigated.[25] Preliminary experiments indicate that contrary to other work, probably some variation exists between species with regard to this property.

Electrical Resistance

In continuation of earlier work,[26] work on sleepers, poles and plywood has been taken up.

Permeability

In view of the importance of the knowledge of the factors affecting the permeability of wood with regard to wood preservation, etc., studies on the permeability of wood and other materials have been undertaken with interesting results.[27] This necessitated the design of a suitable clamp to avoid the necessity of end-sealing specimens, and other apparatus.

Sound Absorption

The sound absorption coefficients of various types of fibre and bark boards made at the Forest Research Institute and vibrating systems have been investigated.[28]

Improved Wood

Investigations on the production of "improved wood" by impregnation with synthetic resins have been carried out with interesting results.[29] Experiments on compressed wood also yielded interesting data.[29] Both laminated[30] and compregnated[31] wood have been produced from various Indian timbers and their properties studied. The influence of species, veneer thickness, adhesive used, the direction of laying of the veneers, and the conditions of pressing on the properties of the resulting product have been investigated. Compregnated wood, even from such an inferior timber as *semul*, has been found to compare favourably with foreign samples. Various parties are interested in the use of the material for ships tail shaft bearings, gear wheels, air-screw blades, shuttles. etc.

Adhesives

A scheme of research on various forms of plywood adhesives was initiated in April 1941. A systematic investigation of caseins of Indian origin was undertaken, and various formulæ for casein glues tested.[32] In view of the acute shortage of casein, other sources of proteins from indigenous materials for adhesives have been explored with encouraging results. Suitable adhesives have been developed from the proteins of oil seed cakes, seed proteins, etc.[33] Highly water-resistant adhesives have also been developed from the aq. alcoholic extracts of cereal meals.[34] Urea-formaldehyde resins, stable in syrup form for a few months and comparing favourably with foreign adhesives, were developed in response to requests from various departments.[35] Tar acid-formaldehyde resin adhesives were also developed from Indian tar acids with good results.[36]

Cork-Substitutes, Boards, etc.

In view of the acute shortage of cork, bottle stoppers were made from softened *Cryptomeria japonica*, which have been found suitable.[37] Various types of composition corks have also been developed from tree barks. Composition boards have also been made from sawdust and wood shavings using various types of binders.[38]

D. N.

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OBITUARY

P. ZEEMAN (1865–1943)

PIETER ZEEMAN, the famous Dutch Physicist, whose death has just been announced, was born at Zonnemain, Zeeland, in 1865. From 1885 to 1893 he studied at Leyden. In 1890 he became connected with the University as a privat-dozent and remained there until 1900 when he was appointed Professor at Amsterdam and later on Director of the Physical Institute. He made the great discovery known after him at the young age of 31, won the Nobel prize at the age of 37 and died at the age of 78. He was a member of many learned societies including the Royal Society and recipient of many degrees, medals, awards and numerous honours, and author of several papers and books.

Faraday had many years earlier, long searched for a relation between magnetism and light and had as early as 1862 placed a sodium flame in a magnetic field, observed the light in a spectroscope but found no effect. Faraday failed because his spectroscope did not possess the necessary resolving power and he did not use strong enough magnetic field. In 1896, Zeeman repeated Faraday's experiment with very strong magnetic fields and a powerful concave grating spectroscope and showed the splitting up of the spectral lines. The electron had just been discovered by J. J. Thomson and Lorentz on the basis of his theory of electrons supplied the explanation of Zeeman's great discovery. The normal triplets of Zn and Cd lines both with regards to their separation and polarisation were in complete accord with Lorentz's theory of electrons oscillating in atoms. The complex Zeeman effect of D lines and of green and blue lines of Zn and Cd which were soon after discovered by Zeeman and others were explained by Preston and Voigt and the discovery of the anomalous effect in the case of D lines by Paschen and Back in 1912 was further support and elucidation of the original theory Bohr's theory of spectral lines was used by Debye and Sommerfeld in giving a newer explanation and opening up fresh fields of investigation.

Lande's prediction of a multiplicity of stationary states and the hypothesis of orientation applied to multiplets and later on the hypothesis of the spinning electron and the introduction of the splitting factor and the most important work on the hyperfine structure and investigation of Bismuth lines by Goudsmit and Back in weak and strong magnetic fields, furnished the complete explanation of the Zeeman effect. If Zeeman effect had not been discovered the nature of spectral series would have remained problematic.

It is a remarkable fact that though nearly half a century has elapsed since the discovery of the original effect, Zeeman's work has kept pace with the latest developments of atomic physics. Originally explained in an elegant manner on the classical theory, its full importance and explanation have been furnished by quantum theory and its effect on the nuclear physics has been of great value.

Zeeman's experimental genius has achieved valuable results in other fields too and his work on gravitation and mass and inertia has been of great importance, especially in the theory of Relativity.

He and his students have contributed a great deal to the investigation of hyperfine structure of spectrum lines and Zeeman effect on these. This has resulted in the development of apparatus of the highest resolving power and the use of the highest experimental skill. Zeeman's influence spread far beyond his country and valuable contributions have come from all over the world.

The world of science has lost a great genial personality whose epoch-making discovery has inspired research of the highest type in experimental and theoretical physics for nearly half a century and has yielded results of the greatest value in understanding the nature of the spectrum lines and the structure of matter.

Lucknow,
December 23, 1943. WALI MOHAMMAD.