CIII. A NOTE ON THE OCCURRENCE OF A PECTIC SUBSTANCE IN BEECH WOOD.

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THE microscopical examination of a disc cut from the log of a freshly felled beech tree was carried out by Mr J. F. Martley in the Forest Products Research Laboratory at South Farnborough in the spring of 1924. It showed that a tertiary layer was present in the cell-wall over certain areas of the disc. This tertiary layer, which was confined to a sector extending from 90° to 290° approximately (*i.e.* the southern side of the trunk), was distinguished from the normal secondary thickening layer of the cell-wall both optically and in its reactions to stains and reagents. It was also found to respond to the micro-chemical tests for pectin.

There being no evidence in the literature of the isolation and chemical examination of a pectic substance from wood, it was decided to apply to the sawdust obtained from the same beech log as the disc mentioned above, the method for the isolation of pectic acid from unlignified tissue advocated by Clayson, Norris and Schryver [1921].

For this purpose, 475 g. of sawdust from the north side of the trunk and 300 g. from the south side were treated separately. They were extracted several times with hot water, and then with 4 % sodium hydroxide solution to extract the hemicellulose [O'Dwyer, 1923]. The sawdust, after the soda solution had been filtered off, was washed free from alkalies, and then treated with hot 0.5 % ammonium oxalate solution several times, and filtered.

Although a large percentage of the tannin had been extracted from the sawdust by the treatment with hot water and sodium hydroxide, a considerable amount came out after treatment with hot ammonium oxalate, and the addition of hydrochloric acid to the ammonium oxalate extract brought down tannin as well as a white precipitate. Hence it was found necessary to eliminate tannin before adding hydrochloric acid to the solution. The reagent used for its removal was hide-powder, employed according to the methods for tannin analysis as outlined in the *Official Methods of the Society of Leather Trade Chemists*, without the preliminary light chroming. This method proved quite successful. The hide-powder did not precipitate the pectic substance, which came down afterwards on the acidification of the tannin-free solution with hydrochloric acid.

This substance, which is insoluble in water but soluble in ammonia, was purified by dissolving in 0.5*N* ammonia and reprecipitating with hydrochloric acid, when a thick gelatinous mass was formed. This was dialysed for some days with distilled water, until the liquid outside the dialyser gave only the faintest turbidity with silver nitrate. The substance was then treated with graded strengths of alcohol and then with ether; to complete the drying it was allowed to stand over phosphorus pentoxide in a vacuum desiccator.

It was found that the yield from the 475 g. from the north side was 1.476 g. (about 0.3 %), whilst the yield from the 300 g. from the south side of the beech log was 1.44 g. (a little less than 0.5 %). The product was found to be free from nitrogen by the method of Kjeldahl. The furfural yield was determined by hydrolysing about 0.2 g. with 12 % hydrochloric acid and treating the distillate with phloroglucinol, as described by the author in a previous communication [1923]. The test for methylpentose gave a negative result. The amount of furfural phloroglucide, reckoned as pentose, obtained from the product from the north side, was 43.0 %, and from that from the south side of the log 42.6 %. These figures approximate very closely to those obtained by Clayson, Norris and Schryver [1921] for the pentose content of pectic acid.

The optical rotation was obtained from a solution of the product in 0.5*N* ammonia, but, as in the case of pectic acid obtained from unligified tissue, it was only found possible to employ small concentrations. A 0.12 % solution gave a specific rotation of + 264°, which is within the limits found for the specific rotation of pectic acid obtained from various sources.

The following results were obtained on analysis by the method of Drenstedt:

- (1) 0.1936 g. gave 0.2808 g. CO₂ and 0.1008 g. H₂O.
Ash = 0.0053 g.; C = 40.73 %; H = 5.89 %; O = 53.38 %.
- (2) 0.1931 g. gave 0.2820 g. CO₂ and 0.1044 g. H₂O.
Ash = 0.0065 g.; C = 40.84 %; H = 5.79 %; O = 53.37 %.

The figure obtained for carbon in each case is a little lower, and that for hydrogen a little higher than those obtained for pectic acid in unligified tissue [Clayson, Norris and Schryver, 1921], but the differences are very slight. Owing to the small amount of the product obtained, it was impossible to purify it by the methods of these authors.

Had this been done, there seems to be little doubt that the results would have agreed even more closely with theirs.

SUMMARY.

There seems to be no reasonable doubt that the product obtained from beech wood by extraction with hot dilute ammonium oxalate and precipitation with hydrochloric acid is of a pectic nature and corresponds with the pectic acid obtained by Clayson, Norris and Schryver from unligified tissue.

The fact that a considerable amount of the product was obtained from a part of the log in which no evidence of a tertiary layer could be found micro-

scopically seems to show that the pectic substances are not confined to this particular layer in the cell-wall.

The isolation of this substance from lignified tissue is of some importance, as it seems probable, from other work being carried out in this laboratory, that there may be some connection between the amounts of pectic substance and of hemicellulose in lignified and unlignified tissue respectively.

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REFERENCES.

- Clayson, Norris and Schryver (1921). *Biochem. J.* 15, 643.
O'Dwyer (1923). *Biochem. J.* 17, 501.