ON THE OCCURRENCE OF LAPACHIC ACID IN BETHABARRA WOOD.

By WM. H. GREENE and SAMUEL C. HOOKER.

[Read at the Meeting of the Chemical Section, April 16, 1889.]

A few weeks ago we were asked by Mr. A. B. Shipley, of this city, a large importer of Bethabarra wood, to investigate the properties of a yellow substance with which the pores of the wood appear to be filled. So far as we know, the wood is used in this country for the manufacture of bows and fishing-rods only, for which purpose it is admirably adapted, on account of its great tenacity and remarkable elasticity.

We have been able to learn nothing of the botanical nature of the tree yielding the Bethabarra wood, which is said to be brought from the West Coast of Africa, but we believe that we may venture the opinion that it is a species of Lapacho. The latter is one of the finest ornaments of the sub-tropical hills and plains of South America. Its far spreading branches are in the spring covered with masses of flowers, red or yellow, according to the variety, so dense that the rays of the sun cannot penetrate them. Its wood is very hard, susceptible of a fine polish, and resists indefinitely the action of moisture.

The considerable cost of the wood made it desirable that, if possible, some use should be found for the refuse.

A few preliminary experiments with the extracted substance showed us that it contained a compound of much scientific interest, and for this reason we felt justified in undertaking the research, independently of any pecuniary result with which we were not concerned.

On referring to the literature of the subject, we found a paper entitled "Preliminary Notice of a New Vegetable Coloring Matter," published by Samuel P. Sadtler and William L. Rowland in December, 1880,* concerning the principle of the Bethabarra wood. Aside from analyses,

* *Amer. Chem. Jour.*, **3**, 22.

this paper throws but little light on the constitution and properties of the substance, dealing mainly with a comparison of the color reactions of the Bethabarra principle with crysophanic acid, santalin, hæmatoxylin and brasilin. The analyses of the authors left them undecided between the formulæ $C_{28}H_{29}O_5$ and $C_{22}H_{23}O_4$, and they conclude their paper with a suggestion that a close relationship exists between the Bethabarra principle and crysophanic acid and hæmatoxylin.

The Bethabarra wood used in our investigation was mainly in the form of sawdust. This was extracted in quantities of about five kilogrammes at a time by percolation with a cold one per cent. solution of crystallized sodium carbonate; the solution was allowed to remain in contact with the wood for several hours, and then drawn off, and the operation was repeated three or four times until the intensity of the deep red color of the extract was much diminished. The liquid was then treated with an excess of hydrochloric acid, and the precipitate allowed to settle, the excess of acid being necessary to insure the rapid separation of the precipitate. The clear liquid was then siphoned off, and the precipitate collected on a filter and dried.

This extract consists of the crystalline principle of the wood, accompanied by a resin, and as both are readily soluble in alcohol, this is not a desirable agent for the first crystallization as recommended by Sadtler and Rowland. On the other hand, we found the resin to be practically insoluble in ether, which freely dissolves the crystalline substance. The dry substance was broken up and shaken with ether in a closed flask; the addition of a few drops of water causes the resin to agglomerate and adhere to the walls of the flask; the ethereal solution could then be poured off without filtration. This operation was repeated with fresh ether; the ether distilled off, and the crystalline mass obtained was thrown on a filter and washed with a little alcohol at the pump. In this way the substance was obtained in a nearly pure condition, one recrystallization from alcohol yielding an absolutely pure product equal in quantity to at least 0.6 per cent. of the wood employed.

After a brief examination of our substance, we were struck by the remarkable similarity of its properties with those of taiguic acid,* which will be found described in Gmelin's Hand-Book, xvi, 521, and which has been shown by Paternò† to be identical with the greenhartin of Stein‡ and with the lapachic acid of Siewert.§ Under the latter name, this substance has been the subject of an admirable research by E. Paternò,|| who from a series of concordant analyses deduced the formula $C^{16}H^{14}O^3$, and was able to assign to it with great probability the constitution of an amylene-oxy-naphthaquinone.

A close examination of the Bethabarra principle established its complete and unquestionable identity with lapachic acid. Its fusing point is $139^{\circ}5-140^{\circ}5$; that of lapachic acid, as given by Paternò, is 138° .

We have prepared a number of characteristic salts. That of ammonia is unstable, losing ammonia with great readiness; a dilute solution of this salt deposits crystals of the acid when evaporated, as observed by Paternò with the ammonium compound of lapachic acid.

The silver salt is obtained as a bright red amorphous powder; on analysis we obtained the following figures:—

	I.	Found.	II.	Calculated for $C^{16}H^{14}O^3 Ag$.
Ag	30.65 per cent.		31.04 per cent.	30.95 per cent.

Mean of analyses by Paternò, 30.87 per cent. Ag.
Analyses I and II were of compounds prepared separately.

* *Comptes rendus*, **46**, 1, 152.

† *Gaz. Chim. Ital.*, 1879, **9**, 505.

‡ *Jour. prak. Chemie*, **99**, 1.

§ *La République Argentine*, par R. Napp, aidé de plusieurs collaborateurs. Ouvrage écrit par ordre du Comité central Argentin pour l'Exposition de Philadelphia. Buenos Ayres, 1876.

|| *Gaz. Chim. Ital.*, **12**, 337-392.

By reducing agents the Bethabarra principle is converted with great facility into a white crystalline substance, which rapidly absorbs oxygen from the air, being reconverted into the original compound. This also characterizes lapachic acid.

By the action of concentrated sulphuric acid we have obtained a beautiful orange-red, quinone-like, crystalline substance, fusible at 155° – 156° and identical with lapachone.* Concentrated nitric acid in the cold gives rise to the same substance, as shown by Paternò.

As the unexpectedly rapid result of our research has left us sufficient material to extend our investigations, and as the constitution assigned by Paternò to lapachone is not in accordance with some reactions which we have observed, we purpose to make this compound the subject of further study.

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ON THE PRESENT CONDITION OF THE PHILADELPHIA WATER SUPPLY. FIRST MONTHLY REPORT

By SAMUEL C. HOOKER, Ph.D.

[*Read at the Stated Meeting of the Chemical Section, April 16, 1889.*]

Many considerations have induced me to undertake a systematic and frequent chemical examination of the water supplied to this city, and at the outset it would seem desirable that I should briefly enumerate some of the principal reasons for the investigation, and mention some of the beneficial results which it is to be hoped may arise from it. In approaching this question of the water supply of Philadelphia, which has given rise to so much discussion and difference of opinion, I desire it to be understood that I am primarily seeking for information, and that I wish to ascertain as nearly as possible the condition of the water at *all* times. We hear occasionally when the water is bad, but we

* Paternò, *loc. cit.*, 372.