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MADRAS RECORD OFFICE.

Government of Madras.

Revenue DEPARTMENT.

G.O. No.	9243	Press Mr.
Dated	31-8-1870	

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Medical.

No. 58. *Read letter from J. A. BOURDILLON, Esq., Officiating Assistant Secretary to the Government of Bengal, Financial Department, to the Secretary to Government, Fort St. George, dated Calcutta, 29th July 1876, No. 2401 (Agriculture).*

Under the orders of the Government of India I am directed to forward, for the information of the officer in charge of the General Hospital, twenty-five copies of "a description of the process at present used for manufacturing 'cinchona febrifuge' at the Sikkim plantations" by Mr. C. H. Wood, Government Quinologist.

DESCRIPTION of the Process at present used for manufacturing "CINCHONA FEBRIFUGE" at the SIKKIM PLANTATIONS, by C. H. Wood, Government Quinologist.

General Object of the Process.—The present method of treating cinchona bark was adopted as a temporary measure to afford the means of ascertaining the medicinal value of the proposed febrifuge. It was considered undesirable to incur any expenditure for factory buildings, machinery, or skilled labor until the efficacy of the product as a remedial agent had been thoroughly determined by extensive trials. Consequently it was necessary to so arrange the process that it could be conducted for some time on a considerable scale, and involve no other appliances than such as were already at hand.

General Nature of the Process.—The dry bark is crushed into small pieces (but not powdered) and is put into wooden casks, where it is macerated in the cold with very dilute hydrochloric acid. The liquor is then run off into wooden vessels and mixed with an excess of a strong solution of caustic soda; a precipitate forms, which is collected on calico filters, and well washed with water. The precipitate is then dried at a gentle heat and powdered. It constitutes the crude febrifuge, which is next submitted to a process of purification. In the latter process a certain weight of the crude product is dissolved in dilute sulphuric acid, and a small quantity of a solution of sulphur in caustic soda is added to the liquor. After the lapse of 24 hours the liquor is carefully filtered. The filtrate is mixed with caustic soda, and the resulting precipitate collected on calico, washed with a small quantity of water, dried and powdered; it is then ready for issue, and is sent out under the name of "cinchona febrifuge."

Arrangement of the Factory Sheds.—A position was chosen conveniently near the dry bark godowns, and so situated on the side of the hill that a copious supply of water could be obtained at a level with the roof of the sheds in which the maceration is conducted.

These sheds are rough temporary erections, constructed with saplings and a mat or thatch roof. Down the centre an open drain is cut to carry off the waste liquor. Over this drain some wooden stands are placed, on which the calico filters rest. The filters are formed by tying a square piece of calico to a wooden frame by the four corners. On each side of the shed is placed a row of twenty-one casks, standing on end upon a stand which elevates them about two feet from the ground. They are empty beer barrels, which have been purchased from the Commissariat Department at Darjeeling, the head removed, and the cask thoroughly cleansed; a hole is cut in the side of the cask at a level with the bottom, and closed with a cork. In front of the casks a row of tubs, formed by cutting beer barrels in halves, is placed, so that on uncorking the barrels the liquor will run out into the tubs.

Outside the shed, at one end, are a couple of large wooden vats at such an elevation that liquid can flow from them along a bamboo trough into any one of the barrels in the shed. The capacity of the vats, up to a mark on the inside near the top, is accurately determined. Water is run into the vat up to the mark, and a certain quantity of muriatic acid is added, and the whole well mixed. This diluted acid can then be run into any one of the casks in a line with the vat by means of a bamboo trough. In addition to the macerating sheds there is a small brick

building heated with charcoal, in which the precipitate is dried; also a separate shed in which the process of purification is conducted.

Method of conducting the Process.—The casks are worked in sets of three, and are marked A B C.

In each shed there are fourteen sets; seven on each side. Each cask receives one maund of dry bark, which undergoes four successive macerations, the liquor being moved in rotation through the three casks. Each maceration lasts half a week. The liquid used for the fourth and last maceration is acidulated water drawn from the vat. When this is run off, it is moved into the next cask to form the third liquor. When this is drawn off, it forms the second liquor for another cask, and, when transferred from that, it goes on to new bark, from which it is drawn off and precipitated. The following table will show the manner in which this rotation is effected. Of course in starting a new shed every cask contains dry bark, consequently the system of rotation is not brought into full operation until after the first fortnight; and it is only after the shed has been in operation for three and-a-half weeks (June 7 in table) that the liquor for precipitation has been used for four macerations. The table is drawn for a new shed; after June 7th, it is in regular order.

The liquor that is for precipitation is run into the tubs. The other liquors are drawn into wooden buckets and poured into the proper casks. The new acid is then drawn from the vats. The diluted acid is made in the vat by adding 1 gallon of muriatic acid to every 100 gallons of water (10 fluid ounces to each cubic foot).

If three sheds are employed, No. 1 is worked on Mondays and Thursdays, No. 2 on Tuesdays and Fridays, and No. 3 on Wednesdays and Saturdays. It will be seen by the table that each set of three casks exhausts one maund of dry bark per week. Three sheds therefore, containing 42 casks each, would exhaust 42 maunds of bark every week.

The weight of acid used in the exhaustion is 64 per cent. of the weight of dry bark. It is obtained from Mr. Watson's chemical works at a cost of 3½ Annas per pound in Calcutta.

To precipitate the saturated liquor a solution of caustic soda is added in excess. The caustic soda is obtained from England in five-cwt. drums, costing from £15 to £20 per ton in London. One part of this is dissolved in three parts of water, and the solution stored in iron vessels. The quantity to be added to the bark liquor must be judged of by the appearance produced. When a sufficient quantity has been introduced, the precipitate assumes a somewhat curdy condition.

About 64 pounds of solid soda are used for every 100 pounds of dry bark.

The filtration is not commenced until the following day, when the liquor is transferred to the calico strainers which have been well wetted. The first portions that run through are returned until the liquid passes of a bright ruby color; it is then allowed to flow away by the drain. After all the liquor has drained off, water is passed through the precipitate until it ceases to acquire a red tint. The alkaloide on the filter should then be of a uniform cream color. The precipitate is now dried and reduced to a fine powder, which is stored in suitable bins. It constitutes the crude febrifuge.

The Process of Purification.—The precipitate during the act of drying acquires a slightly reddish-brown color. It is therefore submitted to a process of purification. Fourteen gallons of water are mixed with two pints of sulphuric acid, and twenty pounds of the dry powder are introduced. The alkaloide dissolve, and a quantity of coloring matter remains insoluble. About half a pint of a solution of sulphur in caustic soda is now stirred in, and the whole allowed to stand for twenty-four hours. It is then filtered through calico into a clean vessel, care being taken to get the liquor perfectly bright. About six gallons of water are used to wash the sediment left on the filters. The clear filtrate is thoroughly mixed with solution of soda to precipitate the alkaloide; the precipitate is collected on calico, washed with a small quantity of water, drained, dried, and reduced to fine powder; it is then ready for issue.

Woven tubs are used for this process, but they are not so well suited for the purpose as stoneware or earthen ware. The purification is conducted in a separate shed by a man who is confined to that work.

The Labor employed.—The only workmen employed in the factory are Nepalese coolies. When the process is once brought into full operation, it is found that these men readily master every detail and conduct the whole thing with all the care and accuracy that is required. But of course the factory is under the supervision of Mr. Gamble, the officer in charge of the plantations, who visits it once a day and sees that the work is being properly performed.

The Bark used.—Dry succirubra bark only is employed. Moreover care is taken to mix the root, stem, and branch bark together in as nearly as possible the proportions in which they are yielded by the plantations. This mixture is broken into small pieces, and a maund of it goes into each cask. This is done to insure uniformity of composition in the product. Green bark is never operated on. It will be seen that the arrangement of the process requires that a certain weight of bark should be put into the casks every week throughout the year. This could not be done with green bark, because bark is only taken from the trees twice per annum. Apart from this, however, it has been found that dry bark yields a much better product and quite as large a quantity. The small cost of drying the bark is more than counterbalanced by the advantages gained.

Temporary Object of the Process.—It must be remembered that this method has only been adopted to furnish a large supply of febrifuge for trial; it does not profess to make the most economical use possible of the bark. The factory is estimated to turn out during the present financial year 4,800 pounds of febrifuge, which, at a rupee an ounce, will pay the whole cost of the plantations and manufacture for the year. If the product proves to be of permanent value as a remedial agent, it is probable that the process will be considerably modified to produce greater economy, but involving the use of permanent buildings and machinery.

SHED No. 1.
Casks marked A B C.

Thursday, May 13th.	Put dilute acid in A	1st liquor for A. (New bark is in A.)
Monday, .. 17th.	Run liquor from A and precipitate.	2nd liquor for A.
Thursday, .. 20th.	Put dilute acid in A	1st liquor for B. (New bark is in B.)
Monday, .. 24th.	Run liquor off B and precipitate.	2nd liquor for B.
Thursday, .. 27th.	Put dilute acid in A	1st liquor for C. (New bark is in C.)
Monday, .. 31st.	Run liquor off C and precipitate.	2nd liquor for C.
Thursday, June 3rd.	Put dilute acid in A	1st liquor for A. (New bark is in A.)
Monday, .. 7th.	Run liquor off A and precipitate.	2nd liquor for A.
Thursday, .. 10th.	Put dilute acid in A	1st liquor for B. (New bark is in B.)
Monday, .. 14th.	Run liquor off B and precipitate.	2nd liquor for B.
Thursday, .. 17th.	Put dilute acid in A	1st liquor for C. (New bark is in C.)
Monday, .. 21st.	Run liquor off C and precipitate.	2nd liquor for C.
Thursday, .. 24th.	Put dilute acid in A	1st liquor for A. (New bark is in A.)

Proceedings of the Madras Government, Public Department,
15th August 1876. No. 912.

No. 59. ORDER THEREON, 15th August 1876, No. 912.

Communicated to the Principal Medical Officer, General Hospital, Madras,
through the Surgeon-General, Indian Medical Department.

2. Copy to the Revenue Department.

(True Extract.)

W. J. Fischer
Chief Secretary

To the Surgeon-General, Indian Medical Department.
.. Revenue Department.

Qm: 1876: 1876

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