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Government of Madras.

Public works **DEPARTMENT.**

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17

Proceedings of the Madras Government, Public Works Department,
29th April 1868

No. 568. Read the following Proceedings of the Madras Government in the Revenue Department, dated 22nd April 1868, No. 1,072.—

Read the following lett^r from J. BROUGHTON, Esq., Quinologist to Government, Ootacamund, to the Secretary to Government, Revenue Department, Fort St. George, dated Ootacamund, 4th April 1868:—

1. I have the honor to state, that I was engaged from January 1st to February 25th in examining the districts adjacent to the Neilgherry Hills, for products which could be employed as materials in the manufacture of alkaloids and other medicinal preparations of the Cinchona barks of the Government Plantations.

2. RESULT OF THE ENQUIRY.—The result to which my enquiries have led me is, on the whole, satisfactory. *With the exception of Sulphuric Acid*, the whole of the materials required for this manufacture are obtainable in the districts surrounding the Hills.

3. ENQUIRY NOT EXHAUSTIVE.—It is perhaps scarcely necessary to state, that the search that I have been able to make is by no means an exhaustive one. The time that I was able to employ would make any pretence to the contrary absurd, when the great extent and variety of the districts are considered. I trust, however, with some confidence, that no abundant natural product that would be of essential service towards the desired end has been passed over. But when the nearest or most convenient source of any material has been ascertained, its possible occurrence in remoter places has been in some instances disregarded.

4. MATERIALS IN QUESTION.—The materials which I had on a former occasion the honor of mentioning as important* were

* Procs Madras Govt, Rev. Dept, No. 240, 14th December 1867. Lime, Soda, Pearlash, Magnesia, Animal Charcoal, Acid, Alcohol, and their possi-

ble substitutes. In the course of investigation I have been necessarily led to make some experimental trials and analysis of the natural substances supplying these materials; and also, in the hope of obtaining practical information, have paid some attention to the uses to which they are applied by the natives. As the facts with which I have become acquainted may not be without an interest beyond their immediate object, I here beg permission to record some special details concerning the above mentioned substances.

5. LIME.—There does not appear to be any true limestone in the neighbourhood of the Neilgherries. The lime employed for building purposes in these districts is derived, as is well known, from the deposit called "Kunkur," which capriciously occurs in nodular masses, over the great part of Coimbatore, Salem, and in the southern division of Mysore. The lime obtained by burning this stone is by no means so pure as could be desired; nevertheless, with care it can be successfully employed for chemical purposes. Analyses were made of specimens obtained from Metapolhem in Coimbatore, and some collected from about four miles west of Goondulpett in Mysore, a mean specimen being taken from several nodules.

	Goondulpett, Mysore	Metapolhem.
Sand and Clay	10.12	19.72
Oxide of Iron	traces	1.58
Carbonate of Magnesia	2.74	2.77
Carbonate of Lime	87.14	75.31
Organic matter and loss	...	0.62
	100.00	100.00

6. The above results shew a greater amount of impurity in the Mettapolhem stone. Nevertheless, a more extended examination did not establish this as a characteristic of the deposit from that locality. While the proportions of Carbonate of Lime and Magnesia appear to be mutually tolerably constant, they are associated in each nodule with very variable amounts of impurity, in the form of sand and more or less ferruginous clay.

In order to obtain an analysis that would fairly represent the mean composition of a considerable amount of the Metapolhem kunkur, a specimen was carefully prepared by mixing the powdered stone obtained from very many nodules.

The results of its analysis were as follow :—

Silica		7 54	} sand, clay, &c.
Oxide of Iron		2 65	
Alumina		2 06	
Carbonate of Lime		82 32	
Do Magnesia		3 02	
Oxide of Iron		1 72	
Organic matter and loss		0 69	
		100 00	

7. The above analyses have been carried somewhat further than was necessary for my own purposes. The mineral being the source from whence is obtained the building lime employed on the Hills, it was thought that data might be thereby afforded to those conversant with the subject, as to its fitness for hydraulic and other cements *

8. SODA —Of this substance South India has a large supply in the “Chouto-munoo,” Overmunoo, Soudoo or Dhobies’ earth. This most interesting and, I believe, most important product is surface earth, impregnated with Carbonate of Soda, mixed with other Soda salts. Large tracts of waste land are covered during the dry season with a white efflorescence, consisting mainly of the former salt. From the sparing notices I have been able to find of this Soda earth, I am led to think that it has hardly attracted the attention in this country that its value deserves. In the Memoirs of the Geological Survey, Vol. IV, Part 1, pages 215 and 216, occurs the following passage :—

“Soda is of wide-spread occurrence in the South Arcot and Trichinopoly districts, chiefly on the gneiss and on the alluvium, more rarely on the cretaceous rocks.† It occurs in a whitish soil, known as “Soud” or Dhobies’ earth, usually occurring in marshy places, and very treacherous to the unwary pedestrian. A large extent of it occurs between Trichinopoly and Tanjore, to the south of the Cauvery; and the alluvial plain to the north of the Vellaur, in the neighbourhood of Chetia-tope and Bhonagui, is formed in great part of a similar soil. Small patches of “Soud” are also frequently met with on the gneiss to the west of the cretaceous rocks in South Arcot, chiefly where the prevailing soil is regur. The earth is collected by washermen, and used instead of soap for washing cloth. The Soda is frequently mixed with common salt, and probably also with other soluble salts, but it has not been analysed.

* An interesting account of the Kunkur deposits is given in the Memoirs of the Geological Survey, Vol IV, Part 2, page 120, and seq., also Part 1, page 207.

† Never derived from the cretaceous rocks, but from the decomposition of the many varieties of hornblende and felspathic gneiss —T. Oldham

9. The most convenient supply for the Hills appears to be near the village of Teloogoopaulum, Coimbatore, where it is found in a tract of Government waste land, said to be of eighty acres in extent. I was led to pay particular attention to this earth. I found the yield of dry Carbonate of Soda from various specimens to be as follows :—

I.	Taken from a heap of earth a Dhoby was collecting	.. 7 0
II.	Do. do. collected by Dhoby	.. 1 2
III.	Collected with care by myself	.. 12 2
IV.	Do. do. all possible care	.. 26 6
V.	An ordinary specimen from Dharapurum in Coimbatore	3 26
VI.	Do. do. Sooramungalum in Salem	.. 7 2
VII.	Do. do. Poodoor	.. 6 0
VIII.	Do. do. Sherapully	.. 7 0
IX.	Do. do. near Mysore	.. 5 0

10. It occurs also at very many other places, and varies greatly in yield according to the care taken in its collection. The Carbonate of Soda is readily obtained by lixiviating the earth with water, and evaporating the solution either in the sun or by artificial heat. The richness of the earth in Soda will, no doubt, be increased by judicious conservation of the land producing it. In order to ascertain this, I requested Mr. Grant to enclose a small portion of the Teloogoopaulum tract. I think it is likely that by allowing the efflorescence to take place for some time undisturbed, a surface richer in Soda will be obtained, while the labor of extraction will be diminished. The Carbonate of Soda should of course be separated on the spot to diminish the cost of carriage.

11. The natives appear fully to appreciate the uses of this substance. In an unintelligent manner they make most ingenious uses of its chemical properties. Besides its direct employment as detergent, it furnishes the alkali for soap-making; a caustic dye being prepared from it by means of chunam. It is employed in dyeing, both for fixing the mordants and for modifying the tints of the dye. The crude Carbonate of Soda obtained from the earth furnishes the alkali required for glass-making, considerable quantities being prepared during the dry season for this purpose. The whole process of the manufacture of glass for bangles could not fail to excite the admiration of any one interested in the natural principles involved. At Poodoor, in Salem, the crude Carbonate of Soda is fused with pounded quartz in reverberatory furnaces of a most simple and effective form, the proportions being three parts by measure of the former to one of the latter. In the preparation of the alkali an addition is always made of a certain proportion of cow-dung, a constituent which, besides sanctifying the result, has also the practical effect of reducing the sulphates to sulphides, and of rendering the mixture more readily fusible and of assisting in the decomposition of the carbonates.

12. Though there is a considerable internal trade in Soudoo earth and its products, there are large tracts existing of which but little use is made. It might be supposed that constant cropping of the efflorescing surface would in time exhaust the yield. But such does not appear to be the case. In Buchanan’s “Mysore,” mention is made of a tract near the village of Mudium, 40 miles from Bangalore, which furnished at the beginning of the present century the necessary Soda to the local glass works. I ascertained that the tract still supplies Soudoo as heretofore, and

*Proceedings of the Madras Government, Public Works Department,
29th April 1868.*

obtained a specimen. As no analysis has been made of Soudoo, I chose this specimen for the purpose. The composition was as follows:—

Sand and insoluble matter...	74 92
Carbonate of Lime	10 70
Sesqui Carbonate of Soda ...	8 41
Sulphate of Soda... .. .	1 24
Chloride of Sodium	1 02
Water	3 27
Nitre and Nitrates	traces.
Organic matter and loss	0 44

100 00

13. It will be observed that the Soda does not exist in the form of normal Carbonate, as in common English washing Soda, but as that which is usually called Sesqui Carbonate. The natives are practically aware of this, for they occasionally use the salt as a kind of "baking powder," in order to make chapatties light, a use for which common Carbonate is unfit. The substance called "uppala kharum," generally employed in the preparation of "peppidams," appears to be a very similar substance. Specimens of the latter, which I have examined, contained, besides the Carbonate of Soda, a considerable proportion of clay, and also a material bearing a suspicious resemblance to cow-dung.

14. It would be difficult, without practical trial, to estimate the actual cost of Soda from this source. It would consist mainly of the expenses of the labor of collection, preparation, and carriage. As these items are far less in amount than those expended in the manufacture of English Soda, (which is, in all respects, an artificial product,) the economy of the employment of native Soda appears to be promising. The impurities which it contains, sometimes in considerable quantities, will, I believe, not influence its usefulness for the purposes required.

15. PEARLASH.—For the object for which these enquiries were instituted, the occurrence of a supply of Soda renders that of Potash of comparatively less importance. Wood-ashes is of course the source from which the Pearlash must be derived; and in a country where wood is the only available fuel, it is not likely to fail the demand. I could, however, not learn that Pearlash was manufactured to any extent by the natives of the district through which I passed. On the Malabar coast the ashes of the cocoa palm-wood and nuts form the source from which the inhabitants obtain the alkali necessary for a limited manufacture of soap. In this ash, however, Carbonate of Soda is also an essential constituent. The natives of the hill-jungles of Coimbatore make use of the ash of a particular kind of wood which is rich in Potash salts. The ashes that I have examined yielded to boiling water the following per-centages of Carbonate of Potash:—

Mean specimen of ash from a burning Neilgherry Shola ...	15 0
Ash of the wood-fuel of Ootacamund	11 5
Specimens of ash from the locomotives of Madras Railway Co. ...	4 8

The latter ash had obviously been injured by exposure.

16. MAGNESIA.—In the most interesting district of Salem, about three miles from the town, on the Woomaloor road, exists a very remarkable deposit of Magnesite. It occurs in seams in the gneiss rock. The mineral is white, and of a texture

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resembling porcelain. The effect of these layers of white material, striping and dotting the low and barren hills, is very striking. Local tradition identifies it as the bones of a monstrous bird, whose death is described in the epic of the Ramayana.* The mineral covers some miles of country, and the white masses consist nearly entirely of pure Carbonate of Magnesia. I had completed some analysis before I was aware that it had been analysed in 1836 by Mr. E. Prinsep. I quote both results:

	Mr. Prinsep's Analysis, 1836.	Analysis, 1868
Magnesia	48 34	47 29
Carbonic acid	51 66	51 53
Silica		1 18
	100 00	100 00 *

17. The analyses only differ from the circumstance that the specimens I have met with contain, as impurity, a small amount of Silica. The freedom of the mineral from lime and other impurities is very remarkable. No source of Magnesia at all approaching this in purity exists in England. Within the last ten years the English demand for Magnesia has been supplied from Magnesite formed in the northern part of the island of Eubœa, from which much Epsom Salts and calcined Magnesia is now manufactured. The specimens I have seen of the Greek Magnesite were, however, certainly inferior in purity to the Salem mineral. The latter is, however, difficult to powder unless previously heated, a quality that causes a little difficulty in some of its applications †

18. ANIMAL CHARCOAL.—This material will have to be prepared, when required, by calcining bones in the same manner as is usual in the sugar manufactories. Bones are tolerably plentiful, and are cheaper than in England

19. ACID.—Sulphuric and Hydrochloric acids are practically unknown in the districts abovementioned, although some of the nitre used for the manufacture of English Sulphuric Acid is the product of these very districts

20. ALCOHOL.—This liquid cannot advantageously be dispensed with in the manufacture of the pure Sulphate of the Chinchona alkaloids. I have, for this reason, paid attention to the processes employed in the native Arrack distilleries. The method of proceeding made use of in the latter is a very remarkable one, and has frequently given rise to some misapprehension when popularly described. The

* Jātāya, king of birds, who having fought for a long time in the sky with Rāvana, was finally killed by the latter. His bones were scattered in various parts of Southern India, then a vast forest. Thus the occurrence of the white mineral in various parts of Salem and Trichinopoly is explained. Reference is given me to *Ramayana Arania Candak*, Cap 51 and 52.

† Within the last few months a new use for Magnesia has arisen, which bids fair to become an important one. I allude to the Magnesia Cement of M. Sorel,* where powdered calcined Magnesia is mixed to the consistence of a thin paste with a solution of Chloride of Magnesia, the whole sets in a few hours to a solid of far greater hardness than that produced from Plaster of Paris, and takes a polish equal to marble. I have verified this with the materials prepared from the Salem Magnesite. The cement possesses the great advantage of setting, even when mixed with twenty times its weight of inactive materials as sold, a quality in which it greatly surpasses Plaster of Paris, which will not solidify with more than twice its weight. Chloride of Magnesium is easily prepared by saturating Hydrochloric Acid with the powdered Magnesite, or can be obtained from the mother liquors of sea salt manufacture

* Comptes Rendus T 65 P 102, and Zeitschrift für Chemie Bd. III S. 607.

same process and proportions of material are employed over very wide distances of country, and both appear to be of great antiquity.

21. The main peculiarity of the process consists in the addition, to the hot solution of jaggery, of chips of "Velraylum puttay," or the bark of *Acacia leucophlea*. This is so invariably done, that it is not unusual for one to be informed that "native spirit is made from Acacia bark;" the jaggery being overlooked. Acacia bark does not contain any constituent that is likely to yield spirit under the circumstances. Indeed it is, at first sight, difficult to perceive the rationale of the employment of the bark at all, since spirit can be obtained from the jaggery without the intervention of what would appear to be an additional source of expense, for the bark costs Rupees 5 per handy-load. Observation, however, combined with a few experimental trials, convinced me of the important use of the bark. Jaggery contains, as impurity, variable quantities of albuminous and other nitrogenous substances, which, when brought into solution, rapidly begin to putrify, and the nauseous products of their decomposition would thus impair the flavour of the spirit. The presence of these substances also, in a state of change, injuriously modifies the process of the fermentation, so that instead of spirit small quantities of other and less palatable substances are formed. The Acacia bark is rich in tannin, and this tannin has the property of combining with the albuminous substances, and by rendering them insoluble, entirely arrests their decomposition. In Arrack manufacture, the tannin of the Acacia bark precipitates the injurious impurities, and thus removes them out of the field. I have found by direct experiment, that the addition of an infusion of the bark for these reasons actually increases the amount of spirit yielded by nearly a sixth part of the whole. Jaggery fermented without the addition of tannin, yields a spirit of bad flavour and of a strongly acid re-action. When bark is used, the greater part of the tannin is found, at the end of the process, nearly unaltered, and hence, probably, a less proportion would answer the purpose instead of the considerable amount now generally employed.

22. I may here mention that the nauseous flavour of spirit obtained from jaggery alone, can be nearly all removed by rectifying from a small quantity of caustic Potash, but even thus improved it is still rather inferior to that obtained by the employment of bark. The ingenuity evinced in the employment of Acacia bark is admirable, and it is difficult to imagine how such a process could have originated among a people where philosophy is opposed to experiment, and who do not possess the knowledge from which the method could be deductively obtained. Indigenous technical expedients of this nature, which have arisen from a source so totally independent of Western science, appear to me to merit, in all cases where they occur, an attentive and respectful study.

For manufacturing purposes, however, I would prefer spirit of as nasty a taste as possible, in order to discourage thieving.

In the case where Arrack is made directly from fresh toddy (instead of from the intermediate preparation of jaggery) the bark is not employed. The albuminous substances do not begin to decompose before the fermentation and distillation are completed, and hence there is no necessity for its use.

23. In most works where the native stills, composed of clay chatties and bamboo-pipes, are employed, the loss by evaporation and liquid diffusion is considerable. By comparing the yield of true alcohol, obtained in two works, in one of

which native stills were used, and in the other copper stills and worms of European pattern, I was enabled to calculate that nearly ten per cent. of the sugar was practically wasted by the loss of its resulting alcohol from these causes.

24. None of the Arrack works that I have visited appear able to supply spirit at less cost than that supplied by the Commissariat Department, and which I have long employed on my laboratory. There are, however, several sources from which spirit perfectly fit for chemical purposes could be prepared at a still smaller cost, supposing that the supply required would justify the starting of a special distillery. This is a matter of no present urgency, and its consideration, I would submit, could be well deferred until the whole subject of alkaloid manufacture has been placed on a mature basis. For the latter purpose alcohol should be considered rather as a tool than a material, since when it has performed its works, it is again recoverable by distillation, and is thus available for an indefinite number of operations.

25. In accordance with the instructions I received, I have also made enquiries concerning native febrifuges. Of these I have obtained specimens, the most promising of which I will submit to chemical examination, whenever my more direct duties will permit.

Miscellaneous

1. The Government are glad to learn that Mr. Broughton's researches have been followed by such satisfactory results, and thank him for his interesting report, which will be communicated to the Supreme and Home Governments.

2. Twelve copies will be furnished to Mr. Broughton, as requested in his covering letter.

(True Extract.)

(Signed) W. HUDLESTON,
Secretary to Government.

No. 569.

ORDER THEREON, 29th April 1863, No. 1,314.

ESTABLISHMENT, No. 60.

Communicated to the Superintending Engineers.

(True Extract.)

Colonel, R. E.,

Secretary to Government.

To the Superintending Engineers.
To Captain Kennedy.

Exd S T. Augustin

92

*Proceedings of the Madras Government, Revenue Department,
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13. It will be observed that the Soda does not exist in the form of normal Carbonate, as in common English washing Soda, but as that which is usually called Sesqui Carbonate. The natives are practically aware of this, for they occasionally use the salt as a kind of "baking powder," in order to make chapatties light, a use for which common Carbonate is unfit. The substance called "uppala kharum," generally employed in the preparation of "peppidams," appears to be a very similar substance. Specimens of the latter, which I have examined, contained, besides the Carbonate of Soda, a considerable proportion of clay, and also a material bearing a suspicious resemblance to cow-dung.

14. It would be difficult, without practical trial, to estimate the actual cost of Soda from this source. It would consist mainly of the expenses of the labor of collection, preparation, and carriage. As these items are far less in amount than those expended in the manufacture of English Soda, (which is, in all respects, an artificial product,) the economy of the employment of native Soda appears to be promising. The impurities which it contains, sometimes in considerable quantities, will, I believe, not influence its usefulness for the purposes required.

15. PEARLASH.—For the object for which these enquiries were instituted, the occurrence of a supply of Soda renders that of Potash of comparatively less importance. Wood-ashes is of course the source from which the Pearlash must be derived; and in a country where wood is the only available fuel, it is not likely to fail the demand. I could, however, not learn that Pearlash was manufactured to any extent by the natives of the district through which I passed. On the Malabar coast the ashes of the cocoa palm-wood and nuts form the source from which the inhabitants obtain the alkali necessary for a limited manufacture of soap. In this ash, however, Carbonate of Soda is also an essential constituent. The natives of the hill-jungles of Coimbatore make use of the ash of a particular kind of wood which is rich in Potash salts. The ashes that I have examined yielded to boiling water the following per-centages of Carbonate of Potash:—

Mean specimen of ash from a burning Neilgherry Shola	15 0
Ash of the wood-fuel of Ootacamund	14 5
Specimens of ash from the locomotives of Madras Railway Co.	4 8

The latter ash had obviously been injured by exposure.

16. MAGNESIA.—In the most interesting district of Salem, about three miles from the town, on the Woomaloor road, exists a very remarkable deposit of Magnesite. It occurs in seams in the gneiss rock. The mineral is white, and of a texture

resembling porcelain. The effect of these layers of white material, striping and dotting the low and barren hills, is very striking. Local tradition identifies it as the bones of a monstrous bird, whose death is described in the epic of the Ramayana.* The mineral covers some miles of country, and the white masses consist nearly entirely of pure Carbonate of Magnesia. I had completed some analysis before I was aware that it had been analysed in 1836 by Mr. E. Prinsep. I quote both results:

	Mr. Prinsep's Analysis, 1836.	Analysis, 1863.
Magnesia	48 34	47 29
Carbonic acid	51 66	51 53
Silica	...	1 18
	100 00	100 00

17. The analyses only differ from the circumstance that the specimens I have met with contain, as impurity, a small amount of Silica. The freedom of the mineral from lime and other impurities is very remarkable. No source of Magnesia at all approaching this in purity exists in England. Within the last ten years the English demand for Magnesia has been supplied from Magnesite formed in the northern part of the island of Eubœa, from which much Epsom Salts and calcined Magnesia is now manufactured. The specimens I have seen of the Greek Magnesite were, however, certainly inferior in purity to the Salem mineral. The latter is, however, difficult to powder unless previously heated, a quality that causes a little difficulty in some of its applications †

18. ANIMAL CHARCOAL.—This material will have to be prepared, when required, by calcining bones in the same manner as is usual in the sugar manufactories. Bones are tolerably plentiful, and are cheaper than in England.

19. ACID.—Sulphuric and Hydrochloric acids are practically unknown in the districts abovementioned, although some of the nitre used for the manufacture of English Sulphuric Acid is the product of these very districts.

20. ALCOHOL.—This liquid cannot advantageously be dispensed with in the manufacture of the pure Sulphate of the Chinchona alkaloids. I have, for this reason, paid attention to the processes employed in the native Arrack distilleries. The method of proceeding made use of in the latter is a very remarkable one, and has frequently given rise to some misapprehension when popularly described. The

* Jatiya, king of birds, who having fought for a long time in the sky with Ravana, was finally killed by the latter. His bones were scattered in various parts of Southern India, then a vast forest. Thus the occurrence of the white mineral in various parts of Salem and Trichinopoly is explained. Reference is given me to *Ramayanum Arama Candah*, Cap 51 and 52.

† Within the last few months a new use for Magnesia has arisen, which bids fair to become an important one. I allude to the Magnesia Cement of M. Sorel,* where powdered calcined Magnesia is mixed to the consistence of a thin paste with a solution of Chloride of Magnesia, the whole sets in a few hours to a solid of far greater hardness than that produced from Plaster of Paris, and takes a polish equal to marble. I have verified this with the materials prepared from the Salem Magnesite. The cement possesses the great advantage of setting, even when mixed with twenty times its weight of inactive materials as sold, a quality in which it greatly surpasses Plaster of Paris, which will not solidify with more than twice its weight. Chloride of Magnesium is easily prepared by saturating Hydrochloric Acid with the powdered Magnesite, or can be obtained from the mother liquors of sea salt manufacture.

same process and proportions of material are employed over very wide distances of country, and both appear to be of great antiquity.

21. The main peculiarity of the process consists in the addition, to the hot solution of jaggery, of chips of "Velvaylum puttay," or the bark of *Acacia leucophlea*. This is so invariably done, that it is not unusual for one to be informed that "native spirit is made from Acacia bark;" the jaggery being overlooked. Acacia bark does not contain any constituent that is likely to yield spirit under the circumstances. Indeed it is, at first sight, difficult to perceive the rationale of the employment of the bark at all, since spirit can be obtained from the jaggery without the intervention of what would appear to be an additional source of expense, for the bark costs Rupees 5 per bandy-load. Observation, however, combined with a few experimental trials, convinced me of the important use of the bark. Jaggery contains, as impurity, variable quantities of albuminous and other nitrogenous substances, which, when brought into solution, rapidly begin to putrify, and the nauseous products of their decomposition would thus impair the flavour of the spirit. The presence of these substances also, in a state of change, injuriously modifies the process of the fermentation, so that instead of spirit small quantities of other and less palatable substances are formed. The Acacia bark is rich in tannin, and this tannin has the property of combining with the albuminous substances, and by rendering them insoluble, entirely arrests their decomposition. In Arrack manufacture, the tannin of the Acacia bark precipitates the injurious impurities, and thus removes them out of the field. I have found by direct experiment, that the addition of an infusion of the bark for these reasons actually increases the amount of spirit yielded by nearly a sixth part of the whole. Jaggery fermented without the addition of tannin, yields a spirit of bad flavour and of a strongly acid re-action. When bark is used, the greater part of the tannin is found, at the end of the process, nearly unaltered, and hence, probably, a less proportion would answer the purpose instead of the considerable amount now generally employed.

22. I may here mention that the nauseous flavour of spirit obtained from jaggery alone, can be nearly all removed by rectifying from a small quantity of caustic Potash, but even thus improved it is still rather inferior to that obtained by the employment of bark. The ingenuity evinced in the employment of Acacia bark is admirable, and it is difficult to imagine how such a process could have originated among a people where philosophy is opposed to experiment, and who do not possess the knowledge from which the method could be deductively obtained. Indigenous technical expedients of this nature, which have arisen from a source so totally independent of Western science, appear to me to merit, in all cases where they occur, an attentive and respectful study.

For manufacturing purposes, however, I would prefer spirit of as nasty a taste as possible, in order to discourage thieving.

In the case where Arrack is made directly from fresh toddy (instead of from the intermediate preparation of jaggery) the bark is not employed. The albuminous substances do not begin to decompose before the fermentation and distillation are completed, and hence there is no necessity for its use.

23. In most works where the native stills, composed of clay chatties and bamboo-pipes, are employed, the loss by evaporation and liquid diffusion is considerable. By comparing the yield of true alcohol, obtained in two works, in one of

which native stills were used, and in the other copper stills and worms of European pattern, I was enabled to calculate that nearly ten per cent. of the sugar was practically wasted by the loss of its resulting alcohol from these causes.

24. None of the Arrack works that I have visited appear able to supply spirit at less cost than that supplied by the Commissariat Department, and which I have long employed on my laboratory. There are, however, several sources from which spirit perfectly fit for chemical purposes could be prepared at a still smaller cost, supposing that the supply required would justify the starting of a special distillery. This is a matter of no present urgency, and its consideration, I would submit, could be well deferred until the whole subject of alkaloid manufacture has been placed on a mature basis. For the latter purpose alcohol should be considered rather as a tool than a material, since when it has performed its work, it is again recoverable by distillation, and is thus available for an indefinite number of operations.

25. In accordance with the instructions I received, I have also made enquiries concerning native febrifuges. Of these I have obtained specimens, the most promising of which I will submit to chemical examination, whenever my more direct duties will permit.

No. 486.

ORDER THEREON, 22nd April 1868, No. 1,072.

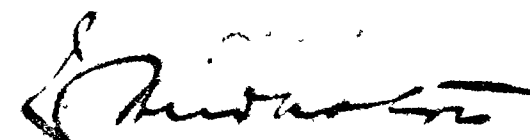
Miscellaneous

1. The Government are glad to learn that Mr. Broughton's researches followed by successful results,

results, and thank him for his interesting report, which will be communicated to the Supreme and Home Governments.

2. Twelve copies will be furnished to Mr. Broughton, as requested in his covering letter.

(True Extract)


Secretary to Government.

To the Government Quinologist.

- " the Board of Revenue
- " the Officiating Conservator of Forests
- " the Superintendent, Government Chinchona Plantations.
- " the Department Public Works.
- " the Military Department
- " the Commissary General.
- " the Chamber of Commerce
- " the Superintendent, Geological Survey.
- " the Literary Society.
- " the Agri-Horticultural Society.
- " the Inspector General, Indian Medical Department.
- " the President, Chinchona Commission
- " the Inspector General, British Medical Service.
- " the Commissioner of Mysore.
- " the Editors' Table.

Ed. S. T. Augustin.

