

INVESTIGATION INTO THE APPLICATION
OF RAYNA (AMOORA ROHITUKA) OIL

IN SOAP MAKING BY. R.L. DATTA & T. DAVV.



Government of Bengal

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**Investigation into the application of
Rayna (Amoora Rohituka)
Oil in Soap-making**

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Illustration of the Rayna leaves and fruits.

Investigation into the application of Rayna (Amoora) Rohituka) Oil in soap-making.

The home of the average inhabitant of rural Bengal is generally surrounded by a few well known trees other than the common fruit trees. Such trees are much prized for the industrial or medicinal value of their fruit, flower, leaf, bark or other products. The Rayna or Pittiraj tree (Amoora rohituka) belongs to this class. Although not so common as of old it is still to be found in the cluster of useful trees near the dwelling house of the villager in many districts of Bengal. It is also found in large numbers, in what may be called the wild state, in the waste jungle lands—a feature common to the neighbourhood of many villages of Bengal. The natural propagation of the tree is helped by the birds which carry the fruit, eat the outer skin and leave the seed at new places where they germinate.

2. In days gone by an oil used to be prepared from the seed of the Rayna fruit which had extensive use as a lamp oil before the advent of the cheap mineral illuminants. Having no longer any economic use for this purpose, the oil is not now expressed from the seed and the latter is not therefore collected at present. In some cases the villagers have started cutting down old trees for fuel. The discontinuance of the practice of making oil from the seed has meant much loss to the province and to the villager, the former in the shape of producible wealth, and the latter in the form of remunerative work, for a good many villagers used to be provided with part-time occupation in the collection of the seed and expression of the oil. The desirability of finding out a suitable industrial application for the oil, otherwise than as a lamp oil, is apparent so that the existing trees might be preserved, new ones planted, and the revenue from the tree and the earnings from work of the nature stated above might supplement the income of the villagers derived from purely agricultural pursuits. The matter was therefore taken up for investigation in the Industrial Research Laboratory of this Department and the present bulletin, issued for general information, embodies the results of the investigation carried out by the present authors with a view to find out whether Rayna oil could be usefully utilised as a raw material for the production of soap, specially the Bengal type of moulded soap made by the graining process. There is a considerable existing demand for this type of soap in this province; the demand for suitable raw material is therefore also considerable. It has been found from actual experiments with this oil that it can be used as a soap-stock in admixture with other well known oils and fats with successful results.

3. The Rayna is an evergreen tree with a large crown of branches which adds to its beauty. Its plantation as an ornamental tree is therefore common. It grows to a large size, and has a thin bark of a grey colour and a reddish, close and even grained wood of a hard nature. It grows wild in many forest tracts of India and the neighbouring islands. It is found in the moist ravines of the Gonda forests in the United Provinces, in the forests of the Sikkim Terai and lower hills up to 6,000 ft., in Assam, Sylhet, Cachar, Chittagong, Northern and Eastern Bengal, tropical slopes of the hills of Burma

up to 3,000 ft., the evergreen forests of the Western Ghats in Konkan, North Kanara and southwards, specially the Anamalties; in the moist regions of Ceylon and the Andamans, Cocos and Malacca islands.

4. It would appear from the above that the tree has a partiality for moist regions, and as such it should find a genial home in many parts of Bengal. As a matter of fact, barring the comparatively dry regions of Western Bengal, the tree is met with in many districts of Bengal, not indeed in the extensively wild state, but as scattered here and there. For example, in the districts of Jessore, Khulna, and Faridpur, in parts of 24-Parganas, and elsewhere the tree is very common in the fruit gardens and homestead lands of the villagers and also in waste jungly tracts.

5. The tree commences fruiting at the comparatively early age of three years when the girth of the trunk is barely 3 inches and the height about 8 feet. A copious yield of fruit, however, seldom takes place before the tenth year. The yield of fruit per tree varies not only with the age and condition of the tree but also with the character of the soil, the climatic influences, the spacing of the trees in the grove and the cultural attention bestowed on it. The tree yields fruit once a year, and in the plains of Bengal the winter months comprise the fruiting period. The tree usually flowers in the months of November and December and the fruit matures by the month of March.

6. The fruit grows in bunches and is of the nature of a pod. It is almost spherical in shape, the diameter averaging one inch. The surface of the fruit changes from green to yellow and finally it turns brown as the fruit ripens. Ordinarily each fruit contains two to three seeds; but a single-seeded fruit on the one hand, and a four-seeded one on the other, are also sometimes found. The seed has a thin fleshy pericarp which becomes reddish on the ripening of the fruit. On attaining maturity the fruit bursts and the seeds leave the fruit and drop down. The foot of the tree is found strewn with clean seeds which can be easily collected. The cattle do not eat them as they are poisonous.

7. The shape of the seed is governed by its number in the fruit and may be anything from a double cone with apexes rounded off, to a sphere, while a good many have depressions on the side giving them the shape of a hemisphere. The seeds are small in size, the axis or diameter being seldom greater than three-fifths of an inch. The average weight of a fresh seed is 0.7 gramme, and 1,200 to 1,300 seeds weigh one seer. The exterior of the seed consists of a hard, brittle and thin shell of a dark colour. The shell is breakable and removable from the kernel underneath except for a small portion which sticks firmly to the latter and cannot be separated easily. The kernel is of the shape of a slightly depressed ellipsoid and is only slightly smaller in size than the seed. It has a dirty yellow colour but is covered by a very thin skin of a brown colour which can only be scraped off with a knife. The oil resides in the kernel but the latter has no oily feel and is moderately hard. The dried kernel can be crushed to a powder on pounding in a mortar.

8. The shell forms a small part of the total weight of the seed, being only 14 per cent. as against 86 per cent. made up by the kernel. Since, however, the shell is comparatively much harder than the kernel it cannot retain any appreciable portion of the oil when the unshelled seed is treated in the oil-press. There is, therefore, no absolute need for

very rigorous decortication of the seeds. Further, since on account of its poisonous nature the cake of this oil-seed cannot be used as a food for cattle there can be no harm in its containing a little crushed shell.

9. It has been found by extracting the oil from the seed by the solvent method that the dried seed without the shell has an oil-content of 56.2 per cent. which is equivalent to an yield of 43.2 per cent. on the undried seed in the shell.

10. The seed has a low moisture content, the unshelled seed containing only 9 per cent. moisture. For the expression of the oil in the country *ghani* or in the various oil presses it is necessary that the moisture of the seed should be completely driven out, for the oil expressed from the moist seed is liable to develop rancidity very quickly. The drying can be carried out as well in steam-heated chambers as in the sun. For the villagers, of course, the latter course is recommended. Since the collection of the seed takes place towards the end of winter, when there is little rain, the seeds can very well be dried in the sun. The drying should be done as soon after the collection as possible, for the undried seed deteriorates on aging. It has been found that the undried seed even in the shell is liable to be eaten up by worms. The drying is facilitated if direct contact is established between the kernel and the atmosphere. For this purpose, however, the total removal of the shell is not necessary. Since in the case of the mature Rayna seed there is invariably a gap between the shell and most part of the kernel it suffices if the shell is only bruised or partly-broken thus allowing passage for the moisture to go out during the process of drying. The shell is further loosened by the contraction, no doubt very small, of the kernel consequent on drying.

11. The seed dried in the above manner should next be ground to a meal of the proper degree of fineness if the oil is to be expressed in an oil-press. It has been found that a meal which passes through a 20 mesh sieve, i.e., a sieve having 20 holes per linear inch, is suitable for expression of oil in a small hydraulic press working at a pressure of 2 tons per square inch. The country *dhenki* can be used advantageously for the grinding of the seed. For small quantities the household stone mill—the *Janta*—would do quite as well. In large scale operations the end-runner mill may be used to crush the seed. For expression of oil in a country *ghani*, however, where the seed is subjected to considerable rubbing action in addition to pressure, the dried seed need not be ground before it is fed into the *ghani*.

12. The country method of preparing oil from the seed was to fry the same in earthenware or iron pans, crush the fried seed in the *dhenki* and then boil the crushed material with water for 5 to 6 hours. On settling, the upper layer which consisted of the oil was carefully separated from the water. It is reported that one seer of oil used to be obtained from 4 to 5 seers seed, or an average yield of 22.5 per cent., which was only about half of the total oil-content of the seed. On the other hand, on treating the dried and crushed seed in shell in the small hydraulic press referred to above an yield of 38 per cent. of oil has been obtained, which was equivalent to an yield of 34.6 per cent. on the undried seed in shell, i.e., an excess of over 50 per cent. over the yield in the country method. The substitution of the hydraulic press by the country *ghani* would also lead to better results than those obtained by the boiling method.

13. The fresh oil has a deep red colour with a cloudiness and an odour which is neither strong nor very disagreeable. On standing, the oil becomes clear, and a solid fat separates from it and settles at the bottom, having a colour much less deep than that of the oil itself. The fresh oil has the following physical and chemical constants:—

Specific gravity at 29.5°C	..	..	0.9016
Refractive Index	..	..	82
Acid value	..	..	24.94
Saponification value	..	..	198.27
Iodine value	..	..	126.73
Titer test	..	..	37.5°C.

14. The high iodine value of the oil indicates the presence in it of a large proportion of unsaturated fatty acids which impart a soft consistency to the soap made from it, while endowing the same with high lathering and detergent qualities. The oil can therefore replace linseed oil or other soft stocks commonly used in admixture with the hard soap-producing fats and oils for the proper softening of the body of the soap. The oil contains resinous matter, which also adds to its cleansing and lathering properties, but at the same time makes it unsuitable for soap-making by the cold process. The oil does not show any unusual behaviour on boiling with caustic soda, the saponification proceeding normally and the resulting soap graining out rapidly on salting. A considerable portion of the colouring matter of the oil is eliminated in the spent lye at the end of the process of salting, the lye becoming dark-brown and the grained soap assuming a cream colour. The soap thus grained can be moulded in earthen cups, but it is found on taking the solidified soap out of the cup that it lacks in the "body" usually associated with the moulded soap.

15. The solidification point of the grained soap on the spent lye is 52°C., which is higher even than that of many a less unsaturated stock. In the manufacture of moulded soap the oil can be used up to 25 per cent. of the entire charge of raw materials without imparting any disadvantageous properties to the soap. The latter will have a yellowish colour, very much like the one common to the household soap, the depth of colour naturally depending on the proportion of the oil used. If a very faint yellow colour is needed the oil should be used in smaller proportions than 7 per cent. and saponified along with the other stocks making up the charge. For the preparation of a pale yellow soap, a preliminary elimination of colour is sometimes desirable. This can be effected by boiling the stock by itself over spent lye of soap charges usually containing some unused alkali which under such conditions saponifies the oil partially, and sometimes completely if the proportion of the lye is large enough. The Rayna soap which floats on the lye is taken out and mixed with other stocks for making up the soap charge. It will be found that this method will enable higher proportions of the oil than 7 per cent. to be used in the preparation of good laundry soaps having the usual paleness of colour, and it will also be found useful in making household soaps of a faint yellow colour by the settled process. The oil, however, can be used in higher proportions up to a limit of 50 per cent. of the charge. The resulting soap will have a deep brown colour which may not find favour with the fastidious consumer, and, as already mentioned, be slightly lacking in body and coherency.

16. The colour of the soap does not undergo any change on storage. A sample of soap made from Rayna oil alone has not shown any change of colour in the course of 9 months.

17. Of scarcely less importance is the resistance which the soap from this oil offers to rancidity. It has been found that the purely Rayna oil soap remains immune from the development of rancidity for a long time. What, however, is of still greater importance is the fact that when used in combination with other stocks prone to turn rancid it protects the resulting soap from rancidity. Further, the slightly aromatic odour which the Rayna oil soap is found to possess remains intact for a long time.

18. Examples of combinations using Rayna oil in proportions ranging from 5 to 25 per cent. for the production of good moulded soaps are given below:—

No.	PARTS.			
1.	Tallow	..	..	38
	Mowha oil	..	..	16
	Groundnut oil	..	..	16
	Cottonseed oil	..	..	15
	Castor oil	..	..	5
	Rayna oil	..	..	5
	Rosin	..	..	5
2.	Tallow	..	..	35
	Mowha oil	..	..	25
	Groundnut oil	..	..	12
	Cottonseed oil	..	..	16
	Rayna oil	..	..	8
	Rosin	..	..	4
3.	Tallow	..	..	40
	Mowha oil	..	..	12
	Groundnut oil	..	..	16
	Cottonseed oil	..	..	15
	Castor oil	..	..	5
	Rayna oil	..	..	8
4.	Tallow	..	..	41
	Mowha oil	..	..	30
	Groundnut oil	..	..	10
	Cottonseed oil	..	..	10
	Castor oil	..	..	5
	Rayna oil	..	..	10
5.	Tallow	..	..	30
	Mowha oil	..	..	15
	Groundnut oil	..	..	20
	Cottonseed oil	..	..	10
	Rayna oil	..	..	12
	Rosin	..	..	4

No.				PARTS.
6.	Tallow	..	..	38
	Mowha oil	..	..	15
	Groundnut oil	..	..	15
	Cottonseed oil	..	..	8
	Castor oil	..	..	5
	Rayna oil	..	..	15
	Rosin	..	..	4
7.	Tallow	..	..	53
	Cottonseed oil	..	..	25
	Rayna oil	..	..	18
	Rosin	..	..	4
8.	Tallow	..	..	42
	Mowha oil	..	..	15
	Groundnut oil	..	..	20
	Rayna oil	..	..	20
	Rosin	..	..	3
9.	Tallow	..	..	36
	Mowha oil	..	..	12
	Groundnut oil	..	..	15
	Cottonseed oil	..	..	10
	Rayna oil	..	..	25
	Rosin	..	..	2
10.	Tallow	..	..	45
	Groundnut oil	..	..	15
	Cottonseed oil	..	..	12
	Rayna oil	..	..	25
	Rosin	..	..	3

19. More examples of combinations using Rayna and other oils will be found in our exhaustive bulletin on the combination of suitable stocks for the manufacture of moulded soaps, now under preparation.

20. It is hoped that once the value of this oil to the soap-maker comes to be generally understood, it will lead to the systematic collection of considerable quantities of the seeds for the purpose of expression of the oil, and convert into money the huge quantities of this raw material which is at present only a waste. It is interesting to note in this connection that the Tripura State Durbar has recently forbidden the destruction of Rayna trees in the State forests for fuel purposes, evidently in the expectation of a profitable utilisation of the oil of the Rayna seed. The results of our investigation into the subject support the farsightedness of the policy underlying the prohibitory order issued by the Durbar, and it may reasonably be expected that the said policy will, in the near future, bring additional revenue to the State and also find employment for a large number of its subjects in the collection of the seed and the expression of the oil.

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