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In search of alternative source of edible oil, biofertilizer and tann

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Abstract: ***Terminalia belerica*** **Roxb known as Bahera, found abundant in tropical, Asia, is a source of new edible oil (37% by dry weight of kernel), biofertilizer and tannin and has not been totally explored. The oilcake contains high amount of nitrogen (8.34%). On biochemical evaluation of the oil cake it is evident that about 60 per cent NaCl extractable proteins digestible which can be converted into biofertilizer or some useful fodder. The extractable high quality tannin present in fruit pulp can be used in leather industry and herbal medicines. The different processes for the extraction of tannin have been discussed.**

Key words : Bahera oil, Biofertilizer and Tannin.

Introduction

The scarcity of the edible oil in our country (5 million tonnes approximately) and other Asian countries has jeopardized the economy to a great extent. At present, production of oilseeds cannot meet the demand. A break through is required to find a new source of edible oil. *Terminalia belerica* Roxb locally known as Bahera is on such abundantly available oil bearing fruit in the tropical Asia. Bahera plant can tolerate moderate drought and heavy rainfall. Bahera plant is able to mature 6 to 8 years yields about 500 kgs of raw fruits annually. The fleshy fruit pulp usually contains 6.1% moisture, 24.4% tannin and 44% of other water extractable. Some information (Nag and De, 1995, Chopra *et al.* 1976) regarding composition of oil has been studied. But in this paper, we have envisaged new users of Bahera seeds as edible oil, biofertilizer and tannin.

Materials and Methods

Bahera (*Terminalia belerica* Roxb) fru just after harvest were washed with dilute potass permanganate and copper sulphate solu (approximately 1% v/v each) to reduce nat fungal growth. The fruits were sun dried w dried fruit were decorticated the upper la containing tannin peeled off as powder. T seeds were collected after cracking the ha nut decorticator.

Determination of the oil content and fatty ac composition

The oil was extracted from the kern with hexane (80°C) using soxhlet apparatu The oil obtained (37%) by weight of dry kern of the seed. And also the fatty acids compositio were determined in the following way:

About 3 g of oil was taken in a 250 n flask and 100 ml of 0.5 N ethanolic KO

Table 1. Comparison of chemical properties between Bahera and Olive oil

Sl.No.	Chemical properties	Bahera Oil	Olive oil
1	Free fatty acid	1.71-1.9	0.3-1
2	Saponification value	180	185-196
3	Acetyl value	<0.4	Nil
4	Iodine value	76	79-81
5	Palmitic acid	18.2	7.5
6	Stearic acid	8.2	2.5
7	Oleic acid	50.2	75.5
8	Linoleic acid	10.8	6.6
9	Others	6.6	7.6

Table 2. Chemical composition of some oil cake for use as biofertilizer

Sl.No.	Oil cake	N_2	P_2O_5	K_2O
	Coconut	6.50	1.30	1.10
	Rape seed	4.80	2.0	1.30
	Neem	5.20	1.10	1.30
	Mahua	2.50	0.80	1.90
	Jajoba	5.00	1.70	1.90
	Bahera	8.24	0.19	0.42

Table 3. Biochemical estimation of oil cake

Sl.No.	Particulars	% of nitrogen per 100 g defatted oil cake
	Total nitrogen N_2	8.240
	10% NaCl extractable protein N_2	2.853
	Protein N_2 precipitated with TCA	0.118
	Protein N_2 left after pepsin and trypsin treatment	1.214
	Digestibility protein	1.634

Fig.1. Extraction of tannin after soaking with shaking

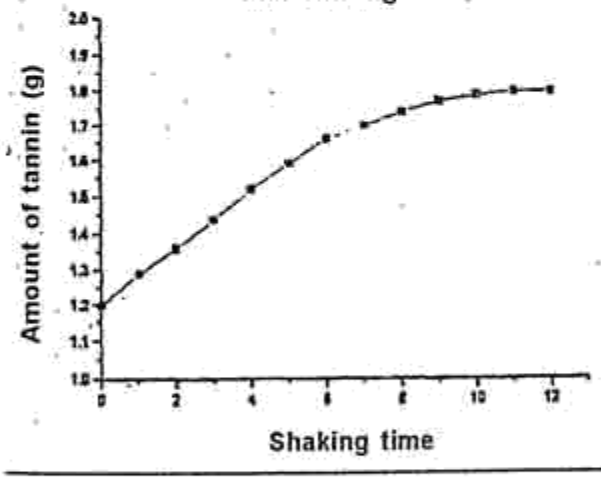
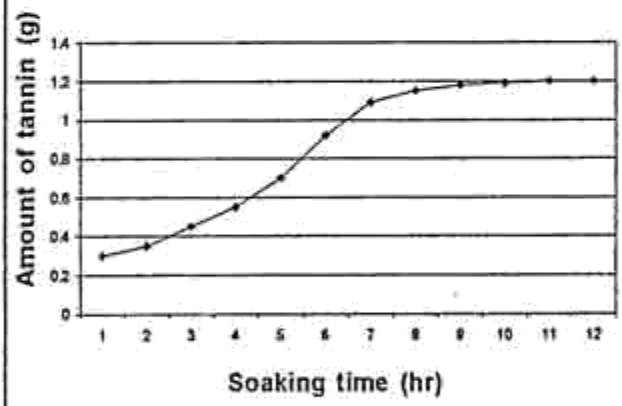


Fig.2. Extraction of tannin with soaking time



was added. The mixture was refluxed for 1 hr, cooled to room temperature and neutralized with HCl. The liberated fatty acids were extracted with chloroform and separated by distillation on water bath, 0.2 ml thionyl chloride was added in the extracted solution and refluxed for half an hour on water bath. Excess thionyl chloride was removed by distilling with 100 ml dried benzene. The acid chloride was boiled under refluxed with 10 ml of anhydrous methanol on a water bath for half an hour. The reaction mixture was then poured on a water and methyl ester were extracted with dried anhydrous sodium sulphate. Analysis of methyl ester (Table 1) were done by measuring the peak areas by gas liquid chromatography (Model Anil Series 5700, Injector temperature-215°C and oven temperature 210°C, temperature of analysis 195°C, flow rate 40 ml/min; carrier gas nitrogen).

Determination of digestibility of the protein

Defatted oil cake (0.5 g) and pepsin (0.2 g) were mixed with 50 ml of 0.1 N HCl in a 100 ml conical flask plugged with cotton. The mixture was kept in incubator for 48 hrs at 37°C followed by the addition of 5.5

Fig.3. Extraction of tannin with soaking and shaking time

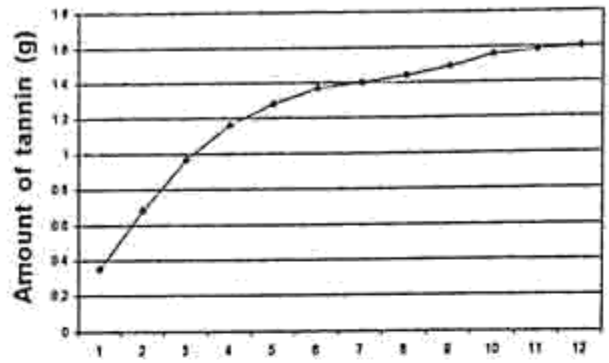


Fig.4. Extraction of tannin with temperature (°C)

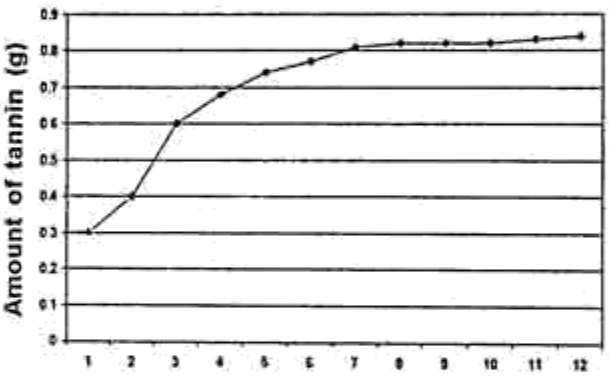
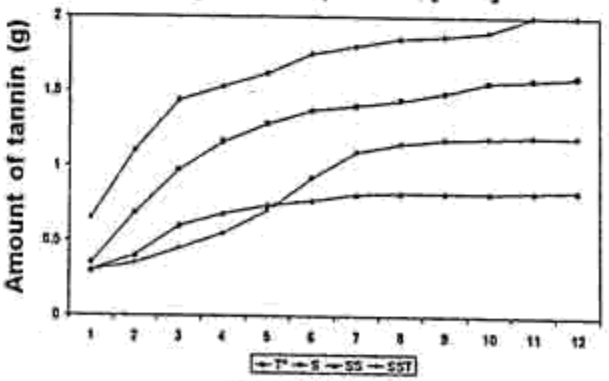


Fig.5. Extraction of tannin with changing all the parameters (Temperature [T], Soaking [S], Soaking and Shaking [SS] and Soaking, Shaking and Temperature [SST]



ml of 10 N NaOH solution and trypsin (0.2 g). The mixture was filtered and aliquots were taken for determination of total nitrogen. A control was performed where only the enzymes were used. Changes in the solubility of protein in oil cake was determined by extracti oil cake (5 g) with 100 ml of 10% NaCl soluti and the mixture was kept 12 hrs in a refrigerat It was centrifuged and the total nitrogen aliquot of the extract was determined by standa bovine serum albumen. The nitrogen precipitat by trichlroro acetic acid was also determin in aliquots of the original NaCl extract (Tab 3).

Determination of toxicity test of the oil

This test was done in well known toxici laboratory (Viswa Bharati University, West Beng India) under the supper vision of Prof.Shel Bhattacharya. Initially 170 g average weig of 10 rats was taken as experimental anima The oils were supplied as food to a rat 2.5 - 5 ml per kg of the body weight per c

i. Experimental animal : Rat
ii. Average weight of rats : 170
iii. Number of rats at experiment : 10 ra
iv. Dose :
    a) 2.5 ml kg^{-1} of body weight
    b) 5.0 ml kg^{-1} of body weight
v. Incubation time : 0, 48, 72 hrs.

Food value of bahera oil

From the toxicity test result, we foun that ther had no acute toxicity, no death an no loss of weight till 6 months on feedin on oil. Within 6 months of observation, al behaviour parameters of rats were found normal Then we have tried for human trial.

Potato chips were prepared with the purifie oil. 100 g of chips were given to twenty perso to determine the taste and any toxicity of th oil. Every one was satisfied with characteristic of the oil and explained that there was n bad taste and odour. Potato chips was sam as purchased potato chips in the market. The had no complaints in digestion after fiftee days. We were sending the oil to Central Foo Technology and Research Institute, Mysore an Pharmacy Department, Jadavpur University Kolkata to get their comments on the edibilit of oil.

:tractions of tannin with soaking ime

5 g Bahera seed coat dust in 0 ml distilled water was taken in 00 ml conical flask and kept at :mperature 30°C in an incubator. Tannin n the solution (Fig.1,2) was measured vith and without shaking with different nterval of time at 30°C. Similarly t different time and temperature, xtracted tannin value (Fig.3,4) was oted. And at the end, tannin value Fig.4) was measured by changing ll three parameters soaking time, haking time and temperature.

lesults and Discussion

From the experimental results, composition of fatty acids were s follows, palmitic acid 18.25%, stearic cid 8.20%, oleic acid 50.20%, linoleic 0.8% and others 6.6% (Table 1). The absence for hydroxyl and other bjectionable fatty acids were also oted. The fatty acids composition of bahera oil has been also compared with oilive oil (Table 1).

One very interesting point to note here is that the oil has only about 10% of the constituent (stearic) saturated fatty acid. The iodine value is fairly high and the free fatty acid is a little higher than olive oil. There was no hydroxyl group present in he fatty acids composition. The nitrogen content (8.24%) of oil cake was letermined (Hilditch, 1979) by kjeldhal's nethod. Total potassium (0.44%) and phosphorus (0.19%) in oil cake were letermined by flame photometry and colorimetric instrument. From Table 2, we find that no oil cakes generally used as biofertilizer have such higher mount of nitrogen. On biochemical valuation it is also evident about 50% NaCl extractable protein (Table 2) in cake is digestible. For trial

Table 4. Extraction of tannin with soaking time

No. of observations	Extraction of tannin with soaking time (°C)			Extraction of tannin with soaking & shaking time (°C)		Extraction of tannin with temperature (°C)		Extraction of tannin by changing the three parameters			
	Soaking time (hr)	Shaking time (hr)	Amount of tannin (g)	Soaking & shaking time (hr)	Amount of tannin (g)	Temperature (°C)	Amount of tannin (g)	Soaking time (hr)	Shaking time (hr)	Temperature (°C)	Amount of tannin (g)
1	1	0	0.30	1	0.35	25°C	0.3	1	1	25°C	0.65
2	2	0	0.35	2	0.68	35°C	0.40	2	2	35°C	1.10
3	3	0	0.45	3	0.97	45°C	0.60	3	3	45°C	1.44
4	4	0	0.55	4	1.16	55°C	0.68	4	4	55°C	1.53
5	5	0	0.70	5	1.28	65°C	0.74	5	5	65°C	1.62
6	6	0	0.92	6	1.37	75°C	0.77	6	6	75°C	1.75
7	7	0	1.09	7	1.40	85°C	0.81	7	7	85°C	1.80
8	8	0	1.15	8	1.44	95°C	0.82	8	8	95°C	1.85
9	9	0	1.18	9	1.49	105°C	0.82	9	9	105°C	1.87
10	10	0	1.19	10	1.56	115°C	0.82	10	10	115°C	1.90
11	11	0	1.2	11	1.58	125°C	0.83	11	11	125°C	2.00
12	12	0	1.2	12	1.60	135°C	0.84	12	12	135°C	2.00

examination to use oil cakes (50 g) as biofertilizer, they were applied to winter vegetable such as spinach grown in pots. It has been observed that plants in the pots which contained Bahera oil cakes had healthy and bushy plants with low level of incidence of insects than the plants grown without oilcakes.

In Fig.1, the amount of tannin extracted against the temperature (°C) is shown. It has been observed that at a particular temperature (135°C), maximum amount of tannin would be extracted and with increase in temperature, there would be no effect on the amount of tannin extraction. The amount of tannin extracted is plotted against soaking and shaking time (Fig.2,3). We observed that a 12 hrs of soaking or shaking the tannin yield was maximum.

Conclusion

Considering the high oil content (37% by weight of the dry kernel of the seed a the nitrogen value (8.24%) of oilcake, Bahe fruit appears very promising for several commerc exploitation and can be considered as "Oli of India".

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