Microencapsulation Of Bael Seed Oil

Megha M. Humane
PG Research scholar, Dept. of Agricultural Engineering
Maharashtra Institute of Technology
Aurangabad, India

Deepak T. Bornare
Assistant Professor, Dept. of Agricultural Engineering
Maharashtra Institute of Technology
Aurangabad, India

Kalyan P. Babar
Assistant Professor, Dept. of Agricultural Engineering
Maharashtra Institute of Technology
Aurangabad, India

Anjali S. Ghorad
PG Research scholar, Dept. of Agricultural Engineering
Maharashtra Institute of Technology
Aurangabad, India

Santosh P. Kahar
Associate Prof., Dept. of Agriculture Process Engineering
Mahatma Phule Krishi Vidyapeeth, Rahuri
Ahmednagar, India

***Abstract*—Bael fruit (A. Marmelos L. Correa) belongs to the family Rutaceae, Every part of the tree such as root, bark, leaf, flower, fruits, seeds, and even latex are important in several traditional system of medicine that is why it is one of the most important trees in India.Attempts were made to microencapsulate bael seed oil, by using wall material i.e., gum arabic and maltodextrin. Bael seed oil was extracted by using solvent extraction method.**

Keywords*— Bael fruit, seeds, extraction of seed oil , microencapsulation

I. INTRODUCTION

Bael has enormous traditional values against various diseases. Fruits are astringent, digestive, tonic, stomachic, laxative and acts as remedy in cases of chronic diarrhoea, dysentery and in loss of appetite. Fresh leaves are astringent, digestive, laxative and febrifuge; useful in eye-diseases and inflammations. The pulp of the fruit is sweet and is highly aromatic. Essential oil exhibits antifungal activity against fungi. Seeds are beneficial to in treating diabetes, high blood pressure and high cholesterol levels. Seed oil exhibits antibacterial activity against different strains of vibrios (Kulkarni et. al., 2012).

Bitter, light-yellow oil extracted from the seeds given in 1.5 g doses render a purgative effect. Bael herb contains 15.6% Palmitic acid, 8.3% Stearic acid, 28.7% Linoleic and 7.6% Linolenic acid. The seed residue contains 70% protein (Maity et. al., 2009).

II. MATERIALS AND METHODYLOGY

A. Separation of seeds

The outer shell of Bael fruit was so tough .outer shell was broken and separate the pulp from the shell with the help of scoop. Then from pulp, the seeds were manually separated by washing under running water. Then dry seeds under sun drying.

B. Physical properties of seeds

In order to characterize Bael seeds, different physical parameters viz. color, shaped, 100 kernel weights, bulk density etc. (Karthiyayini, 2017) were observed and presented in Table 2.

C. Extraction of seed oil from Bael seeds

Fruit collection
↓
Seed separation
↓
Softening of seed shell
↓
Separation of kernel
↓
Crushing of kernel
↓
Grinding of kernel
↓
Extraction of oil

[Kate *et al.*, (2014)]

D. Physico-chemical parameters of Bael seed oil

The physico-chemical parameters of Bael seed oil like colour, refractive index, specific gravity, peroxide value, iodine value and saponification number (Bajaniya et. al., 2015) are listed in table 3.

TABLE I. (ENCAPSULATION) PROCESS VARIABLES AND THEIR LEVELS OF EXPERIMENTAL DESIGN

Treatments	Wall material	Wall material	Solid concentration in emulsion	Wall material(g	Oil load

		details	(%)	)	(%)
1	MD:GA	60:40	25	50	20
2	MD:GA	60:40	30	75	10
3	MD:GA	60:40	30	75	20
4	MD:GA	60:40	30	75	30
5	MD:GA	40:60	30	75	10
6	MD:GA	40:60	30	75	20

E. Preparation of the Emulsion

Different formulations are prepared using wall materials gum Arabic and maltodextrin and this composition is taken as per design in (Table 1). The wall material was dissolved in distilled water under magnetic agitation, one day before emulsification. Coarse emulsions were prepared by blending the Bael seed oil and the wall solution, using a rotor-stator blender, at 15500 rpm for 5 min. (Renata V. Tonon et al., 2010).

F. Spray drying

Microencapsulation was done by using spray drier (LU 222Advanced, Labutima spray drier). The emulsion is fed at the rate of 200ml/hr by use of peristaltic pump and is atomized at high pressure at 4 kg/cm2. The inlet temperature was kept at 180 ± 2°C and outlet temperature at 150± 2°c for entire experiment. The powder is collected and packed in the polythene bags to avoid moisture absorption. The process of spray drying was given below in flow sheet.

Preparation of Emulsion (wall material)
↓
Mixing of Bael seed oil with emulsifier
↓
Homogenization
↓
Spray drying
↓
Packaging

III. RESULTS AND DISCUSION

A. Physico- chemical properties of Bael seed oil powder

From optimized procedure bulk density, encapsulation efficiency, peroxide value, yield, moisture of encapsulated powder for each run was determined and listed in Table 4.

TABLE II. PHYSICAL PARAMETERS OF BAEL SEEDS

Physical parameter	Mean value	SD(±)
Color	Milky white	-
Shape	Oblong	-
Length of seed (cm)	0.48	±0.06
Breadth of seed (cm)	0.25	±0.07
100 kernel wt (g)	7.5	±0.02

[a.] Each value is an average of three determinations.

It is evident from Table. The color of Bael seed was found to be Milky white which shows complete maturity and correct time of harvesting according to (Karthiyayini, 2017). Length and Breadth of Bael seed found was 0.48 cm and 0.25 cm respectively. Shape of Bael seed is mostly oblong shape was found in present investigation which was similar with findings of (Athaya, 1985). The 100 kernel weight of Bael seed oil was found to be 7.5 g (Karthiyayini, 2017).

TABLE III. PHYSICO-CHEMICAL PARAMETERS OF BAEL SEED OIL

Parameters	Mean value	SD (±)
Color	Faint yellow	-
Specific gravity	0.92	0.00
Peroxide value (mEq/kg oil)	Absent	-
Iodine value (g/100kg)	112.78	0.07
Saponification value (mg KOH/g)	182.55	2.41
Free fatty acid (percent)	0.32	0.01
Refractive index	1.465	0.01

[b.] Each value is an average of three determinations.

The physico-chemical parameters of Bael seed oil were given in table. The extracted Bael seed oil is Faint yellow in color. The specific gravity of Bael seed oil found was 0.92. The refractive index of Bael seed oil was found was 1.465 (Bajaniya et. al., 2015).

The peroxide value of oil represents the extent of formation of hydroperoxides which leads to formation of free radicals resulting in oxidative rancidity called lipid oxidation. The peroxide value in Bael seed oil was absent when compared to other edible oils (Bajaniya et. al., 2015). The presence of free fatty acids and acid value are always an important factor signifying the storability of oils. During present investigation, free fatty acid content of Bael seed oil was observed to be 0.32 percent.

Iodine value indicates the presence of unsaturated fatty acids. Higher iodine value indicates lower degree of saturation and vice versa. The iodine value for Bael seed oil was observed to be 112.78g/100kg. The saponification number of Bael seed oil was observed to be 182.55mg KOH/g. Saponification number gives an indication of nature of fatty acids in the fat, longer the carbon chain the less acid is liberated per gram of fat hydrolyzed.

From optimized procedure bulk density, encapsulation efficiency, peroxide value, yield, moisture of encapsulated powder for each run was determined and listed in table.

TABLE IV. PHYSICO- CHEMICAL PROPERTIES OF BAEL SEED OIL POWDER

Run	A:oil %	B:solid %	BD g/ml	EE %	PV mEq/kg	Yield %	Moisture %
1	20	25	0.41	89	1.16	87.57	3.2
2	10	30	0.45	74	1.23	86.24	2.4
3	20	30	0.49	90	1	85.25	3.9
4	30	30	0.42	87	1.28	86.01	2.7
5	10	30	0.42	86.5	1.27	80.35	3
6	20	30	0.43	90	1.15	81.76	2.3

CONCLUSION

It was concluded that Bael seed oil extraction by solvent extraction method was effective. After that further study of encapsulation process the six different runs according to the CCRD were used to study the quality parameters of Bael seed oil powder at various levels oil concentration and solid concentration. The response surface methodology was used to optimize the processing conditions using bulk density, encapsulation efficiency, peroxide value, yield, moisture content values responses. The models for bulk density, encapsulation efficiency, peroxide value, yield, moisture content value were statistically significant. optimum spray-drying process i.e. 20 % oil and 30 % solid content was recommended with predicted responses close to experimental values.

REFERENCES

[1] V.K.Bajaniya, U.K.Kandoliya, N.H.Bodar, N.V.Bhadja and B.A.Golakiya. Fatty Acid Profile and Phytochemical Characterization of Bael Seed (Aegle marmelos L.) Oil. International journal of current microbiology and applied sciences. Volume 4 Number 2 (2015) pp. 97-102.

[2] Renata V. Tonon , Carlos R.F. Grosso, Míriam D. Hubinger (Influence of emulsion composition and inlet air temperature on the microencapsulation of flaxseed oil by spray drying , Food Research International (2011), 44, 282–289.

[3] A. E. Kate, U. C. Lohani, J. P. Pandey, N. C. Shahi, A. Sarkar. Traditional and mechanical method of the oil extraction from wild apricot kernel: a comparative study. Research journal of Chemical and Environmental Sciences. April 2014, vol. 2(2), 54-60.

[4] Dr. R. Karthiyayini, Effect of seed size on germination of Aegle marmelos, L. Corr, Tamilnadu, India, Int. J. Adv. Res., 2017, 5(3), 2320-2323.