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Physico-Chemical Characterization *Elaeagnus latifolia* from Sikkim Himalayas

Vishal Kumar and Prashant Pandharinath Said*

Department of Process and Food Engineering, College of Agricultural Engineering and Post Harvest Technology (CAU), Ranipool, Sikkim, India, 737135

*Corresponding Author E-mail: psaid4@gmail.com

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ABSTRACT

Elaeagnus latifolia, an edible fruits, locally called known as "Soh-Shang". It has been cultivated extensively and utilized for human consumption only. The study was carried out with objective to determine the physical and chemical properties soh-shang fruits and Seeds. At average moisture content of 88.25 % (w.b.), the dimensions of fruits were 3.84 cm (length), 2.49 cm (width) and 2.28 cm (thickness). However, seeds had average length of 2.83 cm and diameter of 1.25 cm. The average unit mass of 100 samples of fruits and seeds were 13.88g and 1.72g, respectively. Fruit had sphericity of about 0.73 (±5.98) and aspect ratio of 65.15 (±6.26) %. However, the seed had 0.58 (±2.48) sphericity and 44.23 (±2.86) % aspect ratio. The average bulk density of E. latifolia fruits was 661.35 (±22.77) kg/m^3 and that for seeds was 570.10 (±0.05) kg/m^3. The average true density of fruits was 1056.26 (±10.55) kg/m^3 and that for seeds was 979.28 (±0.058) kg/m^3. The porosity was found to be 37.38 (±2.39) % for fruits and 41.78 (±3.61) for seeds. The mean value of pulp recovery from fruit was 82.71%. Seed to pulp ratio varies with genotypes and size of fruits. The pulp to seed ratio was 4.82 (±0.50) and was varying significantly. Total Solid Content of the fruit was 8.58 (±0.47) ^{o}Brix.

Key words: *Soh-Shang; Sphericity; Ash content; Pulp; Sikkim Himalayan region.*

INTRODUCTION

Elaeagnus latifolia of family Elaeagnaceae is commonly grown fruit in the backyard of North-Eastern states of India. It has different synonyms *viz*., "Musleri" in Sikkim, "Soh Shang" in Khasi hills of Meghalaya and "Heiyai" in Manipur. The diversity of genus *Elaeagnus* is centered in China[1]. Elaeagnaceae is a small family with three Genera: *Elaeagnus* L., *Hippophae* L. and *Shepherdla* Nutt. In China, it is mainly grown from Yangtze river valley to its Southern region, but it is also found in North-West China. It is also distributed in Eastern Asia, extending to South Asia and Queensland in North-Eastern Australia. Some of species also found in North America and Southern Europe[2]. It is large evergreen spreading type woody shrub with rusty-shiny scales that are often thorny and move upward with support of nearby stuff.

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The flowers are hermaphrodite and pollinated by insect (Bees). The flowering season of the plant is from September to December and light pink coloured fruits become ready to harvest during February to April in 3-4 picking. The shape of fruits is oblong and appears dark red after ripening. Fruits are mostly seasonal and highly perishable fruit due to high availability of moisture content of 87.31%. and can be stored only up to 3-5 days at the ambient temperature[3].

Traditionally, fruits are consumed in the raw form directly or with the salt. The local people of Sikkim found many uses of the fruit besides enjoying it as fresh fruit. They are preparing Chutney, jam, jelly, RTS (Ready to Serve) drinks or refreshing drinks from pulp. The fruit has high nutritional value. It contains as protein (7.8%), carbohydrate (74.06%), crude fibre (9.3%), ash (3.6%) and crude fat (0.52%). The caloric value of 100 g of fruit is 332.10 kcal. Fruit also contains essential minerals such as calcium (1470 mg/100g), iron (180 mg/100g) and potassium (910 mg/100g) in high amount[4].

As the fruits are available only in a particular season, least scientific work has been done. Also the market price of the Soh-Shang is very low during peak season, causing economic loss to the growers. However, consumer finds difficulty to get these fruits, shortly after harvesting season because of low shelf life. Hence, there is opportunity to work on post harvest management of such a nutritious fruit.

For designing post harvest processing equipments such as fruit pulper, grader, cleaner, etc, reliable information regarding the physical and chemical properties of fruit is necessary. Designing of processing equipments without considering engineering specification of proposed fruits may yield poor results[5]. Since, there is not enough information on physic-chemical properties of *E. latifolia* fruits available, the investigation was done to evaluate various physical and chemical properties of *E. latifolia.*

MATERIAL AND METHODS

The fresh fruits of *E. latifolia* were obtained from the local market of East Sikkim district in the month of March and April 2017. Fruit were cleaned manually in running water to remove all dust, contaminated sample, damaged sample, and other stuffs. Prior to experimentation, fruits were kept in polythene bags at 5 - 6 ^{o}C to avoid speedily deterioration. Then samples were randomly chosen for further measurements.

The physical dimensions of the fruits were measured using vernier caliper (Model CD-6BS-Mitutoyo Corporation, Japan) with accuracy of ±0.01 mm. 100 fruits were randomly selected from whole lot and were taken for measuring the dimension like length (L), Width (W) and Thickness (T). Arithmetic mean diameter (D_a), Geometric mean diameter (D_g), Sphericity (Ø) and aspect ratio (R_a) of fruits were calculated using following relationships[6]:

$$Ø = D_g / L$$

$$D_g = (LWT)^{1/3}$$

The unit mass and 1000 fruit mass of samples were measured using digital electronic balance (CONTECH, CA series) with an accuracy of ±0.001g. The reported values are mean of 10 replications. The surface area was calculated using formula as given below:

$$\text{Surface Area} = \pi D_g^2$$

The bulk density was measured by placing fruits in known volume container (1000 cm^3). After putting fruits cylinder were tapped gently and weighed using electronic balance. The bulk density was calculated using following formula[7]:

$$\text{Bulk Density} = \frac{\text{Mass of fruit (g)}}{\text{Volume of fruit (mL)}}$$

True density of fruits was determined using Toluene (C_7H_8) displacement method and calculated using formula as below:

$$\text{True Density} = \frac{\text{Mass of fruit (kg)}}{\text{True volume of fruit } (m^3)}$$

Measurement of the Total Soluble Solid (TSS) of the test solution at 20^{o}C was done using a Pocket Handheld Digital Refractometer (Atago, Pal 1, A828197).

RESULTS AND DISCUSSION

An underutilized fruit, *E. latifolia* has moisture content of 88.25 % (w.b.). The physical properties of the fruits and seed were determined using standard procedures and average values of the same were calculated as given in Table 1.

The study showed that the dimensions of the fruits follows normal distribution pattern at 88.25 % (w.b.) moisture content and when fruit is fully matured. The physical dimensions of the fruits include length (major dimension), width (moderate dimension) and thickness (minor dimension) and three unequal axial dimensions represented the shape of fruit as ovide. The average length, width and thickness of the fruits were 3.84 (±0.38) cm, 2.49 (±0.03) cm and 2.28(±0.41) cm, respectively. About 18 % fruit samples were having longest and shortest dimension (longitudinal), and 64 % fruit samples having moderate dimensions (longitudinal). However the fruit length varied from 2.95 to 4.55 cm. The fruits also had 16 % fruits with minimum and maximum width, and 65 % fruits with average width. The earlier reports had highlighted importance of the axial dimensions for determining aperture size, shape and other parameters in machine design for developing grading and sizing machines[6]. The fruit dimensions (length, width and thickness) were showing normal distribution trend which was as shown in Figure 1. The curves were narrower and had higher peaks, indicating that the fruits have dimensions close to their corresponding means (Table 1).

The width and thickness of the seed were equal. Geometric mean diameter of fruits and seeds was 2.78 (±0.24) cm and 1.64 (±0.08) cm, respectively. The value of geometric mean diameter was lower that the length and higher than the thickness. The arithmetic mean diameter of fruits and seeds was 2.87 and 1.77 cm, respectively. Though, L/T ratio exhibited the highest values, the ratio of L/Dg and L/W had values closest to L/T ratio. The coefficients of correlation (r) showed that all the ratios were found to be highly significant (Table 1). This fact indicated that the length of the seed was positively related to its width, thickness and geometric mean diameter. The following general expression can be used to describe the relationship among the average dimensions of Soh-Shang fruit:

$$L = 1.55W = 1.74T = 1.38D_g = 0.16S = 0.05Ø = 0.3M$$

$$W = 1.13\ T = 0.90\ Dg$$

$$T = 0.82\ Dg$$

For seeds, the relations were:

$$L = 2.27W = 1.73D_g = 0.34S = 0.05\ Ø = 1.65M$$

$$W = 0.76Dg = 0.73\ M$$

The shape of fruits or seeds was decided on the basis of their sphericity and aspect ratio values[5, 8]. The results (Table 1) showed that fruits had sphericity of about 0.73 (±5.98) and aspect ratio of 65.15 (±6.26) %. However, the seed had 0.58 (±2.48) sphericity and 44.23 (±2.86) % aspect ratio. From the results, the fruits are assumed as ellipsoid surface and may roll on flat surface. The tendency of rolling plays important part in the design of hoppers and material handling equipments for fruits and seeds. Besides, the shape of fruit as well as seed may be treated as an ellipsoid for an analytical prediction of its drying behavior.

The surface area is a relevant tool in determining the shape of the seeds and has found to be 24.44 (±4.25) cm^2. According to Alonge and Adigun[9], the behavior of fruits and seeds on oscillating surfaces during processing may be predicted from the surface area.

The mean value unit fruits weight was 13.882 (±4.25) g and unit seed weight was 1.72 (±0.22) g. Density is one of crucial factor in during processing, storing, constructing storage houses or area and designing packaging container. The average bulk density of *E. latifolia* fruits was 661.35 (±22.77) kg/m^3 and that for seeds was 570.10 (±0.05) kg/m^3. The bulk density is important parameter because it determines the capacity of storage and transport systems. The average true density of fruits was 1056.26 (10.55) kg/m^3

and that for seeds was 979.28 (0.058) kg/m^3. This shows that fruits are heavier than water and will settle under the water. This characteristic can be used to separate the fruits from other lighter foreign materials. However, seeds are lighter than water and will float over water. The characteristic of seeds can be used to separate heavier materials from seeds.

The porosity of the mass of fruits and seeds determines the resistance to airflow during aeration and drying process. It was found to be 37.38(2.39) % for fruits and 41.78(3.61) for seeds.

Pulp recovery from fruits was varied from 80.70% to 84.68% with the mean value of 82.71%. Seed to pulp ratio varies with genotypes and size of fruits. The pulp to seed weight ratio of fruit was 4.82 (0.50) and was varying significantly. Total solid content of the fruit was 8.58 (0.47) °Brix.

Table 1: Physic-chemical Properties of *Elaeaguns latifolia* Fruit and Seed

Particulars	No. of Observations	Fruit*#	Seed#
Length (cm)	100	3.84(0.38)	2.83(0.18)
Width(cm)	100	2.49(0.03)	1.25(0.06)
Thickness(cm)	100	2.28(0.41)	_
Geometric Mean Diameter (D_g)	100	2.78(0.24)	1.64(0.08)
Arithmetic Mean Diameter (D_a)	100	2.87(0.24)	1.77(0.09)
Sphericity (Ø)	100	72.74(5.98)	58.02(2.48)
Unit weight (g)	100	13.88(4.25)	1.72(0.22)
Surface Area(cm^2)	100	24.44(4.25)	8.43(0.81)
Aspect Ratio(R_a)	100	65.15(6.26)	44.23(2.86)
Bulk Density(kg/m^3)	10	661.35(22.77)	570.10(0.049)
True Density(kg/m^3)	10	1056.26(10.55)	979.28(0.058)
Porosity (%)	10	37.38(2.39)	41.78(3.61)
TSS (°Brix)	10	8.58(0.47)	0.482
Pulp / Seed Ratio	10	4.82(0.50)	0.517
Pulp percentage (%)	10	82.71(1.49)	1.534
Moisture Content (%)	10	88.25(2.08)	2.133

Note: *Average values; #Values in parenthesis are standard deviation

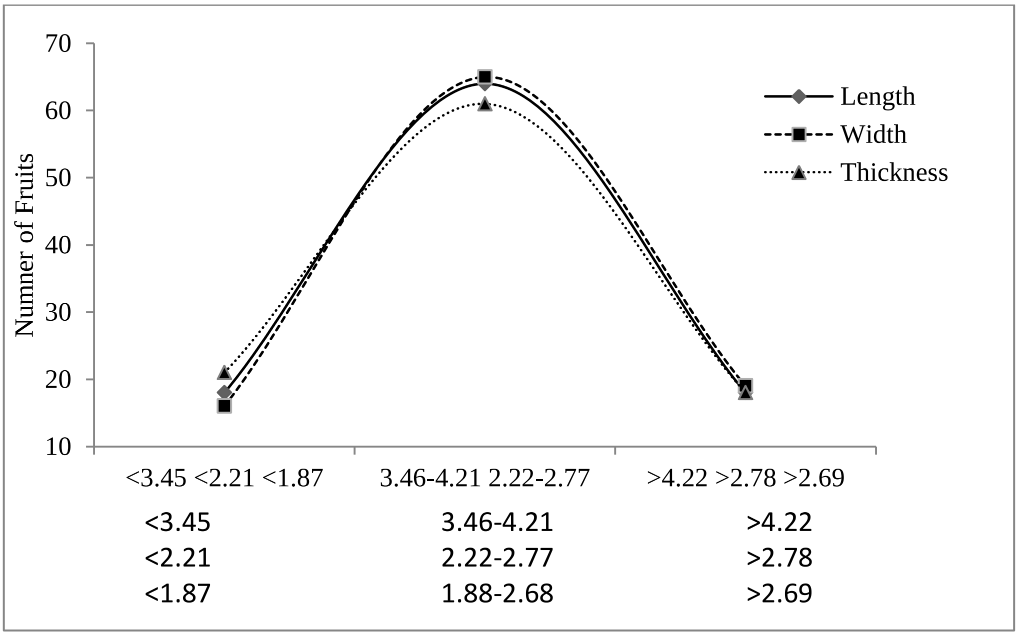

Fig. 1: Distribution pattern of fruit dimensions (Normal Distribution)

The average thickness of fruit pulp was varies from 1 to 1.25 cm. Fruits are as shown in Figure 2.

Fig. 2: Soh-Shang fruits

CONCLUSION

The following conclusion was drawn from above investigation regarding the physical properties and some chemical properties of *E. latifolia* fruit and seed. At moisture content of 88.25 % (w.b.), the averages of dimension of fruits were 3.84cm (length), 2.48cm (width) and 2.28cm (thickness). For seeds, averages of dimensions were 2.83cm (length) and 1.25cm (diameter). The arithmetic mean diameter of fruits and seeds were 2.87cm and 1.77cm, respectively, however geometric mean diameter of fruits and seeds were 2.78cm and 1.64cm, respectively. The mean value of sphericity for *E. latifolia* fruit was 72.74 and for seed was 58.02 while the average aspect ratio was fruits and seeds were 65.15 and 44.23 respectively. The average mass of one hundred *E. latifolia* fruit and seeds was 13.88g and 1.72g respectively. The average of surface area of fruits and seeds were 24.44cm^2 and 8.43cm^2 respectively. True density of fruits and seeds was 1056.26 kg/m^3 and 979.28kg/m^3 respectively and bulk density for them was 661.35 kg/m^3 and 570.14 kg/m^3 respectively while the Porosity in case of fruit was 37.38 % and in regard of seed was 41.78 %, respectively. Apart from these physical properties some other properties like pulp to seed ratio, Total Soluble Solid (TSS) and percentage of pulp recovery from fruit also find importance in processing of fruit. In summary, this paper deals with the physical and some chemical properties of this species that extending the knowledge and providing some important and useful information and data that will help for its post harvest handling and processing.

REFERENCES

1. Patel, R.K., Singh, A. and Deka, B.C. Soh-Shang (*Elaeagnus latifolia*): An under-utilized fruit of north east region needs domestication, *ENVIS Bulletin: Himalayan Eco.* **16(2)**:1-2 (2008).
2. Sun, M. and Lin, Q. A revision of *Elaeagnus* L. (Elaeagnaceae) in mainland China, *J. Systematics and Evolution*. **48(5)**: 356 – 390 (2010).
3. Patel, S. Plant genus Elaeagnus: underutilized lycopene and linoleic acid reserve with permaculture potential, *Fruits*. **70(4)**: 191-199 (2015).
4. Seal, T. Nutritional composition of wild edible fruits in Meghalaya state of India and their Ethno-botanical importance, *Res. J. Bot.* **6(2)**: 58-67 (2011)
5. Said, P.P. and Pradhan, R.C. Moisture dependant physical properties of bottle gourd seed, *Int. J. Agri and Biological Eng.* **6(4)**: 111-120 (2013).

6. Mohsenin, N.N. Physical Properties of Plant and Animal Materials: Structure, Physical Characteristics, and Mechanical Properties, second ed. Gordon and Breach Science Publishers, New York. 1986. p. 891.
7. AOAC. Official Methods of Analysis. Association of Official Analytical Chemists. 14th Edition, AOAC, Arlington (1984).
8. Garnayak, D.K., Pradhan, R.C., Naik, S.N. and Bhatnagar N. Moisture-dependent physical properties of jatropha seed (*Jatropha curcas* L.). *Industrial Crops and Prod*, **27(1):** 123-129 2008.
9. Alonge, A.F. and Adigun, Y.J. Some physical and aerodynamic properties of sorghum relative to cleaning. *Nigerian J. Pure Appl. Sci.*, **14:** 992-998 (1999).