DESHELLINGOFSEMECARPUS ANACARDIUM (BIBBA SEED): A REVIEW STUDY

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ABSTRACT

Semecarpus anacardium is commonly known as Bhallataka. It has been used since hundred of years In Indian system of medicine (Ayurveda). It has lots of medicinal properties due to various chemical compound, which are present in it, like Bhilawa, biflavonoids, phenolic compound etc. The present review deals with the description of semecarpus anacardium and existing machine, Innovative ideas. Semecarpus anacardium is a native of India. Found in the outer Himalayas to coromandel coast, it is closely related to cashew. The fruit is composed of two parts a reddish – orange, accessory fruit and a black drupe that grows at the end . The nut is about 25 mm (1 in) long , avoid and smooth lustrous black .The accessory fruit is edible and sweet when ripe , but the black fruit is toxic and produces severe allergic reaction if it is consumed or its resin comes in contact with the skin. It has been freely used all over India since centuries. The word Semecarpus is derived from Greek word simeion meaning marking or tracing and carpus meaning nut.

Key words: *Bhallataka, Semecarpus anacardium*

1. TITLE

Semecarpus anacardium is one of the most important plant which may be use alternatives of medicine. Several studies show that nuts extract have various chemical which is able to fight against several disease but due to its poisonous nature it should be used with caution. Now days this plant found only in forest area because people are not aware about its important hence people are cutting this plant speedily from their surrounding area, but it should be conserve..Hence while deshelling the bibba must take care of your skin, Bibba fruit cant be in contact with your skin after deshelling Semecarpus anacardium a well known medicinal plant in Ayurvedic medicine. It is one of the most powerful and fast acting Ayurvedic herb. It is used extensively in piles, skin diseases, cancer etc. It is known as Bhallataka (Hindi) in India and was called " marking nut " by Europeans , because it was used by washer man to mark cloth and clothing before washing , as it imparted a water insoluble mark to the cloth . It is also known as bibba in Marathi, agnimukh in Sanskrit. Semecarpus anacardium (SA) is one of the best, versatile and most commonly used herbs as a household remedy, distributed in sub-Himalayan region, Tropical region, Bihar, Bengal, Orissa and central parts of India. It has been freely used all over India since centuries. It is a medium sized deciduous tree, growing up to 10-15 meters in height. The plant grows naturally in tropical and dry climate. Bark is grey in color and exudes an irritant secretion on incising. The leaves are simple alternate, 30-60 cm long and 12-30 cm broad. They are glabrous above and pubescent beneath. The flowers are greenish white, in panicles. Fruits are ripe between December to March and are 2-3 cm broad, ovoid and smooth with a lustrous black. Flowering occurs in June and then onwards the plant bears fruits. It has got no specific soil affinity and Easily recognized by large leaves and the red blaze exuding resin, which blackens on exposure. Now Semecarpus anacardium plant has become a wild plant, it found only in forest area. Day by day the quantity of this plant is decreasing, it is need to aware it's importance to society otherwise it will be become rare and we will loss one of important plant from the dictionary of Indian medicinal plants.

2.MEDICINAL USE

Folk medicine

Semecarpus anacardium is a one of most popular medicinal valuable plant in world of Ayurveda. Charak, Sushrut and Vagbhatt, the main three treatises of Ayurveda have described the medicinal properties of *Semecarpus anacardium* and it's formulation. Bhallataka is used both, internally as well as externally. The fruits, their oil and the seeds have great medicinal value, and are used to treat the wide range of diseases. Detoxified nut of SA were used in Ayurveda for skin diseases, tumors, malignant growths, fevers, haemoptysis, excessive menstruation, vaginal discharge, deficient lactation, constipations, intestinal parasites. (Charaka, Sushruta), Before using Semecarpus anacardium for medicinal purpose, it's necessary to detoxifying it because it is highly toxic for body if not use properly. Number of detoxification methods have been recorded the most common detoxification method involves rubbing of Semecarpus anacardium seeds with brick powder and then washing the seeds with warm water. The second common recommended method is to tie the seeds in muslin cloth and suspended it in a vessel containing coconut water, then heated for about 3 hrs continuously16. The seeds oil is mainly used for medicinal purpose. Seeds are generally boiled in milk and the milk is consumed. The seeds oil is used in minimum possible quantity, typically mixed with food items or mustard oil. Externally, the oil is applied on wounds to prevent pus formation and better healing of wounds, It works well,when medicated with garlic, onion and ajavayana in sesame oil. In glandular swellings and filariasis, the application of its oil facilitates to drain out the discharges of pus and fluids and eases the conditions. It is also use as a brain tonic, blood purifier and haematinic tonic. The combination, Semecarpus anacardium, Terminalia chebula, Sesamum indicum L. seeds powders with jaggery, has excellent results in chronic rheumatic disorders. In dysmenorrheal (painful menstruation) and oligomenorrhea (scanty menstruation), the medicated milk or its oil is salubrious. It reduces the urinary output, hence beneficial in diabetes of kapha type, Bhallataka is the best rejuvenative (rasayana) for skin ailments, vata disorders and as a preventive measure to increase the body resistance. Winter is the best season for its usage.

Pharmacology

Number of drugs are derived from Semicarpus anacardium plant which are available in market against several disease like skin disease, tumors, malignant growth, fungal disease, excessive menstruation, vaginal discharge, fever, haemoptysis, constipation and intestinal parasites. (Charaka, Sushruta). Anti-inflammatory, antiarthritic, antioxidant activity, hypolipidemic, hypoglycaemic, antiatherogenic,anti-inflammatory, antifertility, Neuroprotective activities of Semecarpus anacardium nut with different solvents are also reported on experimental animal and cell lines.

Anti-Cancer activity

Nut of Semecarpus anacardium have antitumours activity. several Studies have been also done in proving the anticancer and hepatoprotective activity of Semecarpus anacardium nut.

Antioxidant activity

Semecarpus anacardium has been reported in various studies to possess potent antioxidant activity. Investigated antioxidant activity of the aqueous extract (nuts of SA) in AKR mouse liver during development of Lymphoma.

MECHANICAL PROPERTIES

The force needed to rupture 37.17kg to 38 kg energy used for rupture 134.80 kg mm and hardness of marking nut 10.82 kg mm-1is higher as compared to the kernel (17.20 kg,2.65 mm, 45.58 kg mm and 6.49 kg mm-1)which indicates that kernel needed the lowest Strain to rupture as compared to marking nut. The study also revealed that optimum moisture content for effective cracking of marking nut was 2.67 to 2.75% for effective cracking/deshelling.

MATERIALS AND METHODS

Sample preparation

For this experiment the marking-nuts were procured from local market. The nuts were tremendously varying in size therefore; the cleaned nuts were divided into three fractions small, medium and large for throughout the experimentation. Moisture content of sample was determined by using a standard oven drying method at an air temperature of 105 ± 2ºC for 24h (AOAC, 2000). The initial moisture content of nut and kernel was found to be 7.60% and 2.03% (d.b.), respectively.

DETERMINATION OF PHYSICAL

Properties

For each moisture content, the length, width and thickness of the nut were measured by a venire caliper (Mitutoyo, Japan)with an accuracy of 0.02 mm. Geometric mean diameter (Dg),sphericity (Φ) and surface area (S) of marking-

nut were calculated by using following relationships (Mohsenin, 1980).The experiments were replicated 100 times.
$Dg= (abc)1/3$ $f= Dg/a$
Where, a = length (mm), b= width (mm),
c= thickness (mm)and e = Eccentricity

OPTIMUM MOISTURE CONTENT

In sun drying the nuts were spread out in open area exposing to sun without any obstacle between 9:00 am to 5:00 pm in the month of February to March at varying 29 to 38ºCtemperature with relative humidity 18 to 30%. The marking nut Sheller was used for the nut cracking and each nut was examined and categorized after cracking (Gabadam *et al*.,2009) are as a) Fully cracked (FC) in which case the kernel was whole and free of shell attachments, b) Partially cracked (PC)meaning that there is some shell adhering to the kernel, c) Split and loosely attached (SLA) in this case the kernel was cracked and split into two or more parts but free of any shell attachment Split and rigidly attached (SRA) meaning the kernel was split into two or more parts but with shell attachments Not cracked(NC) in this case the it had not been cracked at all.

PHYSICAL PROPERTIES OF
MARKING NUT AND KERNEL

A summary of the results of determined physical parameters of nut and kernel is shown in Table 1 and 2. The thousand nut weight, fractions of marking nut, size are provided along with other physical parameters. The nut length, width and thickness are found to be in the range of 14.73 to 21.40 mm, 12.99 to18.17 mm and 7.58 to 8.48 mm, respectively for small to large size. Corresponding values for the Jatropha seed(Garnayak al., 2008 and Sirisomboon et al.,2007) are18.65 to 21.02 mm, 11.34 to 11.97 mm and 8.91 to 9.58mm. The marking nut is thus bigger than Jatropha seed. The importance of these dimensions in determining aperture size, clearance between the cracking unit and other parameters in machine design have been discussed and highlighted by(Kale mullah and Gunasekar, 2002). The shape of marking nut and kernel are determined in terms of its sphericity. The sphericity of marking nut and kernel are found in the range of to be 0.77 to 0.69 and 0.62 to 0.55, respectively. In this study, kernel shows relatively less sphericity than marking-nut. The shape of marking-nut and kernel is ellipsoid for calculation of the surface area. A similar result is also found for Jatropha seed (Garnayak *et al.*, 2008).The thousand nut and kernel weight are in the range of 1549.75 to 2575.45 and 170.14 to 276.52 g, respectively. The surface area of marking nut is larger than that of kernel by 40.74 to 45.12%, indicating that mass or energy transfer rate through the surface of the fruit might be slower than the rate for kernel. The bulk density of marking nut and kernel are 576.98 to 537.65 and591 to 485.50 kg m-3, respectively. This indicates that the bulk density of the marking nut is higher than that of kernel. This indicates that nut need more space per unit mass than kernels. The true density of kernel and marking nut was closer to each other. This indicates that separation of marking nut shells from nut after cracking should not be done by blowing air (winnowing) or floating in water. The porosity of marking nut and kernel were found in the range of 55.08 to 50.40 and 50.17 to 60.35%, respectively. Since the porosity depends on the bulk as well as true densities, the magnitude of variation in porosity depends on these factors only. The porosity of the bulk of kernel is higher than that of the nut. This indicates that aeration of the bulk of kernel is easier than of the bulk nut. Adhesion between container wall and material affected the value of angle of repose. The angle of repose of marking nut is 66 to 68.52% which is higher than that of the kernel. This value implies the lowest flow ability of the kernels as compared to the marking nut. Similar results were found for Apricot fruits, pits and kernels (Ahmadi et al., 2009) and fruit, nut and kernel of palm oil (Akinoso, 2010). The percent increase in coefficient of friction were found to be higher in marking nut as compared to kernel on glass, stainless steel sheet, plastic sheet and wood surfaces, for small to large size marking nut, respectively.

OPTIMIZATION OF MOISTURE IN MARKING NUT

Marking nuts was dried in sun and tray dryer to evaluate the optimum moisture content by regression analysis of moisture content verses per cent fully cracked marking-nuts. Daily collected samples were cracked by using marking nut Sheller and distributed the cracked nuts into five groups viz., fully cracked, partially cracked, split and loosely attached, split and rigidly attached and not cracked. 1) For moisture content verses per cent fully cracked in sun drying gives direct value of optimum moisture content by using quadratic equation. The optimum moisture content was found to be 2.63% for efficient cracking of sample from the equation. The Fig. 2 gives the relationship of moisture content verses percent fully cracked marking nut for efficient marking nut cracking at 70ºC temperature. From Fig. 2, it reveals that the optimum moisture content was 2.72% for efficient cracking.

DESIGN AND DESCRIPTION

OVERVIEW

The Bibba de-shelling machine was developed based on the following consideration:

1. The availability of materials locally to reduce cost of production and maintenance of the machine.
2. The de-shelling plunger was introduced in between crank slider mechanism.
3. It is desired that the Bibba fruits should be well de-shelled without Bibba seed breakage and also that seed extracted should not be distorted, thus pulleys were carefully designed/selected to meet the required synchronized speeds of the de-shelling units.
4. Deshelling machine should be protective to operate.

MECHANICAL PROPERTIES

The mechanical properties of marking nut and kernel like rupture force, deformation at rupture point, deformation ratio at rupture point, hardness, and energy used for rupture are presented in Table 1,2. The force needed to rupture and deformation at rupture point of marking nut is the higher as compared to the kernel. This is because the nut has a hard shell and the kernel has soft texture. This indicates that kernel needed the lowest strain to rupture compared to nut, these indicate that the mechanical properties of the sample depended to some extent on its original size.

The minimum clearance between the taper compression surfaces needed for deshelling or cracking or nut shelling was equal to the size of the nut minus the deformation at rupture point. The hardness of the marking nut was the highest as a hard skin covered the kernel. The energy used for rupture or the toughness of marking nut was the highest and that of the kernel was the lower due to easily broken the material. It is noticed that the standard deviations of data relevant for calculating mechanical properties are high.

PHYSICAL PROPERTIES OF MARKING NUT AND KERNEL

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Sr. No	Bibba specification	Minimum	Maximum
1	Length, mm	14.73	18.40
2	Width, mm	12.99	14.90
3	Thickness, mm	7.58	8.36
4	Size, mm	11.30	13.16
5	Kernel fraction, %	9.01	10.09
6	Shell fraction, %	89.91	90.99
7	Surface area mm^2	577.75	580
8	Porosity, %	55.08	56.60

Table 1: Physical Properties of marking nut and kernel

Sr. No.	Mechanical properties Bibba and Kernel	Bibba	Kernel
1	Rupture force, (kg)	37.17	17.20
2	Deformation, mm	3.61	2.65
3	Hardness, (kg /mm)	10.82	6.49
4	Energy used for rupture, (kg mm)	134.80	45.58
5	Deformation ratio at rupture point	0.20	0.11

Table 2: Mechanical properties of marking nut and kernel

DESIGN PROCEDURE

SELECTION OF PULLEY AND DETERMINATION OF THEIR SPEEDS AND BELT TENSIONS:

The machine requires Six pulleys and a belt for its drives. Standard pulley were selected due to simplicity in design, availability/economy of maintenance. Due to its availability, durability, cost and performance, Cast iron pulleys were selected. The driving pulley was mounted on the motor shaft and the driven on the intermediate shaft. In motor shaft the pulley diameter 20 mm and intermediate shaft 20mm diameter, thus the of motor shaft has transmitted power to intermediate shaft with v-belt drive run at the less speed and this speed was determined as 432 rpm using the relation;

N1D1 = N2D2

$\frac{D2}{D1} = \frac{N1}{N2}$

Where, $N_1$is the speed of the driving pulley = 1440

N_2 is the speed of the driven pulley

= 432rpm N5=2160 speed of the pulley No.3,5=2160rpm

N_6 speed of pulley No.2 and No.6,4=10rpm

D_1 is diameter of smaller pulley=76.2mm

D_2, D_4, D_6 is diameter of lager pulley=254mm

D_3, D_5=50.8mm

The centre distance, C between the adjacent pulleys=280mm.

DESIGN OF THE BELT(ON THE BASIS OF DDB)

1.Design power Pd:

$Pd = P_R \times K_1 \times K_O$

=678.18Watt

Where,

K1=Overload service factor XV-2 (DDB)

K0=Capacity co-efficient of inclination XV-3

2.Belt tension:

$(F_1 - F_2) = Pd/Vp$

Where, Vp=Peripheral velocity

=19.15m/s

3.Belt tension ratio:

$F_1/F_2 = e^{\mu\theta}$

Where, μ=0.30

Θ_1=Angle of lap in radiant

$= \pi - \left(\frac{(D2-D1)^2}{280}\right)$

=2.44 rad

Θ2=2.41rad

Θ3=2.41rad

Length of the belts

L_1=916.68mm

L_2=882.33mm

L_3=882.33mm

Using by formula, $L=\frac{\pi}{4}(D_2+D_1)+2C+\frac{(D2+D1)2}{4C}$

Where, D1 is the diameter of the pulley on the driving motor shaft and driven shaft D_2.

Type "A" V-belt is suitable for this drive since the drive transmitted less than 810W. Based on a v-belt with standard nominal width=13 mm

nominal thickness=8 mm,

bending stress factor=2.52mm

Where, Angle of lap of the drive,Vp= Peripheral velocity (Belt speed),Vp=19.15 m/s

DETERMINATION SHAFT DIAMETER:

The diameter, d for each of the shaft of this machine was determine using maximum stress relation given by Where, Allowable shear stress for steel shaft with provision for key ways = 88.8 N/mm^2

T = Torque transmitted by the shaft, N-mm

M = Maximum bending moment on the shaft, N-mm

Kt = Combined shock and fatigue factor for twisting

Kb = Combined shock and fatigue for bending

SHAFT MATERIAL CONSIDER AS SAE 1030 STEEL

Sut = Ultimate tensile strength=527 MPa

Syt = Yield strength in compression =296 MPa

Therefore, design shear stress should be < 0.30 Syt

Design Torque

$Td=\frac{60\times P\times K1}{2\pi N}$

Td=7.4205 N-m

Required force=381.60N

Final torque=F× d

T=4.57 N-m

Where, *N1* is the speed of the driving pulley = 1440RPM

N2 is the speed of the driven pulley = 432RPM

D1 is diameter of smaller pulley=70.2mm

D2 is diameter of lager pulley =254mm

The centre distance, C between the adjacent pulleys was computed as 280mm.

Thus, length of the belt, l_1,l_2,l_3 was computed as 923.30mm,905mm,891.71mm from expression given above.

Where, D1 is the diameter of the pulley on the driven motor shaft. Type "A" V-belt is suitable for this drive since the drive transmitted less than 1 kW.

Based on a v-belt with standard

Nominal width=13mm

Nominal thickness=8mm

Bending stress factor=2.54

Angle of lap of the drive=2.41 to 2.41rad

Vp= Peripheral velocity (Belt speed),m/s=19.15m/s

Hence we have prepared for 10mm shaft

Diameter of shaft=20mm

ELECTRIC MOTOR SPECIFICATIONS:

A three phase 1hp electric motor with a rated speed of 1440 rpm was chosen for the de-shelling machine. It is because it is the range of electric motor available in the market with a specification close to the estimated minimum power requirement of 0.745 kW and by virtue of the bibba mass to let the bibba be deshelled by impaction of force by means of plunger.

MATHDOLOGY :

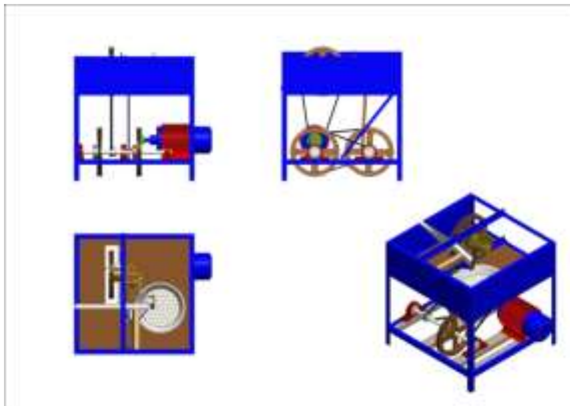

Fig.1.Fabricated deshelling machine

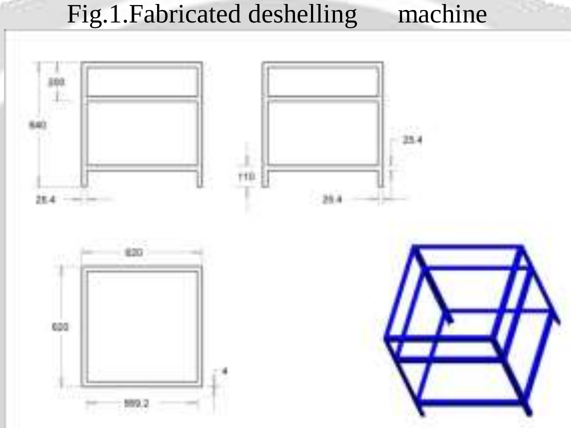

Fig.2.Layout of frame

The major components of the developed Bibba de-shelling machine shown in Figure 1 are frame, plunger, driven and driver pulleys, rubber belt and motor and bearing housing. Fig.1. Diagram of the developed Bibba de-shelling machine. The frame is the main supporting structure upon which other components of this machine were mounted. The frame is a welded structure construction from 6460mmx5693mm angle plate715.1mm. The de-shelling unit comprises of one is shaft and plunger. Intermediate shaft is a mild steel rod of 20mm diameter and 280 mm, 500mm long supported at both ends by ball bearing. A 1 H.P (0.746 KW) induction motor, which is attached to the base of stand transmits power from motor shaft to intermediate shaft No. 1 to pulley P1 (76.2mm) and pulley P2 (254mm) which are attached to motor shaft, intermediate shaft respectively and is connected by V-belt drive 923.30 mm,905mm,891.71mm Motor shaft is rotated at 1440 RPM and intermediate shaft is rotated at 380 RPM. In intermediate shaft located the pulley P3 (50.8mm) which transmitted the power to plunger at which rotate speed 380 RPM, Since Bibba de- shell contain low strength, hence it requires low speed for deshelling, The de-shelling rod attached to frame structure which is near the slider crank mechanism. The bibba fruit locate to the de-shelling by means of plunger. The crank slider mechanism is used here to control over the plunger. Initially rotating motion convert into the reciprocating motion by mans of crank and then into sliding motion.

CONCLUSION

From above information it is conclude that the semecarpus anacardium is responsible for various the potential and especially in joint disorder, cancer, piles, skin disease. Many research studies revels that it is useful herbal plant for anti-inflammatory property. It breaks at minimum moisture content trough deshelling process at near about 379.78 to 378.0N force.

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