International Journal of Advanced Biochemistry Research

ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2024; 8(5): 1012-1015
www.biochemjournal.com
Received: 01-03-2024
Accepted: 04-04-2024

Dr. Mohini M Dange
Assistant Professor, Department of Agricultural Process Engineering, College of Agricultural Engineering and Technology, Dr. PDKV, Akola, Maharashtra, India

Corresponding Author:
Dr. Mohini M Dange
Assistant Professor, Department of Agricultural Process Engineering, College of Agricultural Engineering and Technology, Dr. PDKV, Akola, Maharashtra, India

Drudgery reduction by using women friendly technology for harvested Roselle

Dr. Mohini M Dange

DOI: https://doi.org/10.33545/26174693.2024.v8.i5l.1233

Abstract
After harvesting Roselle from the plant, the calyses are separated/ detached manually, these Roselle calyses are then used for preparing different value added products e.g. sharbat, Jam, syrup, pickle, Roselle supari etc. the manual method is laborious and time consuming. With the increasing demand of calyces for preparing various value added products there was an urgent need to develop a detacher for calyces separation/ detaching from Roselle fruit and hence Roselle calyces detacher (RCD) was developed. The developed detacher consist of cutting blade, cutting blade holder, spring and rivet arrangement. The Detacher is a manual hand operated tool with wt. of 125 g and overall dimensions of 225 mm x 105 mm x 20 mm.
Female labour can efficiently perform the detaching operation with Roselle calyces detacher (RCD) with the capacity of RCD is 5.37 kg/h as compared to manual detaching i.e 0.95 kg/h and efficiency is 96.8% as compared to 68.9%. The ergonomical observations like HR, EE, ODR and BPDS shows that detaching operation falls under LIGHT WORKLOAD.

Keywords: Roselle, women friendly technology, developed and adapted

Introduction
Roselle (*Hibiscus sabdariffa* L.), is a member of malvacae family and it is a tropical plant of considerable economic potential. Roselle is quite hardy and grows well in most soils that are deep, fairly fertile and Roselle is a drought-tolerant crop. Roselle grows well in a wide range of climates except in the super-humid zones. The crop is cultivated extensively at present in India, Thialand, Germany, Senegal and Egypt for its pleasant red coloured calyces which are used for making jam, jelly and bottle drinks (Omobuwajo *et al*. 2000).
After harvesting Roselle from the plant, the calyses are separated manually, these Roselle calyses are then used for preparing different value added products e.g. sharbat, Jam, syrup, pickle, Roselle supari etc. There are two traditional methods by which the calyces are detached from the Roselle plant i) Dried roselle calyces are obtained either by harvesting the fruits fresh, decore them, and then dry the calyces; or the other way is by ii) leaving the fruits to dry on the plants to some extent, harvest the dried fruits, dry them further if necessary, and then separate the calyces from the capsules. Both the methods are laborious and time consuming. Thus, with the increasing demand of calyces for preparing various value added products there is an urgent need to develop a detacher for calyces separation from Roselle plant.

Objectives
- To develop a detacher for Roselle calyces.
- Testing and evaluation of Roselle calyces detacher (RCD) for detaching Roselle calyces from Roselle fruit.

Materials and Methods
A) Physical and mechanical properties of Roselle fruit
The Roselle fruits used for the study were obtained from local market of Akola district. The good healthy matured Roselle fruits were selected for the study. The 25 fruits were randomly selected for determination of physical properties. The measurements were carried out with three replications.

Different physical properties of Roselle fruit (RF) and Roselle Seed Capsule (RSC) were determined by standard methods *viz*. length, width, thickness, geometric mean diameter, roundness, sphericity, surface area and moisture content. The volume, bulk density, true density and porosity of Roselle seed capsule (RSC) was determined.

B) Development of Detacher and calculation of Detaching Efficiency

i) Observations with respect to efficiency of detacher for fresh calyces is calculated by the expression.

Detaching Efficiency, DE (%) = W_T - W_D/ W_T x 100

where,
DE (%) = Detaching efficiency, %
W_T = Total weight of Roselle fruits, kg
W_D = Weight of damaged calyces, kg

C) Ergonomical observations

The ergonomical observations with respect to psychophysical response such as overall discomfort rating (ODR), body part discomfort (BPDS), heart rate, pulse rate and energy expenditure of operator while operating Roselle calyces detacher were taken. I) Test Conditions II) Body weight and height of the subject III) Measurement of Heart Rate IV) Energy Expenditure V) Classification of workload VI) ODR & BPDS.

Results and Discussion

The avg. length of Roselle fruit (RF) and Roselle seed capsule (RSC) calyces was 43.01 mm and 21.51 mm respectively. The avg. width of RF and RSC was 18.03 mm and 14.12 mm respectively. And the avg. thickness of RF and RSC was16.06 mm and 12.98 mm respectively. The avg. weight of RF and RSC was 8.27 gm and 3.33 gm respectively. The avg. moisture content of RF and RSC was 76.20 (% wb) and 22.8 (% wb) respectively. The geometric mean diameter of RF and RSC was 23.18 mm and 15.80 mm respectively. Also the sphericity for RF and RSC was 53% and 73% respectively. The solid density of the RSC was calculated to be 1.208 g/cc. It shows that RSC was more compact and dense. The bulk density of the fruit was found to be 0.809 g/cc

Since we are interested to develop a device for detaching calyces from seed capsule attached with epicalyx of fruit, the average diameter at this particular point was measured and found to be 13.58± 1.012 mm. The developed Roselle calyces detacher is shown in Plate 1. A special stainless steel (SS -304) cutting blades made for the purpose of detaching calyces from seed capsule attached with epicalyx were welded firmly to upper and lower jaw (blade holder). The jaws were riveted to mild steel handle. A spring arrangement was given at the point of rivet to keep the handle in released position and allows the cutting blades to be at a distance of 16 mm. The sharp edge of cutting blade was sufficient enough to produce cutting force more than 4 kg at the point where calyces are joined to seed capsule attached with epicalyx. Thus, Roselle calyces can be detached and held in one hand and epicalyces with seed capsule can be detached with the help of Roselle calyces detacher by the other hand.

The Roselle fruits were harvested from the STRU, Dr. PDKV, Akola field and brought to AICRP on PHTS lab. The erogonmical observations were taken at the temp of 25-29 °C and 35-38% humidity. 5 female labours were selected for study as given in Table1.

Table 1: BMI of the female subject

Subject Code	Name of Subject	Age, yrs	Weight kg	Height, m	BMI	Category	Limits, yrs
F	Sau. Savita More	49	60	1.625	22.718	mesomorph	20-25
G	Sau. Pushpa Chavan	28	51	1.524	21.958	mesomorph	20-25
H	Sau. Anita Sukdane	41	57	1.651	20.91	mesomorph	20-25
I	Sau. Varsha Phukat	35	49	1.575	19.758	ectomorph	〈 20
J	Sau. MandaDahatonde	38	58	1.600	22.650	mesomorph	20-25

The weight and height of the subjects were measured and the Body Mass Index (BMI) for female subject was measured as per categorized presumptive diagnosis. Table 1 shows the presumptive diagnosis of female subjects as mesomorph and ectomorph i.e these subjects are normal and low weight (Normal) and hence can perform the psychophysical work of detaching Roselle calyces.

Fig 1: Female Labour detaching Roselle Calyces with Roselle Calyces detacher

The performance of Manual & Roselle Calyces Detacher is shown in Table 2.

Table 2: Performance of manual detaching and detaching with RCD:

Sr. No	Name of Subject	Replications	Working Heart Rate (beats/min.)		Energy Expenditure (kJ/min)		Output (kg/h)		Category of WL on the basis of HR	
			M	RCD	M	RCD	M	RCD	M	RCD
1.	"F"	R1	89	88	5.431	5.272	0.980	4.200	Light workload	Light workload
		R2	88	88	5.272	5.272	0.880	4.850		
		R3	89	88	5.431	5.272	0.800	4.765		
2.	"G"	R1	107	106	8.293	8.134	0.870	5.800		
		R2	105	106	7.975	8.134	0.900	5.900		
		R3	104	104	7.816	7.816	1.000	5.360		
3.	"H"	R1	95	99	6.385	7.021	1.200	5.800		
		R2	96	97	6.544	6.703	1.400	6.000		
		R3	98	99	6.862	7.021	1.000	6.100		
4.	"I"	R1	95	92	6.385	5.908	0.800	4.900		
		R2	96	90	6.544	5.590	1.100	5.200		
		R3	94	94	6.226	6.226	1.000	5.600		
5	"J"	R1	89	89	5.431	5.431	0.600	5.200		
		R2	92	90	5.908	5.590	0.850	5.100		
		R3	88	92	5.272	5.908	0.910	5.700		
Avg			95	94.8	6.385	6.353	0.95	5.37		
SD(±)			6.28	6.60	0.998	1.050	0.187	0.541		

M – Manual detaching of Roselle Calyces
RCD – Roselle calyces detacher for detaching of Roselle Calyces

It was observed from Table 2 that the average working heart rate for manual detaching was 95 beats/min and with RCD it was 94.8 beats/min respectively. The average energy expenditure for manual Roselle calyces detaching was 6.385 kJ/min and for RCD it was 6.353 kJ/min respectively. The output/capacity for manual detaching was 0.95 kg/hr and for RCD it was 5.37 kg/hr respectively. Thus from the category of work load is falling under LIGHT WORKLOAD on the basis of energy expenditure and heart rate data.

The psychophysical responses of the female subject by performing the detaching operation manually and with RCD was observed from ODR and BPDS and is given in table 3.

Table 3: Psychophysical response of the female subject by performing the detaching operation manually and with Roselle Calyces Detacher:

Sr. No.	Name of Subject	Replications	Overall Discomfort rating		Mean rating (ODR)		Body part discomfort score		Mean rating (BPDS)	
			M	RCD	M	RCD	M	RCD	M	RCD
1.	"F"	R1	3.8	2.6	4.0	2.6	20	10	19	11
		R2	4.1	2.5			19	11		
		R3	4.2	2.7			18	12		
2.	"G"	R1	3.5	1.5	3.7	1.2	18	12	19.7	11
		R2	3.7	1.0			21	10		
		R3	3.9	1.2			20	11		
3.	"H"	R1	3.1	2.2	3.4	2.2	20	11	21	11.7
		R2	3.5	2.5			21	13		
		R3	3.6	2.0			22	11		
4.	"I"	R1	3.7	1.5	3.8	2.0	19	12	19.3	12
		R2	3.9	2.4			20	13		
		R3	3.9	2.2			19	11		
5.	"J"	R1	3.8	2.1	3.9	2.1	20	13	19	12
		R2	4.0	2.2			18	11		
		R3	3.9	2.0			19	12		
AVG			3.77	2.04	3.76	2.02	19.6	11.53	19.6	11.54
SD (±)			0.273	0.518	0.230	0.511	1.183	0.990	0.834	0.508

Thus, for ODR it was observed that in case of manual detaching, the operator faces more than light discomfort is 3.76 and while working with Roselle calyces detacher the operator faces light discomfort is 2.02. For, BPDS it was observed that, the operator has more BPDS while working manually (19.6) as compared to working with Roselle calyces detacher (11.54).

Conclusions

- The capacity of Roselle calyces detacher was found to be 5.37 kg/h, which was five time more than manual detaching capacity.
- Detaching calyces by Roselle Calyces Detacher is falling under LIGHT WORKLOAD on the basis of energy expenditure and heart rate data.

- The Overall Discomfort rating (ODR) for manual operation was 3.76 which was reduced comparatively by Roselle calyces detacher i.e 2.02.
- The BPDS while working manually was 19.6 which was reduced comparatively by Roselle calyces detacher (11.54).

References

1. Plotto A. Post-production management for improved market access. Food and Agriculture Organization of the United Nations (FAO). 2004, 3-4.
2. Corlett EN, Bishop RP. A technique for assessing postural discomfort. Ergonomics. 1976;19:175-182.
3. Gite LP, Singh G. Ergonomics in agriculture and allied activities in India. Tech. Bulletin No. CIAE/97/70. CIAE, Bhopal; c1997.
4. Mohsenin NN. Physical properties of plant and animal materials. 2nd ed. New York: Gordon and Breach Science Publishers; c1980. p. 238-241.
5. Morton J. Roselle (*Hibiscus sabdariffa* L.). In: Morton JF, editor. Fruits of warm climates. Miami, FL; c1987. p. 281-6.
6. Verghese MA, Saha PN, Atreya N. A rapid appraisal of occupational workload from modified scale of perceived exertion. Ergonomics. 1994;37:485-491.