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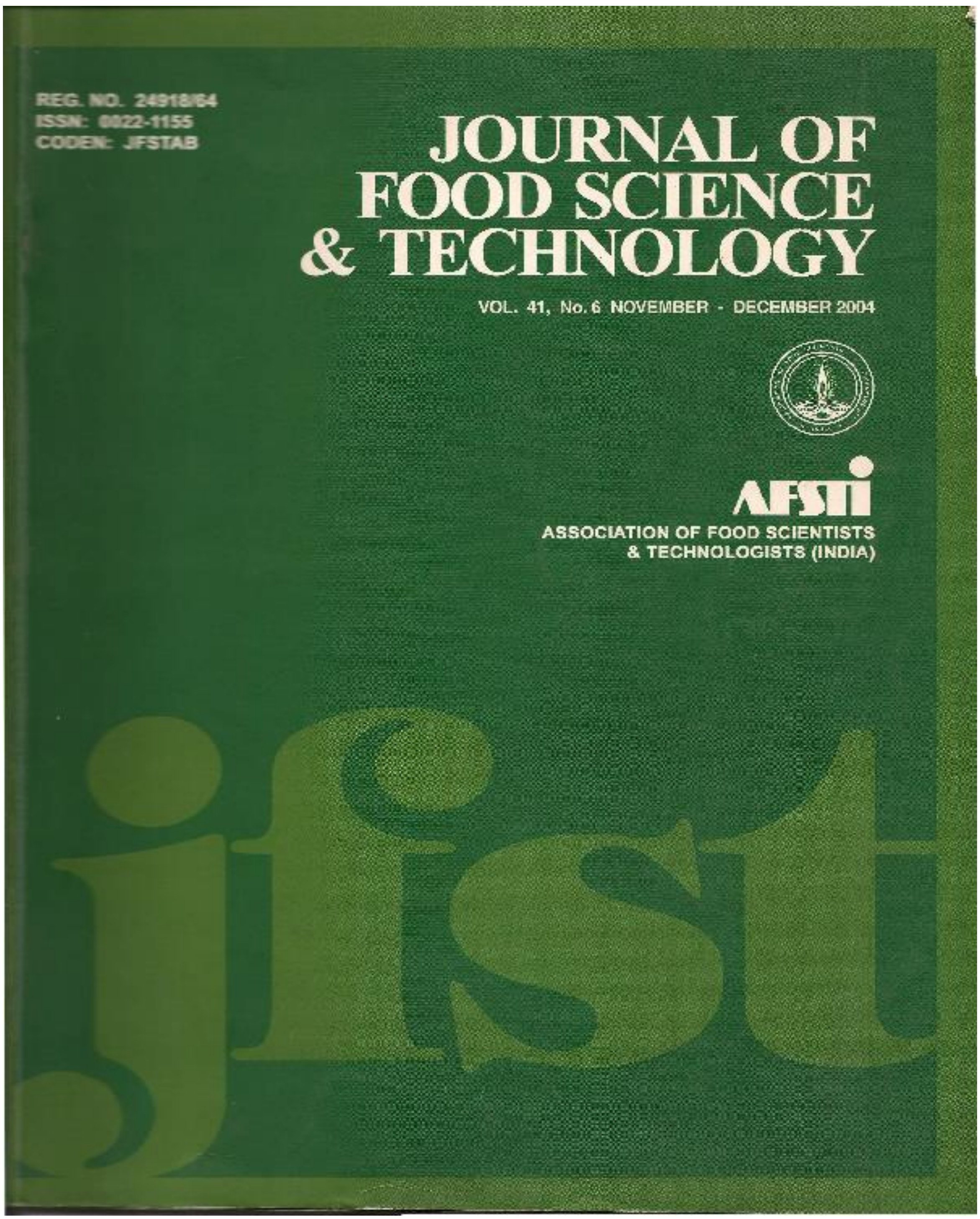

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CONTENTS

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Safeda' followed by 'Lucknow-49' were found best for pulp preparation. The pulp acidity and ascorbic acid content decreased during 60 days of storage. The highest organoleptic rating was for 'Allahabad Safeda' followed by 'Lucknow-49', organoleptic rating decreased during storage.

Cost of production of pulp was Rs. 11/kg.

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RESEARCH NOTE *J. Food Sci. Technol., 2004, Vol. 41, No. 6, 686-689*

Mechanical Behaviour of Two Beniseed (*Sesamum indicum* L.) Cultivars Under Compression Loading

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Mechanical properties of 2 beniseed (sesame seed) cultivars, 'Yandev-55' and 'E8' of relevance to oil expression were determined at moisture levels of 4.1, 5.3 and 7.7% (wet basis). The properties determined were the force required, the deformation sustained and the energy needed to rupture and express oil from the seed. The applied force, sustained deformation and energy required to rupture and express oil from the seed ranged from 7.73 to 20.40 N, 0.17 to 0.54 mm and 0.4 to 1.1 mJ respectively for both whole and dehulled seeds, at 4.1% moisture content. These values increased with the increase in moisture content. The mean values for all the parameters were higher for dehulled than for undehulled seeds. Seed cultivars, preconditioning method and moisture content have significant effect on the parameters studied.

Keywords : Beniseed, *Sesamum indicum*, Mechanical properties, Compression, Moisture content, Dehulling

Beniseed (sesame seed) is pear shaped, ovate, small, slightly flattened and thinner towards the hilium. Recent works have shown that it is an excellent source of high quality oil and protein (Yen and Shyu 1989; Codex Alimentarius 1992; Olayanju 2003). Its hull which is lower in oil content and rich in fibre constitutes 15-20% of the seed weight (Gandhi 1998). Beniseed oil is widely used as cooking oil and raw materials in the manufacture of margarine and pharmaceuticals. After burning, beniseed oil yields top-quality black ink. Its protein has a desirable amino acid profile and is nutritionally as good as soybean protein (Johnson et al. 1979).

The usual method of beniseed oil extraction at domestic level is slow with low oil yield and the oil produced is of unpleasant odour and bitter taste (UNIFEM 1987). Therefore, the mechanization of its processing has generated much interest in the recent time. In order to actualise this, it is necessary to establish some of its mechanical properties.

Several investigators have described the mechanical properties of different crops by observing their behaviour under compression loading. Faborode and Favier (1996) in a study of oil expression from some oilseeds developed a relationship between seed bed compression and seed kernel properties. A threshold compressive pressure at which oil first emerges from a seed kernel in a seedbed during mechanical seed-oil expression (referred to as the oil-point) was theoretically related to the kernel density, which enables its determination from the initial bulk properties of the seedbed. They stated that the potential advantage of identifying the oil-point include the need to predetermine the effective pressure required for oil expression.

Patil (1998) studied the effect of thermal and hydrothermal pretreatments on oil-point of raw soybean, blanched soy-splits and extruded soybean that were mechanically compressed in a developed oil-point tester using the carver press. His results indicated that minimum pressure was required for reaching the oil-point of extruded soybean followed by blanched

* *Corresponding Author*

TABLE 1. MECHANICAL CHARACTERISTICS OF TWO BENISEED CULTIVARS AT DIFFERENT MOISTURE CONTENT LEVELS

Pre-conditioning	Moisture, %,wb	Rupture force, N		Specific deformation, mm		Energy needed mJ	
		'Yandev 55'	'E8'	'Yandev 55'	E8	'Yandev 55'	'E8'
Undehulled	4.10	5.77	7.09	0.19	0.13	0.5	0.4
	5.31	7.73	8.92	0.23	0.17	0.7	0.6
	7.69	9.71	10.89	0.26	0.19	1.0	0.8
Dehulled	4.10	11.79	8.74	0.37	0.35	1.1	1.0
	5.30	13.96	11.06	0.46	0.44	1.3	1.2
	7.69	15.12	13.01	0.48	0.46	1.6	1.4

TABLE 2. ANALYSIS OF VARIANCE FOR THE MECHANICAL CHARACTERISTICS OF BENISEED AT 5% SIGNIFICANCE LEVEL*

Sources of variation	D.F.	Rupture force, N	Specific deformation, mm	Energy needed, mJ
Treatments	9			
Accession (A) (CV)	1	0.0344^{NS}	0.0311^{NS}	0.0491^{NS}
Pre conditioning (C)	1	3.141^{NS}	20.13^{**}	5.320^{NS}
Moisture content (M)	2	1.281^{NS}	8.000^{NS}	203.00^{**}
A × C	1	221.25^{**}	1.00^{**}	10.00^{NS}
A × M	2	1.019^{NS}	20.00^{**}	0.333^{NS}
M × C	2	0.645^{NS}	0.050^{NS}	1.00^{NS}
A × C × M	2	0.0097^{NS}	0.0029^{NS}	0.0004^{NS}

*, Calculated 'F' value; **: Highly significant; NS: Non-significant

TABLE 3. REGRESSION EQUATIONS FOR THE MECHANICAL CHARACTERISTICS OF BENISEED IN THE MOISTURE CONTENT RANGE OF 4.1 TO 7.7% WB.

Property	Beniseed CV type	Linear regression equation	Coeff. detn	CC
RF, N	'Y-55' UD	1.692 + 1.061M	0.967	0.983
RF, N	'Y-55' D	8.683 + 0.866M	0.876	0.936
RF, N	'E8' UD	3.116 + 1.026M	0.973	0.987
RF, N	'E8' D	4.450 + 1.138M	0.945	0.972
SD, mm	'Y-55' UD	0.121 + 0.019M	0.930	0.964
SD, mm	'Y-55' D	0.279 + 0.028M	0.737	0.859
SD, mm	'E8' UD	0.075 + 0.016M	0.865	0.930
SD, mm	'E8' D	0.259 + 0.028M	0.737	0.859
ER, mJ	'Y-55' UD	0.050 + 0.137M	0.995	0.998
ER, mJ	'Y-55' D	0.549 + 0.137M	0.995	0.998
ER, mJ	'E8' UD	-0.013 + 0.108M	0.966	0.983
ER, mJ	'E8' D	0.587 + 0.107M	0.966	0.983

M: Moisture content, % wb; RF : Rupture force, SD : Specific deformation; ER: Energy required; UD : Undehulled; D : dehulled; CC: Correlation coefficient; Coeff. detn: Coefficient of determination.

soy splits. According to him increasing moisture content increased the oil point pressure for the three soybean samples studied. He also reported that minimum pressure of 19.9 Mpa was required for soy splits, which was more than double (8.8 Mpa) that was required for raw rapeseed sample. This was due to the low oil content (18-20%) of soybean and is harder compared to soft rapeseed which contains over 40% oil.

From the foregoing, it is evident that optimum processing conditions for oil expression from beniseed must be identified for higher oil yield and to improve cake quality at minimum cost. Therefore, the objective of this study was to determine some of the mechanical properties of beniseed as they relate to oil expression. The selected properties to be determined are the applied force, the sustained deformation and the energy needed to rupture and express oil from the seed.

One kg, each of the 2 most common beniseed (*Sesamum indicum*) cultivars (cv) 'Yandev 55' and 'E8' were conveyed to the experimental site in wet jute bags to prevent dehydration. The seeds were cleaned using a specific gravity separator to remove dust, sand, dry leaves and empty capsules. The moisture contents of the 2 beniseed cv were determined by the oven drying method (ASAE 1998). Method described by Kachru et al (1994) was used to adjust seed moisture to the desired level. The seeds were preconditioned into dehulled and undehulled samples by using FIIRO method (Olayanju et al. 2000).

Compression tests were performed on

Fig. 1. Load - deformation curve for individual 'Yandev -55' beniseed kernels at 5.3% moisture content wet basis.

Fig. 2. Load - deformation curve for individual 'E8' beniseed kernels at 5.3% moisture content wet basis.

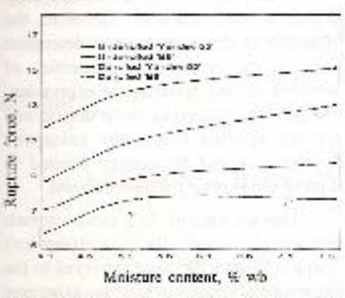

Fig. 3. Rupture force as a function of moisture content for the two pre-conditioned beniseed cv.

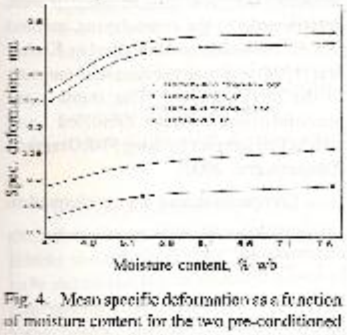

Fig. 4. Mean specific deformation as a function of moisture content for the two pre-conditioned beniseed cv.

beniseed kernels using the Monsanto Universal Testing Machine. The testing conditions for the Instron machine were loading range 0-500 N; chart speed, 50/mm and crosshead speed, 1.5 mm/min. The procedure used to measure these parameters was that of Braga et al (1999). Ten samples, each of the 2 beniseed cv in both dehulled and undehulled form and at three moisture levels of 4.1, 5.3 and 7.7% (wet basis) were

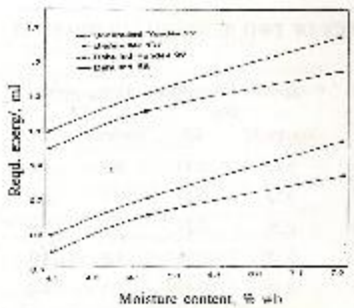

Fig. 5. Mean energy as a function of moisture content for the two pre-conditioned beniseed cv.

used for the test. Each seed was placed between the compression plates of the tensonometer. The seed was compressed at a constant deformation rate of 1.25 mm/min. The applied force at rupture and oil - point and their corresponding deformation for each seed sample was read directly from the force-deformation curve. The mechanical behaviour of beniseed was expressed in terms of force required for maximum strength of the seed, energy required to deform the seed to initial rupture and the seed specific deformation. The rupture force and the specific deformation were determined as the values on the digital display when the seed under compression makes a clicking sound. The energy required was measured as the area under the force-deformation curve. Each process was often completed whenever the break point of the positioned seed was reached.

For this 2 × 2 × 3 factorial experiment in completely randomized design (CRD) with a total of 120 observations (2 cv in 2 forms × 3 moisture levels × 10 replications) was used for each of the studied parameter.

A summary of the results of the mechanical properties of beniseed at different moisture contents is shown in Table 1. The analysis of variance are summarized in Table 2. The result indicates that the seed cv, pre-conditioning method-dehulling and moisture content levels and their interactions have no significant effects on the applied force of beniseed at the 5% level of significance for seed cv and pre-conditioning method. The regression equations in the moisture content range of 4 to 8% as presented in Table 2, show a positive correlation of all the parameters with moisture content, all having a relatively high correlation coefficients.

Fig. 1 and 2 show the variation in force required to rupture and to reach the oil point of individual kernels and their corresponding deformations. These values were obtained at 5.3% moisture content (wet basis) which is the safe storage moisture for beniseed. The effect of moisture content on the rupture force, specific deformation and energy requirement of the two beniseed cv are shown in Fig. 3, 4 and 5. The seed rupture point in the force deformation curves was determined by a visual decrease in force (Point A) as deformation increased. The oil-point indicated the threshold force (Points B and B') and corresponding deformation at which the oil emerged from an oilseed kernel when pressed mechanically.

Vital values of some mechanical properties of beniseed had been established. This would enable engineers, food scientists and processors to get on with work on the mechanisation of production and utilisation processes of Nigerian grown beniseed.

Conclusions

1. The force required to rupture and express oil from undehulled cv 'Yandev - 55' is greater than for undehulled cv 'E8'. For rupture the values were 8.3 and 7.9 N while at oil-point the values were 20.4 and 18.4 N for 'Yandev - 55' and 'E8', respectively.
2. For dehulled seeds, the values for 'Yandev -55' and 'E8' were 8.7 and 9.0 N at rupture; 18.6 and 20.8N at oil-point, respectively.
3. The specific deformations follow a similar trend with values ranging between 0.123 and 0.494 mm and 0.46 to 0.54 mm at rupture and oil-point, respectively.

The analysis of variance result shows that there is no significant difference in cv and moisture content means for all the parameters.

Part of this work was conducted at the National Centre for Agricultural Mechanization (NCAM) Ilorin, Kwara State with the assistance of Engi... Ogunjirin and A.K. Kamal.

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RESEARCH NOTE

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Comparing Chemical Composition of Four Potato Varieties for Processing

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Potato varieties, 'Agria', 'Cosima', Herta' and 'Picaso' were evaluated for their chemical composition. 'Cosima' and 'Herta' were the best varieties in terms of nutritional components, since they contained the highest amount of total solids (25%, 22.4%), starch (60.2, 60.4 g/100 g d.m.) and specific gravity (1.086, 1.088), respectively. 'Agria' contained the lowest amount of reducing sugar (1.2 g/100 g d.m.), free amino acids (20.5 mg/g d.m.), phenolic compounds (38.6 mg/100 d.m.) and chlorogenic acid (23.2 mg/100 g d.m.). These cultivars may be regarded to be superior for potato processing (chips, french fries and dehydrated potato product). The colour of finished product was correlated with the chemical composition of potato varieties. 'Picaso' with the highest amount of free amino acids (28.1 mg/g d.m.), phenolic compound (145.4 mg/100 g d.m.), chlorogenic acid (65.8 mg/100 g d.m.) and reducing sugar (2.4 g/100g d.m.) was more susceptible to enzymatic and chemical discoloration. On the other hand, 'Picaso' with lowest amount of starch (55.3 g/100 g d.m.), total solids (18.6%) and specific gravity (1.068) was found inferior for processing.

Keywords : Potato varieties, 'Agria', 'Cosima', 'Herta', 'Picaso', Chemical composition, Potato processing, Discoloration

Potato is one of the major foodstuffs in many regions of the world, either for direct consumption or for processing. It must meet certain requirements concerning chemical composition and quality for processing. Potato tubers high in dry matter (DM) specific gravity and starch content are suitable for dehydrated and fried potato products (Lisinska and Leszczynski 1989). In this regard, Baki and Gawish (1992) compared the processing quality of 6 varieties of potato in terms of chemical and nutritional composition. They suggested that high solid and specific gravity varieties with low reducing sugar are generally better suited for processing. Paul and Kulshrestha (1994) studied the frying quality of 5 varieties of potato and suggested that the processing quality of potato depends on biochemical composition of its variety, particularly its content of dry matter, reducing sugars, protein and nitrogenous and phenolic compounds. Varieties with lowest reducing sugars and total phenols and the highest starch content are rated superior for chips manufacturing. Marwaha (1998) investigated the processing quality and optimum processing maturity of 10 potato cultivars at different stages of growth. His results indicated that the minimum level of reducing sugars with optimum specific gravity and dry matter content should be considered for potato chips. Waghmare et al (1999) reported that high total solids (19.55%) and specific gravity (1.089) of potato cultivars, resulted in higher

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