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RESEARCH ARTICLE

Analysis of physical and chemical properties of dill seed

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ABSTRACT : The different physical properties of dill seeds, namely size in term of length, breadth and thickness; sphericity; bulk density; porosity; angle of repose and co-efficient of static friction against different surfaces (wood, steel and glass) were determined at 5.9 per cent moisture content. The average length, breadth and thickness of the dill seeds as 5.06 mm; 2.07 mm and 1.17 mm, respectively. The size and sphericity of the dill seeds found to be 2.28 mm and 0.451, respectively. The average value of bulk density and porosity at 5.9 per cent (d.b.) were found 444.88 kg/m^3 and 60.04 per cent, respectively. The average value of angle of repose was 38.22^o. The co-efficient of static friction against wood, steel and glass were found to be 0.740, 0.591 and 0.464, respectively. The average values of the chemical composition such as moisture content, crude fat, crude fibre, protein, carbohydrate and total ash were 5.9 per cent (d.b.) 2.63, 32.61, 12.25, 51.25 and 7.66 per cent, respectively.

KEY WORDS : Dill seed, Essential oil, Distillation

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INTRODUCTION

Gujarat is the leading state in India for cultivation (3 lakh ha.), production (2.5 lakh tonnes) and export (Rs.300 crores) of seed spices (Anonymous, 2003) *viz*., cumin, fennel, dill seed and fenugreek.The seed spices are highly adapted and profitable crops of arid and semi-arid regions of the state. Spices are exported in bulk or as value added products such as ground spices, curry powder, spice mixes, spice oils and oleoresins.Dill seed (*Anethum graveolens* L.) one of the important medicinal and aromatic crop, belongs to the family Umbelliferae. Dill seeds are also popularly used as a carminative, aromatic stimulant and diuretic in Ayurvedic and Unani medicines. Dill's essential oil relieves intestinal spasms and griping and helps to settle colic. Dill makes a useful addition to cough, cold flu remedies and is a mild diuretic. Decoction prepared from dill seed is given to woman after delivery as milk stimulating agent. Dill seed is also fed to animal after calving in many parts of the country.

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EXPERIMENTAL PROCEDURE

Dried dill (*Anethum graveolens* L.) which was harvested in summer season of variety GD-1 was used as a raw material for extraction study. About 20 kg dill seeds of variety GD-1 were procured from Main Dry Farming Research Station, Sardarkrushinagar Dantiwada Agricultural University, Sardar krushinagar, and Banaskantha District of Gujarat State. From 20 kg bulk sample, five samples having 100 g weight were drawn randomly and the initial moisture content of the seed was determined (AOAC,1996). The seeds were cleaned and graded by a mechanical cleaner (Laxmi Iron and Brass Factory, Sidhpur) using appropriate set of sieves to remove foreign matters, broken and immature seeds.The chemical composition such as moisture content, carbohydrates, protein, crude fibre, crude fat and ash were determined. The methods employed are referred below. Three replications were made for each sample

and the average values have been reported on moisture free basis (except moisture content).The physical properties of dill seeds such as size, in terms of length, breadth and thickness, sphericity, bulk density, porosity, angle of repose and co-efficient of static friction were determined. The methods employed are referred below. Ten replications were made for each sample and average values have been reported.The principal dimensions of dill seed in terms of length, breadth and thickness are measured with help of varnier caliper (MITU and TOYO, Japan) reading to 0.01 mm. The longest dimensions in the longitudinal direction were considered as length while the dorsoventral dimensions were measured as thickness of the seed. The triaxial dimensions were measured for 100 seeds randomly selected from the bulk of dill seed sample. The mass of 1000 dill seeds was measured using electronic balance (K-Roy electronic) least count reading to a 0.001 g. The average values of 100 observations are reported.Bulk density as the ratio of weight of seeds to the volume occupied by the same seeds was measured with the help of two containers having volumes of 750 and 1125 cm^3. The bulk density was expressed in kg/m^3. The measurement of the bulk density was replicated ten times for each container. The porosity as per cent voids of unconsolidated mass of the material in terms of volume was determined using a porosity measurement as described by day (1964). The angle of repose of dill seeds was determined by standard circular platform method (Mohsenin, 1986). The co-efficient of static friction was measured by using a calibrated tilting table apparatus against wood, steel and glass surface.

EXPERIMENTAL FINDINGS AND ANALYSIS

The average values of the chemical composition such as moisture content, crude fat, crude fibre, protein, carbohydrate and total ash are given in Table 1. The data show that the seed was very rich in carbohydrate (51.25 %), protein (12.25 %) and crude fibre (32.61 %). The obtained values of carbohydrate and crude fibre for dill seeds were found higher then reported values for cumin seeds by Agrawal, 2000, whereas the obtained values of protein and ash for dill seeds were found lower then the reported values for cumin seeds (Agrawal,2000). The values of chemical composition particularly, protein and carbohydrate for dill seeds were found higher except crude fibre and crude fat as compared to chemical composition of fennel seeds (Gopalan, 2000).

Table 2 indicates the average length of the dill seed as 5.06 mm; breadth 2.07 mm and thickness 1.17 mm. The thickness and breadth were found very close to each other and were only about one third length of the seed.

The size of the seed was found to be 2.28 mm (Table 2) at 5.9 per cent (d. b.) moisture content. The thousand dill seeds weight was 3.99 g. The size of the dill seeds in this study was found similar to the size of cumin seed (variety, GD-1) as reported by Desai and Limbashia (1994). The sphericity value 0.451 was obtained by using standard equation. It indicates that the dill seeds were low near sphere shape. On the contrary, the seed could be as cylindrical considering the close value of breadth and thickness, both quite low as compared to length of the seed. However, the exact shape of the dill seed can be described as “elongated oval” with the thickest portion in the middle. The shape of the dill seed in this study is found similar

Table 1 : Chemical compositions of dill seeds (%)

Moisture	Carbohydrate	Crude fat	Crude fibre	Protein content	Total ash content
5.9	51.25	2.63	32.61	12.25	7.66

Table 2 : Physical properties of dill seeds at 5.9 % (d.b.) moisture content

Properties	Range	Average value
Length (mm)	4.99 – 5.12	5.06
Breadth (mm)	2.00 – 2.13	2.07
Thickness (mm)	1.13 – 1.21	1.17
Size (mm)	2.25 – 2.32	2.28
Sphericity	0.445 – 0.456	0.451
Bulk density (kg/m^3)	432.2 - 458.02	444.88
Porosity (%)	58.82 - 61.76	60.04
Angle of repose (Degree)	37.12 - 39.29	38.22
Co-efficient of static friction against different surfaces		
Wood	0.698 - 0.765	0.740
Steel	0.587 - 0.603	0.591
Glass	0.434 - 0.494	0.464

to cumin (variety, GD-2) as described by Sangani (1997) and Desai *et al.* (1994). They reported the value of sphericity of cumin (variety, GD-1) was 0.444 and 0.468, respectively. Table 2 shows the results of bulk density and porosity of dill seeds. The average value of bulk density and porosity at 5.9 per cent (d.b.) were found 444.88 kg/m^3 and 60.04 per cent, respectively. The bulk density obtained in this study was found more or less similar to the cumin seeds (variety, GD-1) as reported by Desai *et al.* (1994) and Kachru *et al.* (1994) (variety MC-43). They also reported that as the moisture content increased, the bulk density decreased. In accordance with the above fact, the bulk density of dill seeds determined at 5.9 per cent (d.b.) moisture content was lower than those determined at 6.8 and 7.8 per cent d.b., respectively by the above researchers. The porosity of dill seeds was found 60.04 per cent. This value is quite close to the porosity of cumin seeds (62.32 and 61.98 %) reported by Sangani (1997) and Desai *et al.* (1994) for variety GD-1 at 6.1 and 6.8 per cent d.b. moisture contents, respectively. This indicates that the volume of the seeds remains more or less same at 5.9 per cent d.b. moisture content of dill seeds and 6.1 and 6.8 per cent d.b. moisture content of cumin seeds for the above said varieties. The angle of repose of dill (GD-1) seeds at 5.9 per cent (d.b.) moisture content was found between 37.12 to 39.29^o (Table 2). The average value of angle of repose was 38.22^o. This value was also found similar to those reported by Kachru *et al.* (1994), Desai *et al.* (1994), Sangani (1997) and Srivastava (1996) for cumin seeds. It could be due to similar surface roughness of the dill seeds (GD-1) and cumin seeds (varieties, GD-2, MC-43 and GD-1). The results of co-efficient of static friction of dill seeds (variety, GJ-1) against different surfaces are shown in Table 2. The co-efficient of static friction against wood, steel and glass were found to be 0.740, 0.591 and 0.464, respectively. The highest value of static co-efficient of friction was found in case of wood as compared to the other two surfaces which indicated that steel and glass had relatively smoother surfaces. These values of static co-efficient of friction were found nearer to the values of static co-efficient of friction for cumin seeds (variety, GD-2) reported by Sangani (1997) for the above said three surfaces.

Concusion :

The average length, breath and thickness of dill seeds found was 5.06 ,2.07 and 1.17 mm, respectively. The size and sphericity of dill seed found at 5.9 per cent (d.b.) moisture content was 2.28 mm. and 0.451, respectively. The average value of bulk density and porosity found was 444.88 kg/m^3 and 60.04 % respectively. The average value of angle of repose of dill seed was 38^0.22$^/$ and the coefficient of static friction of dill seed against wood, steel and glass found was 0.740,0.591and 0.464 respectively.

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