iJPPHT
e ISSN-2231-6426
Volume 8 | Issue 2 | December, 2017 | 108-112
■ Visit us: *www.researchjournal.co.in*
International Journal of Processing and Post Harvest Technology

RESEARCH PAPER
DOI: 10.15740/HAS/IJPPHT/8.2/108-112

Performance evaluation of specific gravity separator

■ A. P. CHAUDHARI*, K. P. DHAKE AND M. R. BARI

Department of Agricultural Process Engineering, Dr. Ulhas Patil College of Agricultural Engineering and Technology, JALGAON (M.S.) INDIA
Email : apchaudhari1@rediffmail.com

*Author for Correspondence

■ **Research chronicle : Received :** 24.10.2017; **Revised :** 09.11.2017; **Accepted :** 23.11.2017

SUMMARY :

The research was carried out to evaluate the cleaning efficiency of specific gravity separator (SGS) for gram seed. Seeds consist of various contaminants like weed, other crop seed and other material like stems, leaves, broken seeds and dirt. Vijay variety of gram seed was analyzed for different physical properties. Data shows that average moisture content of gram seed was found to be 12.3 per cent (wb). The weight of thousand gram seed was found to be 178.80 g. Average geometric mean diameter of gram seed was found to be 0.37cm. Average sphericity of gram seed was found to be 0.68. The specific gravity of gram was found to be 0.84. The angle of repose of gram seed was found to be 30.6.° Average cleaning efficiency of specific gravity separator for gram seed was found to be 65.13 per cent.

KEY WORDS : Specific gravity separator, Physical properties, Gram seeds, Moisture content

How to cite this paper : Chaudhari, A.P., Dhake, K.P. and Bari, M.R. (2017). Performance evaluation of specific gravity separator. *Internat. J. Proc. & Post Harvest Technol.*, **8** (2) : 108-112. **DOI: 10.15740/HAS/IJPPHT/8.2/108-112.**

Seed, as it comes from the field, contains various contaminants like weed seeds, other crop seeds, and such inert material as stems, leaves, broken seed, and dirt. These contaminants must be removed, and the clean seed properly handled and stored to provide a high-quality planting seed that will increase farm production and supply uniform raw material for industry. Good seed is an important input to agriculture. To obtain good quality seed it is necessary to process the seed obtained from the farm to get rid of inert materials, weed seeds, other crop seeds, other variety seeds, damage seeds and deteriorated seeds (Agrawal, 1994 and Gregg *et al.*, 1970). A mixture of seeds can be separated in the basis of difference in length width, thickness, specific gravity, surface texture, colour, shape, electrical conductivity and magnetic property.

Specific gravity separator is one of the most important cleaning machines in most seed processing plants. Almost most seeds are cleaned by a specific gravity separator. Specific gravity separator affects the separation on the basis of difference in specific gravity, weight and density of seed (Honaker *et al*., 1995). This enables the specific gravity separator to use two cleaning elements *i.e.* stratification and separation.

Turnbull (1975) stated that the ease with which sound seeds can be differentiated depends on the degree of

difference between the seeds and the matter to be separated from them and the degree of uniformity among the seeds themselves.

ISTA (1993) stated that the physical properties used in the cleaning process are: floating velocity, thickness, width and length of the seed, friction co-efficient, specific gravity, elasticity, surface structure and colour.

Vaughan Charles *et al.* (1985) stated that the gravity is an upgrading or finishing machine and is usually the last separating machine in the processing sequence. In some spatial cleaning operation, gravity is used ahead of another upgrading or separating machine, as in cleaning alfalfa seed effective use of gravity separator require specific air stratification of the seed (Kaul, 1967; Riley *et al.*, 1995 and Sahay and Singh, 1994). The specific gravity separator makes the separation according to difference in density and specific gravity of the materials. This separation works on two principles,

– The characteristics of the grain to flow down over inclined surface.

– The flotation of particles due to upward movement of air.

EXPERIMENTAL METHODS

Determination of physical properties:

The following physical properties of the gram were determined.

Moisture content:

Moisture content is given by,

$$\text{Moisture content (\%)} = \frac{W_1 - W_2}{W_1} \times 100$$

where,

W_1 = Initial weight of sample before drying, g

W_2 = Final weight of sample after drying, g.

Weight of thousand gram kernels:

The weight of thousand gram kernels was found by weighing 100 g kernels randomly and the replications were taken.

Geometric mean diameter (*Dg*):

For this experiment, 100 gram seeds were randomly selected; the length (L), width (W) and thickness (T) of gram seeds were measured using a vernier calliper. The average diameter was calculated by using the arithmetic mean and geometer means of the three axial dimensions.

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

where,

D_g = Geometric mean diameter (cm)

L = Length (cm)

W = Width (cm)

T = Thickness (cm).

Sphericity:

The sphericity (Φ) was calculated by using the following relationship,

$$\Phi = \frac{(LWT)^{1/3}}{L}$$

where,

Φ = Sphericity

L = Length (cm),

W = Width (cm)

T = Thickness (cm).

Bulk density:

Bulk density was calculated from the mass of bulk grain divided by the volume containing mass,

$$\rho_b = \frac{M_b}{V_b}$$

where,

ρ_b = Bulk density (gcm^{-3}),

M_b = Mass of seeds (g),

V_b = Volume of container (cm^3).

Specific gravity:

Specific gravity of gram was determined as follows.

$$\text{Specific gravity} = \frac{W}{V} (g/cm^3)$$

where,

W = Weight of gram seed

V = Volume of gram seed.

Angle of repose:

The angle of repose of gram seed was measured with the help of angle of repose apparatus. The angle was calculated by the formula as follows.

$$\theta = \tan^{-1}\left(\frac{2h}{d}\right)$$

where,

θ = Angle of repose

h= Height

d = Diameter.

Sample collection:

The sample of gram used for test was a representative sample which contains the same constituents as are present in the seed lot and in the same proportion.

The samples collected from three different places of the machines are as:

– Feed inlet
– Cleaned seed outlet
– Rejected seed outlet.

Evaluation of cleaning efficiency:

The evaluation of the cleaning efficiency of the specific gravity separator is done by the following formula:

$$\text{Cleaning efficiency} = \frac{E\,(F-G)\,(E-F)\,(1-G)}{F\,(E-G)^2\,(1-F)}$$

where,

E= Fraction of clean seed at clean seed outlet
F= Fraction of clean seed in feed
G= Fraction of clean seed at foreign matter outlets.

EXPERIMENTAL FINDINGS AND ANALYSIS

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Determination of moisture content:

The moisture contents of the 5 samples were calculated by using the oven dry method. The average value of moisture content was found to be 12.3 per cent (wb).

Determination of weight of thousand gram seeds :

The weights of thousand gram seeds were calculated. The weight of thousand gram seed was found to be 178.80 g.

Determination of geometric mean diameter:

The geometric mean diameter of gram seed was calculated with the help of vernier caliper. The average geometric mean diameter of gram seed was found to be 0.37cm.

Determination of sphericity:

The sphericity of gram seed was calculated by using the standard procedure. The average sphericity of gram seed was found to be 0.68.

Determination of specific gravity:

The specific gravity of the gram seed was calculated and the average value was found to be 0.84.

Table 1: Physical properties of Bengal gram seeds

Sample No.	Moisture content (%wb)	Length (cm)	Width (cm)	Thickness (cm)	Geometric mean diameter (cm)	Sphericity	specific gravity	angle of repose (^{0})
1	12.30	0.530	0.3	0.312	0.36	0.66	0.85	30.6
2	11.80	0.610	0.319	0.305	0.39	0.72	0.84	30.5
3	11.50	0.570	0.301	0.300	0.37	0.68	0.83	30.6
4	12.90	0.540	0.309	0.314	0.37	0.68	0.84	30.8
5	13	0.520	0.335	0.309	0.37	0.68	0.86	30.5
Avg.	12.3	0.554	0.312	0.308	0.37	0.68	0.84	30.6

Table 2 : Cleaning efficiency for lot no. 1

Sample No.	Sample fraction	Feed (kg)	Clean seed (kg)	Rejected seed (kg)	Cleaning efficiency (%)
1	Cleaned seed	94	98	3	67
	Impurities	6	1.9	97	
2	Cleaned seed	93.99	97.89	3.01	66
	Impurities	6.01	2.10	96.99	
3	Cleaned seed	94.01	97.50	3	60
	Impurities	5.99	2.5	97	
	Average				64.33

Table 3: Cleaning efficiency for lot no. 2

Sample No.	Sample fraction	Feed (kg)	Clean seed (kg)	Rejected seed (kg)	Cleaning efficiency (%)
1	Cleaned seed	92.98	97	2.98	60
	Impurities	7.02	3	97.02	
2	Cleaned seed	93.79	97.80	2.95	68
	Impurities	6.21	2.2	97.05	
3	Cleaned seed	94	98	3	67
	Impurities	6	1.9	97	
	Average				65

Table 4 : Cleaning efficiency for lot no. 3

Sample No.	Sample fraction	Feed (kg)	Clean seed (kg)	Rejected seed (kg)	Cleaning efficiency (%)
1	Cleaned seed	93	97.99	2.99	72
	Impurities	7	2.01	97.01	
2	Cleaned seed	93.99	97.89	3.01	66
	Impurities	6.01	2.10	96.99	
3	Cleaned seed	92.98	97	2.98	60
	Impurities	7.03	3	97.02	
	Average				66.07

Determination of angle of repose:

The angle of repose of the gram seed was calculated and the average value was found to be 30.6°

Cleaning efficiency:

The cleaning efficiency of specific gravity separator for gram seed is calculated and the results are shown in the Tables 1 to 4.

The average cleaning efficiency of specific gravity separator for gram was found to be 65.13 per cent. For different lots of gram the cleaning efficiency varies. For specific gravity separator the performance level varies as per different makes and models of the machine. The cleaning efficiency of the specific gravity separator also depends upon the impurities present in the feed sample. The cleaning efficiency of specific gravity separator may be different for the same sample but with different makes and models. The use of specific gravity separator machine depends on the seed characteristics and unit weight or specific gravity. The static air pressure also depends on the unit weight or specific gravity of the seed.

Conclusion:

On the strength of the result of the research work we came to the following conclusion:

– Average moisture content of gram seed was found to be 12.3 per cent (wb).

– The weight of thousand gram seed was found to be 178.80 g.

– Average geometric mean diameter of gram seed was found to be 0.37cm.

– Average sphericity of gram seed was found to be 0.68.

– The specific gravity of gram was found to be 0.84.

– The angle of repose of gram seed was found to be 30.6°

– Average cleaning efficiency of specific gravity separator for gram seed was found to be 65.13 per cent.

LITERATURE CITED

Agrawal, Rattanlal (1994). *Seed technology*, Oxford and IBH Publication Company Pvt. Ltd. pp. 330-335.

Gregg, B. R., Law, A. G., Virdi, S. S. and Bali, J. S. (1970). S*eed processing co-operatively.* Published By Mississippi State University, National Seed Corporation and USAID.

Honaker, R.Q., Paul, B.C., Wang, D. and Ho, K. (1995). *Enhanced gravity separation: An alternative to flotation, proceedings, high efficiency coal preparation*: An International Symposium, SME, Littleton, Colorado, pp. 70-78.

ISTA (1993). International rules for seed testing. *Internat. Seed Testing Association. Seed Sci. & Technol.*, **21**: 2-288.

Kaul, R. N. (1967). Physical properties of agricultural materials affecting the cleaning and separating process. *Bull. Grain Technol.*, **5** (2) : 109.

Riley, D. M., Firth, B. A. and Lockhart, N. C. (1995). Enhanced Gravity Separation, Proceedings, High Efficiency Coal Preparation: An International Symposium, SME, Littleton, Colorado, pp. 79-87.

Sahay, K.M. and Singh, K.K. (1994). *Unit operations of agricultural processing*, 2nd Ed., Vikas Publishing House Pvt. Ltd., NEW DELHI, INDIA.

Turnbull, J.W. (1975). Seed extraction and cleaning. In: *The Report of FAO/DANIDA Training Course on Forest Seed Collection and Handling*, Vol. **2**, FAO, ROME, ITALY.

Vaughan Charles, E., Bill R. Gregg and James, C. Delouche (1985). Seed processing and handling, Seed Technology Laboratory, State University, Mississippi.