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Study of moisture content and resistance of airflow of blackgram

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ABSTRACT

The effect of moisture content on resistance to airflow of blackgram was studied. Pressure drops were measured in clean blackgram (*Vigna mungo* Proxb.) beds at moisture content of 5.02 to 20.21 % (d.b.) for superficial air velocities ranging between 0.0108 and 0.8651 $m^2/s\ m^2$ at bed depths of 0.2 to 0.6 m with bulk density ranging from 690 to 825 kg/m^3. Increase in moisture content resulted in decrease of 36% in resistance to airflow of loose fill blackgram. Shedd's equation described the airflow resistance data well. Coefficient A of modified Shedd's equation was linearly related to grain moisture content and represented the change in airflow resistance with moisture content.

Key words : Airflow rate, Pressure drop, Shedd's model.

Blackgram (*Vigna mungo* Proxb.) is extensively used as vegetable, processed food and splits. The grain forms an important source of protein with protein content 24%. In India, blackgram legume (pulse) is cultivated on 2.89 million hectares with an annual production of 1.27 million tones (Anonymous, 1999). Drying of pulse grain is an essential unit operation during milling to obtain splits. A survey by Nimkar and Chattopadhyay (1999) indicated that deep bed drying/ aeration of various pulses is mostly required at various stages of milling/ storage. In order to design efficient drying/ aeration system, airflow resistance data is needed.

The pressure drop for airflow through any particular system depends on the rate and direction of airflow, surface and shape characteristics of the grain, the number, size and configuration of the voids, the particle size range, bulk density, depth of product bed, method of filling bin, fines concentration and moisture content (Brooker *et al.*, 1921). Jayas (1987) pointed out that the data on airflow resistance of pulse crops are scarce. It was revealed that very few studies on legumes, namely, soybean, peas, bean and lentils have been reported. Nimkar (1997) studied the airflow resistance of chickpea, pigeonpea and green gram grain in different ranged of airflows, moisture content and bulk density.

Henderson (1994) studied airflow resistance of clean soybean grain with bed depth of 0.15 to 2.44 m and reported that packing of grain beds reduced airflow rates to about 88% as compared with loose fill condition. Shedd (1951) found the airflow resistance of clean soybean (cv. Lincoln) for airflow range of 0.0056 to 0.3058 m^3 (s.m^2) and reported rate range from 0.0462 to 0.926 m^3 (s.m^2) for clean peas (cv. NEW ZEALAND MAPLE) at moisture content of 5% w.b.

Sokhansanj *et al.* (1990) studied the resistance to airflow through bulk lentils and reported that with an increase in moisture content of lentils (cv. LAIRD) from 10.4 to 19.9% (w.b.) resulted in 22.5% decrease in resistance to airflow. The usable design data on the resistance of pulse grain, except to some extent of peas, beans, lentils, chickpea, pigeonpea and green gram have been reported in the literature. Till date, no data on the resistance to airflow through bulk blackgram have been reported in the literature or compiled in the ASAE standard D 272.3 (ASAE, 1996).

Hence, the present experiment was planned to study the effect of moisture content on pressure drop of blackgram.

METHODOLOGY

The Blackgram pulse grain samples of variety TAU-1 was procured from the Pulse Research Unit of Dr. Panjabarao Deshmukh Krishi Vidyapeeth, Akola. The moisture content of the grain sample of about 25 g was determined following standard oven drying method at an air temperature of 103 ± 2^0C h and subsequently cooling in desiccator for one hour before taking the weight. (AOAC, 1997).

The effect of moisture content on pressure drop through clean blackgram was studied with the source samples in bags of 50 kg at each moisture level. Bag 1 was left at its original moisture content of 5.02% and bags 2 and 3 were moistured to 12.51% and 20.21% (d.b.), respectively, by adding tap water to the grains and thoroughly mixing in a rotating drum. The material was then sealed in high molecular high density polyethylene