ABSTRACT

A survey of some selected pulse mills was conducted to study the existing milling processes including the prevalent industrial pulse dryers. Based on the survey, ranges of the operating parameters, viz., airflow rate, grain moisture content, bed depth, and bulk density were decided for experimentation on airflow resistance of the selected pulse grains, namely, chickpea, pigeonpea and greengram. Relevant physical properties of industrial grade and pure varieties of these pulses at different moisture contents were determined. Grain size, thousand grain mass and porosity were found increasing with increase in moisture content, but bulk density and true density decreased. An apparatus for measurement of airflow resistance was fabricated and used to obtain pressure drop data of the selected industrial grade pulse grains. These data were fitted to the modified Shedd's equation, Hukill and Ives equation, and modified Ergun equation to find out the best fit using non-linear multiple regression analysis with iterative procedure. Results indicated that all the three models were acceptable to predict pressure drop through the pulse grains. However, the modified Shedd's equation was found to be the best fitted model with its coefficient **A,** physically representing the change in airflow resistance. For predicting pressure drop by using drag forces in Ranz equation, required ratio of intergranular velocity to the superficial air velocity was determined based on the experimentally observed pressure drop data of the pulse grains. Although simple in nature, the Ranz equation could be utilized for predicting pressure drop through pulse grains marginally using the predicted velocity ratios for different sub-ranges of airflows. The pressure drop per unit bed depth was maximum for greengram followed by pigeonpea and chickpea. When compared with available airflow resistance data of other crops, it revealed that these pulse grains had much less resistance than rice. However, pigeonpea and greengram exhibited more airflow resistance than soybean. Airflow resistance of all these pulse grains increased with the increase in airflow rate, grain bed depth and bulk density, but it decreased with the increase in moisture content. Effect of grain size on pressure drop was studied for pigeonpea only, which showed that decrease in the grain size resulted in increased pressure drop. A statistical model incorporating all the variables was developed to fit the experimental data reasonably well within the experimental limits.

Keywords **:** ***Aeration, Airflow rate, Airflow resistance, Chickpea, Greengram, Pigeonpea, Pulse grain, Pressure drop, Pulse dryer.***