Measurements of Terminal Velocity

The test equipment is initially run without any seed while response of the measuring instrument: Pitot – static tube and manometer are observed. The seed sample is placed on a mosquito wire netting within the duct and is blown upwards using a centrifugal blower whose speed is controlled by a variable speed motor. The air velocity at which the seed is lifted off the contacting surface is determined.

Computation of Terminal Velocity using Sphericity Method

The terminal velocity of beniseed was also computed based on its sphericity. According to the equation proposed by Torobin and Ganvin (1960) as reported by Gorial and O'callaghan 1991; the drag coefficient, $C_D = 5.31 - 4.884\ \psi$ for low Reynold's number (with $\pm$ 4% accuracy) where ψ is sphencity of grain with $2000 < Re < 200{,}000$.

The value of C_D is then used in an equation proposed by Kashayap and Pandya, 1986 for calculation of terminal velocity as:

$$V_t = \sqrt{\frac{2Mg}{A_p S_f C_D}}$$

where:

M = Weight of particle (kg)

A_P = Projected area of seed, LW (m^2)

C_D = Drag Coefficient

δ_f = Density of fluid (air), (kg/m^3) = 1.150

N.B - Density and Viscosity of air were assumed constant at the temp and pressure when the experiment was carried out

g = Acceleration due to gravity, m/s^2 = 9.81

Terminal Velocity

This is the main characteristic employed in the separation process and can be determined by the suspension velocity test which as follows: A duct 1m long with a rectangular section of 0.1m x 0.1m is used to suspend particles in an air stream. Air is supplied by a centifugal fan driven by an electric motor. The fan delivered air through a converging duct. Mmean air velocity is determined as a function of mid velocity, obtained from computation using a pitot tube and manometer of trading up to less than 1m/s.

Suspension tests are carried out on all components or the grain mixture by placing particles of the grain mixture on the duct until the particles, seen through the transparent wall, floated in the central area of the air stream.

Mechanical Behaviour of Beniseed under Compression Loading

Compression tests are performed on seeds/kernels using the Monsanto Universal Testing Machine (National Centre for Agricultural Mechanization, (NCAM) Ilorin, Kwara State). Testing Conditions for the lnstron Machine were loading range: 0 - 500N; chart speed – 50rpm/mm; Crosshead speed – 1.5mm/min. The procedure used by Braga et. al. (1999) is followed.

Each seed is placed between the compression plates of the tensonometer (Plate 3). The seed is compressed at a constant deformation rate of 1.25mm/min. The applied forces at bioyield and oil points and their corresponding deformations for each seed sample is read directly from the force-deformation curve. The mechanical behaviour of seed is expressed in terms of force required for maximum strength of the seed, energy required to deform the seed to initial rupture and seed specific deformation. The rupture force is determined as the force on the digital display when the seed under compression makes a clicking sound. Each process is often completed whenever the break point of the positioned seed is reached.