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Determination of physical and rheological properties of sugarcane residue to design a picker and baling mechanism

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Post harvest sugarcane residues including sugarcane tops, dry and green leaves and cane bits are widely used in sugarcane producing countries. It is an important forage source for ruminants. Because a suitable machine doesn't exist and manual removal would be too expensive, therefore, these residues are burnt after drying for a few weeks and this will result in more environmental pollution. For optimum design of a picker and baling mechanism, some physical and rheological properties of sugarcane residues are determined. A confined compression with three level of axial strain (35, 45 and 65% of initial length) on sugarcane residues was applied. The experiment was conducted in a completely randomized block design with three replications. The results showed that the stress increased with an increase in strain. The highest value for the measured parameters for sugarcane residues (stress, modulus of elasticity, the energy of compression and time of stress relaxation) were obtained at 65% of strain. The results showed that the compression level effect on energy consumption was too significant. Modulus of elasticity was determined by fitting some deference models. External friction coefficient and residues' terminal velocity experiments was performed in completely randomized design. External friction coefficient for sugarcane residues was obtained on iron sheet, teflon, soft concrete, rough concrete surfaces with three levels of normal force. The results showed the effects of moisture contents, friction surfaces, normal loads and their interactions on the external friction coefficient were significant. Terminal velocity for particle type (sugarcane tops and leaves) was determined with three moisture levels and five replications. The results indicated that a significant difference existed between 8-15% moisture content level and other moisture contents (20-30, 30-40%). The mean value of terminal velocity of cane tops and leaves were 4.6 and 1.7 m/s, respectively.

Keyword: Sugarcane, Terminal velocity, Friction coefficient, Modulus of Elasticity, Stress, Strain

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