**The Canadian Society for Bioengineering**
*The Canadian society for engineering in agricultural, food, environmental, and biological systems.*

CSBE | SCGAB

**La Société Canadienne de Génie Agroalimentaire et de Bioingénierie**
*La société canadienne de génie agroalimentaire, de la bioingénierie et de l'environnement*

**Paper No. CSBE13-008**

# Overall Energy Analysis for Post-harvest Processing and Densification of Agricultural Straw Residue

**Phani Adapa**

University of Saskatchewan

Phani.adapa@usask.ca

**Lope Tabil**

University of Saskatchewan

Lope.tabil@usask.ca

**Greg Schoenau**

University of Saskatchewan

Greg.schoenau@usask.ca

**Written for presentation at the**
**CSBE/SCGAB 2013 Annual Conference**
**University of Saskatechewan, Saskatoon, Saskatchewan**
**7-10 July 2013**

Agricultural biomass residue has the potential to be used for sustainable production of bio-fuels and offset greenhouse gas emissions. Biomass has low bulk density, making it difficult and costly to store and transport in its native loose form. Therefore, an integrated approach to densification of non-treated and steam exploded barley, canola, oat and wheat straw was developed. During this process the significance of major contributing factors on pellet density, durability and specific energy consumption were determined. It has been found that the applied pressure (60.4%) was the most significant factor affecting pellet density followed by the application of steam explosion pre-treatment (39.4%) for lab-scale single pelleting experiments. Similarly, the type of biomass (47.1%) is the most significant factor affecting durability followed by the application of pre-treatment (38.2%) and grind size (14.6%) for pellets manufacture from pilot-scale pellet mill. Also, the applied pressure (58.3%) was the most significant factor affecting specific energy required to manufacture pellets followed by the biomass (15.3%), pre-treatment (13.3%) and grind size (13.2%), which had lower but similar affect on specific energy for lab-scale single pelleting experiments. Overall energy analysis of processing and densification of agricultural straw was performed, which showed that a significant portion of original agricultural biomass energy (89-94%) is available for the

production of biofuels. Almost, similar amount of specific energy is required to produce pellets from straw grinds. Customized pellets having steam exploded straw required more energy to manufacture resulting in availability of only 89% of total energy for biofuel production.