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HANDLING OF CORN STOVER BALES FOR COMBUSTION IN SMALL AND LARGE FURNACES

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ABSTRACT Corn stover was harvested in the spring when it is very dry (moisture content below 10%). Two bale formats were considered for direct combustion in two furnaces: small rectangular bales (0.35 m x 0.45 m x 0.60 m; 10 kg) and large rectangular bales (0.8 m x 0.9 m x 1.8 m; 200 kg). A small 500,000 BTU/h dual chamber log wood furnace was located at a hay growing farm (Neuville, Québec) where the heat was initially transferred to a hot water pipe system and then transferred to a hot air exchanger to dry hay bales. The small stover bales were placed directly into the combustion furnace. The low density of the bales compared to log wood, required filling up to 8 times more frequently. Stover bales produced an average of 6.4% ash on a DM basis and would require an automated system for ash removal. Combustion gas contained levels of particulate matter greater than 1417 mg/m³, this is above the local acceptable maximum of 600 mg/m³ for combustion furnaces. Corn stover bales cannot be used directly without improving combustion or using an exhaust gas filtering system. The second combustion unit was a high capacity 12.5 million BTU/h single chamber furnace used to generate steam for a feed pellet mill (Saint-Philippe-de-Néri, Québec). Large corn stover bales were broken up and fed on a conveyor and through a screw auger to the furnace. Again, the stover was light compared to the wood chips used in this furnace (46 vs. 163 kg DM/m³ for bulk density). The stover could not be fed continuously to the furnace mainly for mechanical reasons: roll up of stover on the walking floor, auger clogging and bridge over the auger. Only a small quantity of stover was actually fed in the furnace, and no significant combustion data could be collected. Stover cannot therefore be used directly in furnaces designed for traditional wood logs or wood chips. Either the stover should be transformed into a suitable physical form (dense pellets, cubes or logs) or the furnace must be modified and adapted for the fuel.

Keywords: Corn, Stover, Handling, Combustion, Ash, Emissions, Heat recovery.