Research to Apply Kinetic Disintegration System to Process Various Biomass Feedstocks for Pelletization

Xcel RDF Advisory Board Project Presentation

Minnesota Valley Alfalfa Producers
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MnVAP History

- Minnesota Valley Alfalfa Producers (MnVAP) is a Minnesota farmer-owned cooperative founded in 1994 to process and market alfalfa products.
- It is the largest alfalfa cooperative in the United States.
- MnVAP has identified the biomass pellet market as being a value-added opportunity, offering economic and environmental benefits to agricultural-based municipalities and regions in Minnesota and elsewhere.

Project Scope and Goals

- Evaluate the new, energy efficient Kinetic Disintegration System (KDS) technology for processing biomass.
- Evaluate KDS system's capability of handling a wide variety of feedstocks with varying levels of moisture.
- Conduct energy consumption and performance comparisons between MnVAP's current system and the KDS process, focusing on maximizing biomass through-put capabilities while minimizing energy utilization.
- Research will lead to biomass optimization design modification if applicable.
- Engage engineering assistance to design plant floor plan to incorporate KDS system into our current process.

Technology Evaluated

- Kinetic Disintegration System (KDS) for use in alfalfa pelletization.
- The KDS technology was invented for use in pulverizing ores and minerals.
- The MnVAP project applied this technology to processing biomass, gathering information on performance and appropriateness of the KDS for the biomass industry, and introducing the KDS process as a more energy efficient option for processing biomass when compared to the current biomass processing methods.
- The KDS system dries and grinds the feedstock in one process, eliminating the need for an energy-intensive drying process prior to grinding.

Accomplishments

1) Work with the MPCA to ensure compliance with environmental regulations.
2) Completed initial KDS testing to determine baseline performance utilizing various biomass feedstock characteristics (moisture).
3) Design, fabricate and integrate shredding/grinding system with emissions containment.
4) Design, fabricate and install blending, conveying and dryer equipment to feed the KDS.

Accomplishments

5) Redesign and fabricate KDS machine after initial test operations.
6) Feedstock testing and pellet quality evaluation between systems.
7) Design a modified KDS specifically for biomass processing with throughput goal at 5-7 tons per hour; conduct on-site demonstration of technology.
8) Complete analysis of biomass industry, AURI lab testing of final product pellets.
   - Biomass Industry Assessment; http://www.auri.org/assets/2012/04/midwest-biomass-inventory.pdf
   - Biomass Industry Assessment Presentation presented at the 2012 Heating the Midwest Conference and Expo, Ramada Convention Center, Eau Claire, Wisconsin. View the full agenda at: http://heatingthemidwest.org/conferences/2012-2/

Project Results

- Research results indicated that the current MnVAP process is more efficient processing large quantities of biomass through their current process.
- Total energy cost was greater per ton for the KDS compared to MnVAP's current system based on equivalent through-put values.
- Densification trials resulted in similar pellet durability and density; however through-put efficiency is limited due to fiber structure of material processed through the KDS system.

Project Benefits

- The KDS project created a platform to focus on the efficiency of MnVAP's current operation of processing.
- Provides MnVAP a better knowledge of a current technology that could have been beneficial improving MnVAP's operation efficiency processing biomass.
- Funding assistance provided helped MnVAP to make useful comparisons between the KDS technology and its own current technology.
- Project allowed MnVAP the opportunity to investigate another means of grinding and drying to potentially improve current process efficiency.

Lessons Learned

- It was discovered that the KDS system was not the most efficient option based on the throughput capacity required for MnVAP's operation.
- In order to optimize the KDS technology, it required a specific moisture and fiber length from their current system to improve throughput, performance and acceptable particle size for pelleting.
- Automation of the KDS system into their current process would be challenging.
- Information obtained from the research supported by the Xcel RDF resulted in MnVAP's decision to save time, labor and capital by not moving forward with full installation.

Thank You!

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