Research Unit

5447-05 – Integrated Cropping Systems Research Unit
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Project Titles

1) Fiber Extrusion to Improve Use and Production of Ethanol Byproducts (USDA-ARS)
2) Assess Utility and Value of Distillers Grains and Modified Distillers Grains (South Dakota State University)
3) Use of DDG as a Biocomposite Fabrication Material (South Dakota State University)
4) Assessing the Manufacturing Potential for Ethanol Processing Residue Streams (Northern Illinois University)

Investigator

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Current Research Projects and Objectives

The production of corn-based ethanol in the U.S. is dramatically increasing; so is the quantity of coproducts generated from this processing sector. These streams are primarily utilized as livestock feed, which provides ethanol processors with a substantial revenue source and significantly increases the profitability of the production process. With the construction of many new plants in recent years, it is imperative to find new outlets for these coproducts, in order to maintain the economic viability of this industry. Distillers grains, the primary residuals, have much potential for value-added processing and utilization in other sectors, but barriers currently exist. One primary challenge to use of DDGS is poor flowability.

The thrust of these collaborative projects is twofold: 1) conduct research that will overcome material handling challenges with distillers grains, and 2) through collaborative efforts with our customers and partners, develop value-added feeds, foods, and industrial materials from these coproducts.

Three specific research objectives include: 1) identify, characterize, and quantify specific physical and chemical properties of distillers grains that affect storability and flowability behavior of these coproducts; 2) develop and evaluate improved processes for converting distillers grains into value-added feed materials for livestock and aquaculture; 3) develop and evaluate processes for converting distillers grains into value-added industrial and food products.

Attaining the objectives outlined above will provide ethanol processors with new and refined methods for storing and handling distillers grains. Additionally, new market opportunities for these coproducts will be identified and developed. Thus, this project will improve manufacturing economics as well as augment the viability of the entire fuel ethanol industry.

These projects respond directly to the NP 307 Action Plan's Component I, Ethanol, specifically by developing higher-value new coproducts or improving the existing ones from the non-starch, non-fermentable portion of the feedstock grain, which will result in a reduced net manufacturing cost for the production of ethanol. Additionally, they respond directly to the NP 306 Action Plan's Component 2,

Problem Area 2b, New Uses for Agricultural By-Products, as well as Component 2, Problem Area 2c, New and Improved Processes and Feedstocks, specifically by developing improved and new techniques and technologies to convert agricultural materials into value-added biobased products.

Key Accomplishments

1) Adding Value to DDGS by Pelleting

Densifying, or pelleting, is one of the easiest ways to add value and increase the market potential for DDGS (Distillers Dried Grains with Solubles), but to date has not been pursued commercially due to lack of information in industry. A series of experiments was conducted to develop DDGS pellets, both on a laboratory scale and on a commercial scale. We were able to produce high quality pellets without the use of binders, using traditional feed milling equipment; and, we did not find detrimental effects on the resulting nutrient compositions of these pellets. Additionally, bulk density increased (9.1 to 20.1%), and angle of repose decreased (18.3 to 19.2%) versus unmodified DDGS. Thus, pelleted DDGS offers the possibility of alleviating flowability issues during storage and transport, and also offers the possibility of expanding DDGS use beyond the feedlot, into rangeland settings, which could have implications for cattle producers throughout the U.S., as well as throughout the entire livestock industry. This accomplishment addresses NP 307 Component I. Ethanol – Coproduct Development; NP 306 Action Plan's Component 2, Problem Area 2b, New Uses for Agricultural By-Products – Cereals, Oilseeds, and Novel Crops; and NP 306 Component 2, Problem Area 2c, New and Improved Processes and Feedstocks – Cereals, Oilseeds, and Novel Crops.

2) Adding Value to DDGS by Developing Aquaculture Feed

Distillers Dried Grains with Solubles (DDGS) has potential to be used as an alternative protein source for aquaculture feed production, especially in the north central area of the U.S., but to date has seen limited use because of its difficult functionality, which is due to the high protein and fiber contents, and lack of starch. A series of experiments was conducted to overcome these processing challenges, both on a laboratory scale and on a pilot scale, aimed at developing balanced rations for Nile tilapia species, using DDGS as the primary protein source. Feed rations were successfully developed using DDGS at rates of up to 60% of the diet, and these pelleted feeds had excellent nutritional and physical properties. Moreover, these feed pellets had excellent floatability, which is a key to producing aquaculture feeds. Because functionality challenges have been overcome, and because DDGS offers the potential to displace fish meal as a protein source, a feeding trial is currently underway at South Dakota State University to test the efficacy in a production setting, and is the next stage in commercializing this technology. This accomplishment addresses NP 307 Component I. Ethanol – Coproduct Development; NP 306 Action Plan's Component 2, Problem Area 2b, New Uses for Agricultural By-Products – Cereals, Oilseeds, and Novel Crops; and NP 306 Component 2, Problem Area 2c, New and Improved Processes and Feedstocks – Cereals, Oilseeds, and Novel Crops.