Economic Analysis and Feasibility of Cottonseed Oil as a Biodiesel Feedstock

FINAL REPORT

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TABLE OF CONTENTS

PHASE I

Cost Modeling of Cottonseed Oil Based Biodiesel

PHASE II

Performance Testing of Cottonseed Oil Biodiesel Blends

Executive Summary

This research effort with the National Cottonseed Products Association in collaboration with PYCO, Incorporated is to investigate the costs of manufacturing cottonseed oil based biodiesel and test the performance characteristics for two cottonseed oil types. In the first phase of this project, a complex cost model has been developed to determine multiple financial characteristics of using cottonseed oil as a primary feedstock for biodiesel production. An executive summary of the cost model provides pertinent information which includes, total sales revenue, total annual manufacturing& logistics cost, manufacturing & logistics cost/gallon, total annual recovery cost, total capital investment, total annual labor cost, total annual raw material cost, total annual material handling cost, total annual utilities cost, and total annual miscellaneous costs associated with the production of cottonseed oil based biodiesel. A summary of the labor and energy costs by process is included as well.

The first cost model (Full Model) assumes that a biodiesel production facility must be constructed from the ground up, therefore, capital investment costs associated with the construction of a new plant facility are considered. An additional model (Special Oils) has been created to assume that the plant facility is already in place and there is no add-on capital cost of building a new facility. The biodiesel facility has the ability to blend in other oils in the biodiesel production process. Small cottonseed crushing operations with a production facility already in place can blend in various different oil types to produce the most cost efficient biodiesel.

The second phase of this research project tests the performance of two cottonseed oil types as blends of biodiesel added to typical low sulfur content diesel. Two oil types (PBSY and RBD) are used at two horsepower loads (20 and 60), one speed (1800 rpm), and four biodiesel blends (B_2, B_5, B_{10}, B_{20}). A total of 63 test runs are conducted (54 glass filter and 9 Teflon filter) creating 40,320 data points.

Statistical analysis of the data resulted in the following overall conclusions. RBD cottonseed oil outperformed PBSY oil on gaseous emissions for Nitrous Oxides and Carbon Monoxide. On average, RBD outperformed PBSY by 10% on the Carbon Monoxide gas emissions. PBSY and RBD are below the EPA emissions standards for Carbon Monoxide. RBD also outperformed PBSY on Nitrous Oxides emissions ranging 6% to 17% dependent upon the blend type (B_{20} = 17.55%). When the PBSY and RBD oil blends are compared with Diesel the blended biodiesel was within the EPA emissions standard for Nitrous Oxide. However, at the individual blend types some of the blends for both cottonseed oil types did exceed the allowable emissions for NOx. Therefore, from a cost standpoint it is more economically feasible to utilize PBSY cottonseed oil as a biodiesel feedstock. If emission standards are more stringent in some states and the selection criteria are based on quality of emissions, the RBD blend would be more applicable in that situation.