

CRADA Closeout Final Report (CRADA No. 17- CR-01): Cornerstone Resources Feedstock Characterization and Conversion Assessment of Treated MSW Materials

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September 2017



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and Conversion Assessment of Treated MSW
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Final CRADA Report

Cornerstone Resources Feedstock Characterization and Conversion Assessment of Treated MSW Materials

PROJECT INFORMATION

CRADA No.: 17-CR-01

Completion Date: 9/30/2017

Participant(s) and Point of
Contact(s):

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Scope and Objective

Cornerstone Resources has developed a proprietary advanced preprocessing technology, the BurCell® System, for production of a high quality organic biomass feedstock from numerous waste resources. While suitable for a variety of feedstock, the focus of development for the BurCell® System has been thus far municipal solid waste (MSW). In MSW, the system technology is able to capture non-recyclable waste paper, cardboard, and organic materials, homogenize these materials and allow for separation of the non-organic fraction. The resulting homogenized organic material typically represents in excess of 50% of the raw MSW feed. The recently released Billion Ton Study now includes MSW as a feedstock resource showing it to be one of the lowest cost and most widely distributed biomass resources available; however, acknowledging the concerns with the potential physical and chemical variability of an MSW based feedstock stream. The focus on MSW has also been driven by MSW being a resource with a clear, well understood and mature supply-chain. Treating MSW in the BurCell® System will make that source of biomass substantially more accessible. To further promote the use of this MSW derived biomass and beneficially exploit the use of the BurCell® System for processing of biomass for Bioenergy production facilities, more detailed lab data is now required.

The treated materials organic fractions have preliminarily been shown to have higher concentrations of cellulose and other carbohydrates than raw MSW. Moreover, while raw MSW tends to be compositionally highly variable, the post BurCell® System material appears to be more homogenous. Processing raw MSW with the BurCell® System, besides aiding in the separation of non-organics, effectively pre-treats the material making it more amenable to bioprocesses through increased accessibility of the substrate. These processed organics are thus an inexpensive and easily processed source of fermentable cellulosic sugar. Preliminary conversion experiments have shown excellent recovery of glucose in mild operating conditions using moderate loadings of commercially available enzymes developed for the cellulosic ethanol industry. These same initial experiments have shown that these separated organics when compared to known literature data to be easier to process than pulped recycled paper. Compared to pulped recycled paper, BurCell® System separated organics require less pH adjustment and appear to provide better viscosity reduction and superior separation of hydrolysate from solids by filtration and/or centrifugation.

The goal of this work is to complete the quantitative characterization of the BurCell® System treated MSW materials, optimize enzyme loadings and develop a more accurate assessment of the simple sugars recovery potential. Attention also needs to be devoted to identify the potential for the formation of inhibitory compounds which would require characterization. This information will enable Cornerstone to develop a precise estimate of the value of BurCell® System processed organics as a source of fermentable

sugar for bio-based processing and support accordingly its technical and business development activities. This information and data will also be incorporated into the Bioenergy Feedstock Library; expanding the knowledge on MSW feedstocks for the bioenergy research community.

Project Accomplishments

INL provided Cornerstone Resources compositional characterization data and biochemical conversion efficiency data using commercially available enzymes for enzymatic hydrolysis for the BurCell® System treated MSW materials.

Researchers found that samples processed with the BurCell® System were less variable than raw MSW but still had high levels of variability that would be necessary to address in a large scale system. While total moisture, ash and carbon content was fairly consistent across the samples, the percentage of lignin and carbohydrate contents varied significantly.

Furthermore, the processed and separated organic MSW contained higher concentrations of carbohydrates. The BurCell® system provided a level of pre-treatment that allowed for carbohydrates to be more easily accessed for conversion to biofuels over raw MSW, and conversion experiments resulted in good recovery of glucose.

All told, the project produced good data on the BurCell® System's ability to process MSW into a material suitable for conversion to biofuels. Cornerstone Resources and INL researchers are exploring additional opportunities to collaborate.

Benefit to DOE

This work provided an opportunity for INL to collaborate with a small business interested in establishing biofuel conversion technologies.

Economic Viability

A technoeconomic analysis will be performed using the data generated from this research to assess the economic feasibility of incorporating a cellulosic ethanol conversion component to the current system technology.

Generated Data and Reports

Emerson R, Schaller K. Chemical Characterization and Conversion Assessment of BurCell® System Treated MSW Materials. September 2017. 9 p. INL/EXT-17-43190.

Project Status and Summary

Cornerstone resources will use the research provided through this CRADA as the foundational data to pursue more funding and/or resources in the biofuel conversion industry. Further collaboration opportunities with INL are being pursued.

