



## TEST REPORT

**CLIENT:** Gulf Ethanol Corp.  
1240 Blalock Rd.  
Suite 200  
Houston, TX 77055  
ATTN: Bill Carmichael

**OBJECTIVE:** To demonstrate and compare enzymatic digestibility of Gulf Ethanol processed samples to a small scale laboratory grade mill.

**SAMPLES:** Five samples were received at Hauser Labs on August 29<sup>th</sup>, 2008 and labeled as:

- 1) Whole Corn – Whole Corn
- 2) 1 yr old Sorghum Stalks – Whole Sorghum
- 3) Processed Sorghum – 1 pass Pre-processor by Gulf Ethanol
- 4) Powdered Sorghum – Gulf Sorghum
- 5) Powdered Corn – Gulf Corn

**TESTING:** Only Samples 1, 2, 4 and 5 were used in this project. Samples 1 and 2 were milled in accordance to NREL LAP for preparation of biomass. The laboratory preparation of samples is to provide the most consistent, small particle sized samples to ensure a complete representative sub-sample for use in theoretical yield calculations.

Tests were performed in accordance with the following Chemical Analysis and Standard Testing Procedures:

- Procedure Title: Enzymatic Saccharification of Lignocellulosic Biomass

The procedure was modified to remove “free glucose” using water extractives. Cellulose and amylase dosages were in excess of 6% to eliminate enzyme to sample loadings as the limiting factor during Saccharification.

Samples 1 and 5 were tested for digestibility using alpha-amylase due to the high corn starch content and Samples 2 and 4 were tested for digestibility using Cellulase enzyme.

**RESULTS:** Results are shown below in Figures 1 - 7. Verbal discussion of results can be found in the Discussion and Conclusion sections of this report.

**DATA REVIEWED AND  
REPORT WRITTEN BY:**

**REPORT REVIEWED BY:**

---

Matt Quinn  
Chemistry Department Manager

---

Emily Rogge  
Technician III

For any feedback concerning our services, please contact the Managing Director or Trevor Boyce, President, at [tboyce@microbac.com](mailto:tboyce@microbac.com) or Bob Morgan, Chief Operating Officer, at [rmorgan@microbac.com](mailto:rmorgan@microbac.com). This report applies only to the sample(s) tested or analyzed. This report may be copied only in its entirety, unless prior written consent has been granted by an authorized agent of the Hauser Laboratories Division of Microbac Laboratories, Inc.

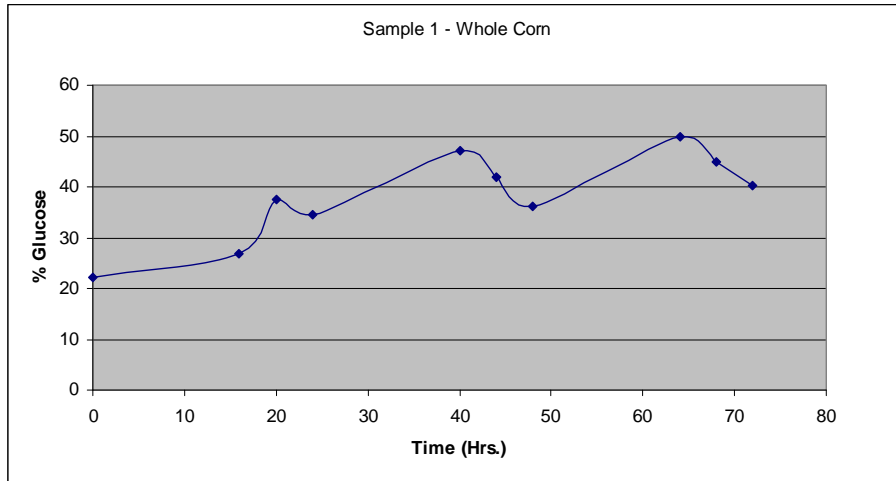
**Microbac Laboratories, Inc., Hauser Laboratories Division**

4750 Nautilus Court South, Unit A, Boulder, CO 80301 Ph: 720 406 4800 Fax: 303 581 0195

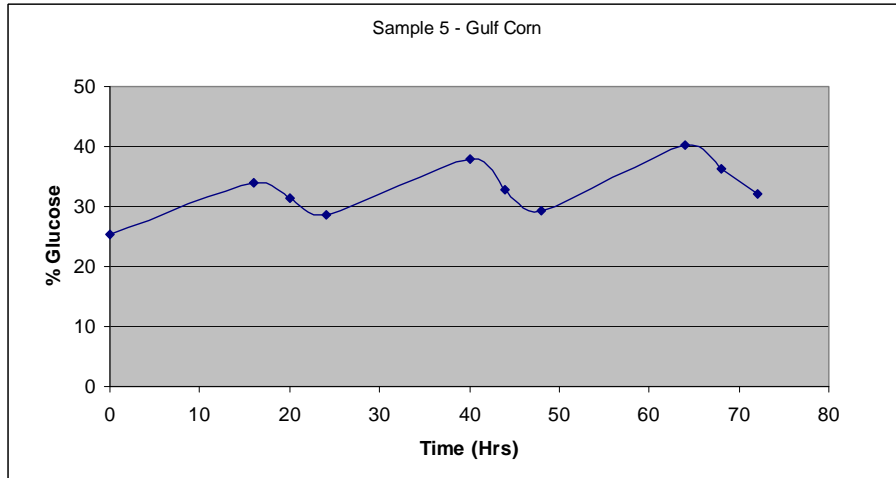
[www.hauserlabs.com](http://www.hauserlabs.com)

[www.microbac.com](http://www.microbac.com)

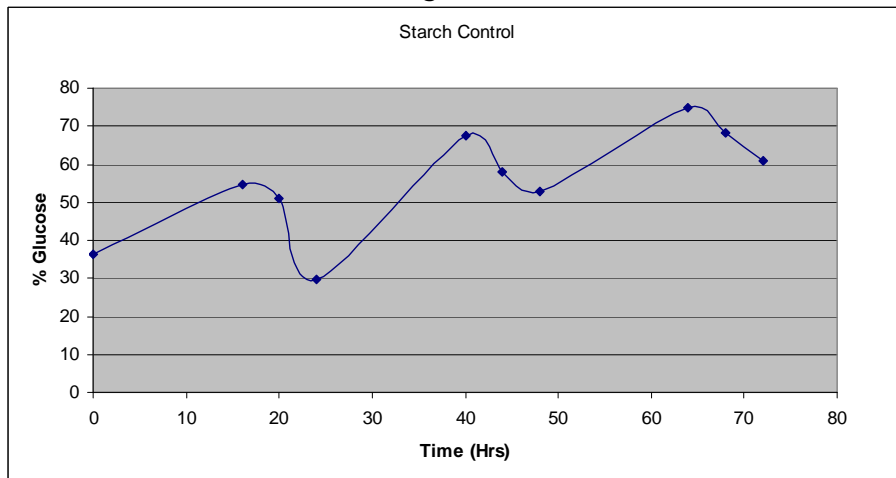
**Figure 1.**



**Figure 2.**

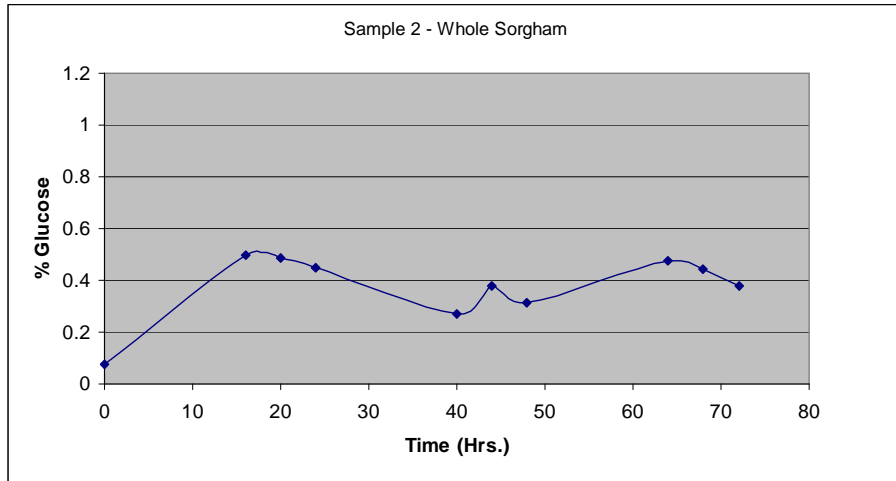


**Figure 3.**

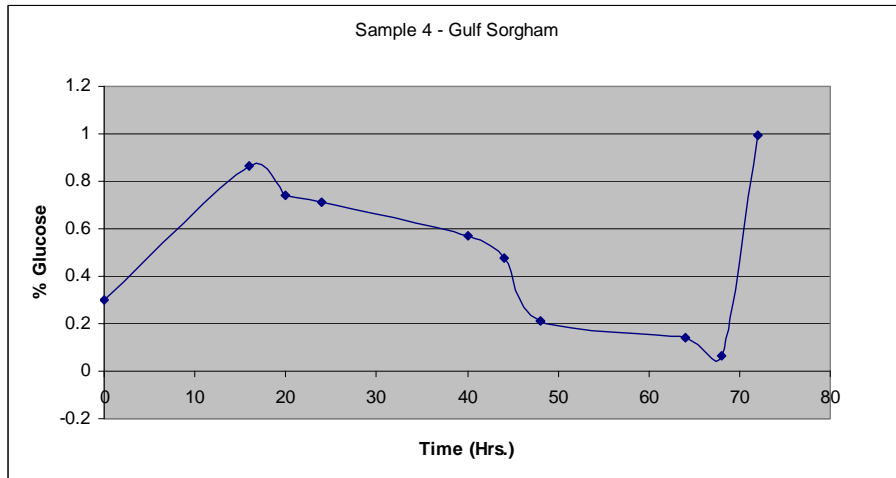


For any feedback concerning our services, please contact the Managing Director or Trevor Boyce, President, at [tboyce@microbac.com](mailto:tboyce@microbac.com) or Bob Morgan, Chief Operating Officer, at [rmorgan@microbac.com](mailto:rmorgan@microbac.com). This report applies only to the sample(s) tested or analyzed. This report may be copied only in its entirety, unless prior written consent has been granted by an authorized agent of the Hauser Laboratories Division of Microbac Laboratories, Inc.

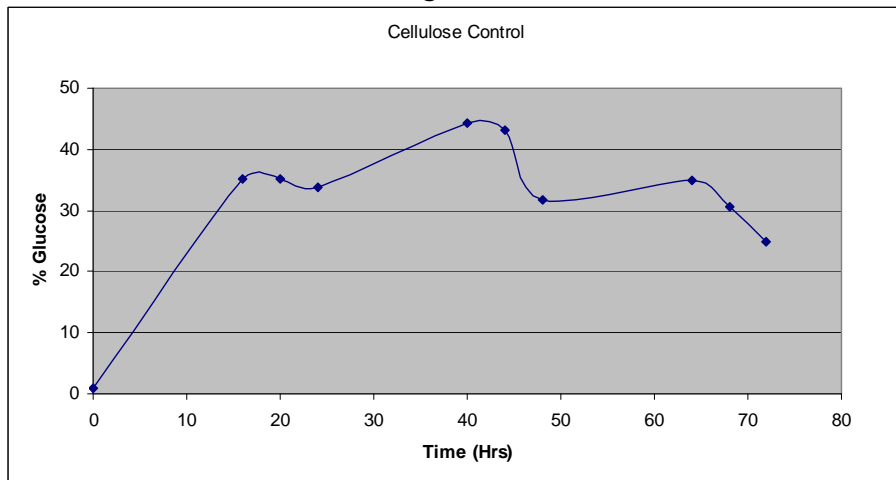
**Figure 4.**



**Figure 5.**



**Figure 6.**



For any feedback concerning our services, please contact the Managing Director or Trevor Boyce, President, at [tboyce@microbac.com](mailto:tboyce@microbac.com) or Bob Morgan, Chief Operating Officer, at [rmorgan@microbac.com](mailto:rmorgan@microbac.com). This report applies only to the sample(s) tested or analyzed. This report may be copied only in its entirety, unless prior written consent has been granted by an authorized agent of the Hauser Laboratories Division of Microbac Laboratories, Inc.

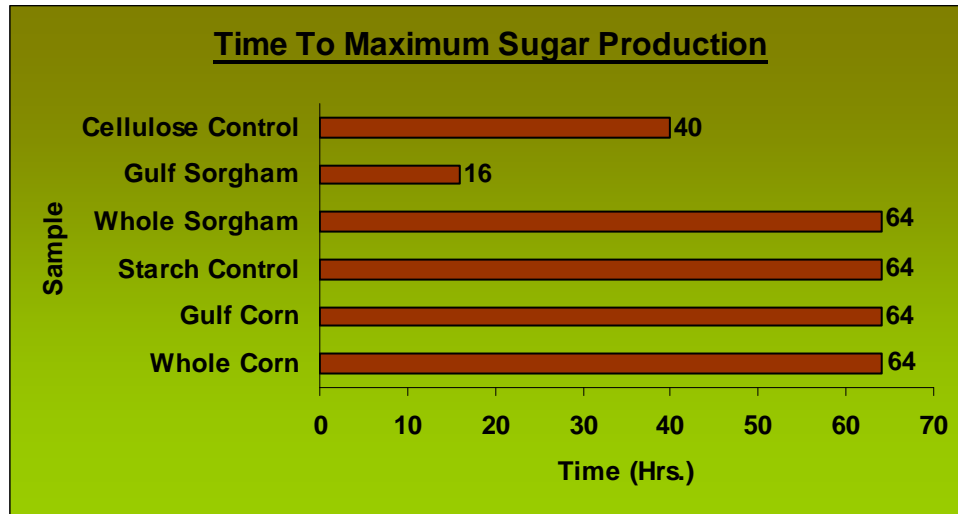
**Microbac Laboratories, Inc., Hauser Laboratories Division**

4750 Nautilus Court South, Unit A, Boulder, CO 80301 Ph: 720 406 4800 Fax: 303 581 0195

[www.hauserlabs.com](http://www.hauserlabs.com)

[www.microbac.com](http://www.microbac.com)

Figure 7.



\*Result for Gulf Sorghum sample at 16hrs is similar to the result shown at 72hrs. as shown in Figure 5.

**DISCUSSION:** Saccharification of biomass is highly dependent upon temperature, enzyme-sample loadings, biomass pretreatments as well as enzyme activity coefficients. This experiment was designed to compare samples with each other and not for use in theoretical sugar production values. Therefore, sample weights, temperature and enzyme-sample loadings were kept as equivalent as possible throughout the digestion.

The controls were used to provide a baseline of enzyme activity, HPLC operation and operator error as well as theoretical yields using this method of Saccharification.

**CONCLUSION:**

The results of the corn sample conversions exhibit that starch based Gulf Ethanol processed samples (Gulf Corn) are digested just as well as small scale laboratory processed samples (Whole Corn).

The results of the sorghum sample conversions exhibit that cellulosic based Gulf Ethanol processed samples (Gulf Sorghum) are as efficient at digestion as a small scale laboratory processed samples (Whole Sorghum).

The results show that the Gulf Ethanol process is just as efficient as small scale laboratory milling, except that the process occurs on a much larger scale and could provide a more efficient method of biomass to fuel conversion by assisting in the pretreatment of the biomass. This statement is based upon the % Glucose present after a 0-72hr conversion process using enzymatic Saccharification.

For any feedback concerning our services, please contact the Managing Director or Trevor Boyce, President, at [tboyce@microbac.com](mailto:tboyce@microbac.com) or Bob Morgan, Chief Operating Officer, at [rmorgan@microbac.com](mailto:rmorgan@microbac.com). This report applies only to the sample(s) tested or analyzed. This report may be copied only in its entirety, unless prior written consent has been granted by an authorized agent of the Hauser Laboratories Division of Microbac Laboratories, Inc.