

Corn Fiber For Cellulosic Ethanol

Neal Jakel

Partner, Strategy and Technology



FQT's Technology & Engineering Expertise

The FQT Team

- Corn Wet Milling / Ethanol / Biochemical Industry Expertise
- 20+ Chemical and Mechanical Engineers (50+ Employees)
- Leading Nutritionist, QA/QC, Construction Management
- HQ: Cedar Rapids, IA
 - Locations in Brazil and China

Engineering/Design

- 2.4+B gal/yr of Biofuels Utilize FQT Technology Systems
- State-of-the-art Greenfield Biofuels/Biochemical Facility Design
- Process Optimization / Integration / Commercialization
- EPC / Turnkey Provider

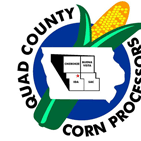


2019 | ETHANOL PRODUCER PROJECT OF THE YEAR

Fluid Quip Technologies' MSC™ installation at Flint Hills Resources in Fairmont, NE is the 2019 Ethanol Producer Project of the Year.



Partner Companies



Center Ethanol Co, LLC



BADGER STATE ETHANOL



GREENFIELD



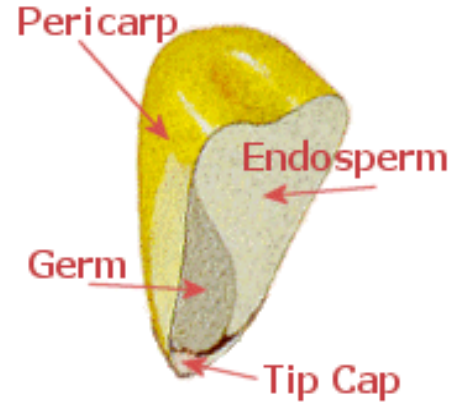
Corn Kernel Fiber for Cellulosic Ethanol

Fiber Types

- Pericarp Fiber (course)
- Fine Fiber (cell wall)

Fiber Make-up

- C5 Sugars
- C6 Sugars



Which fiber works best and how best to separate the fibers?

Corn Kernel Fiber Technology Landscape

- In-Situ conversion – comingled fermentation
- Whole stillage conversion – excess “other” material
- Wet cake conversion – cleaner stream
- Fiber conversion **pre** or **post** fermentation



FQT's Proven Technologies for Wet Fiber Separation

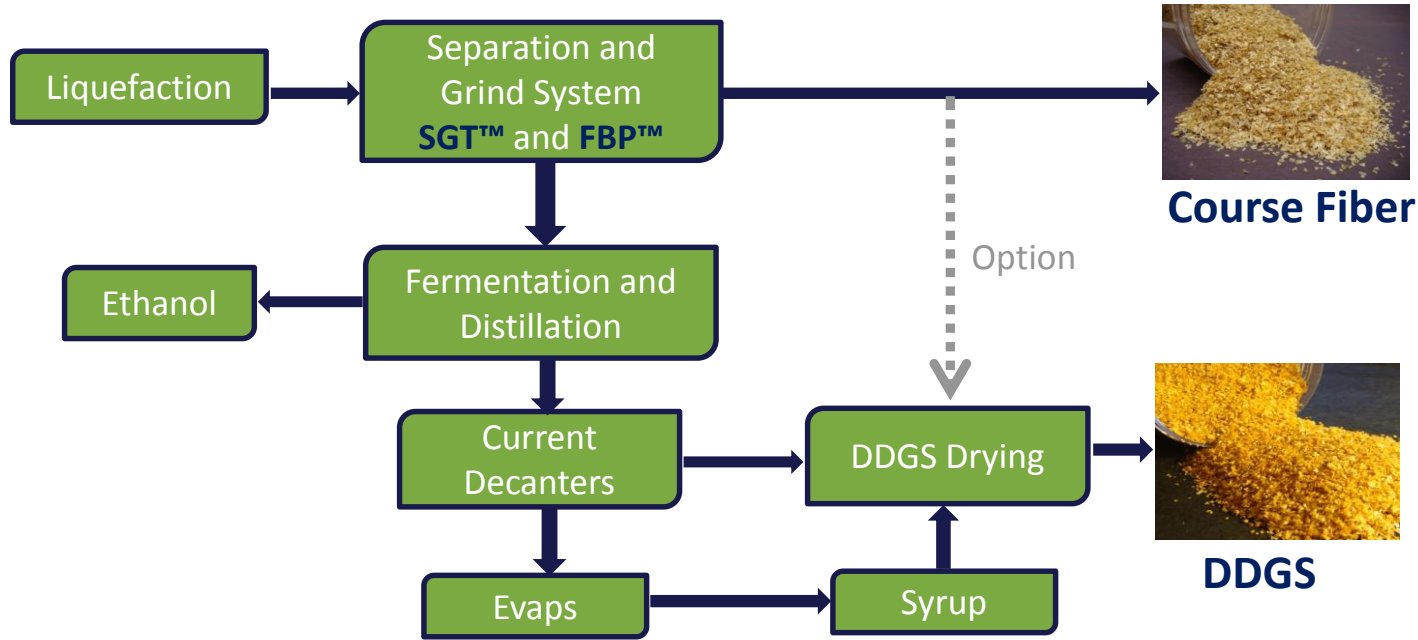
Fiber By-Pass™



Maximized Stillage Co-Products™



Fiber By-Pass (FBP)™ System



FBP™ Overview

- 4 systems in operations
- Ethanol yield gain
- Throughput gain >5%
- Yields pure fiber stream

Fiber By-Pass (FBP)[™] System Yields



DDGS

- 10.0 lb/bu
- 34% Protein
- 7% Fat



Clean Fiber

- 4.0 lb/bu
- 20% Protein
- 4% Fat
- <2% starch
- 65% NDF



Oil

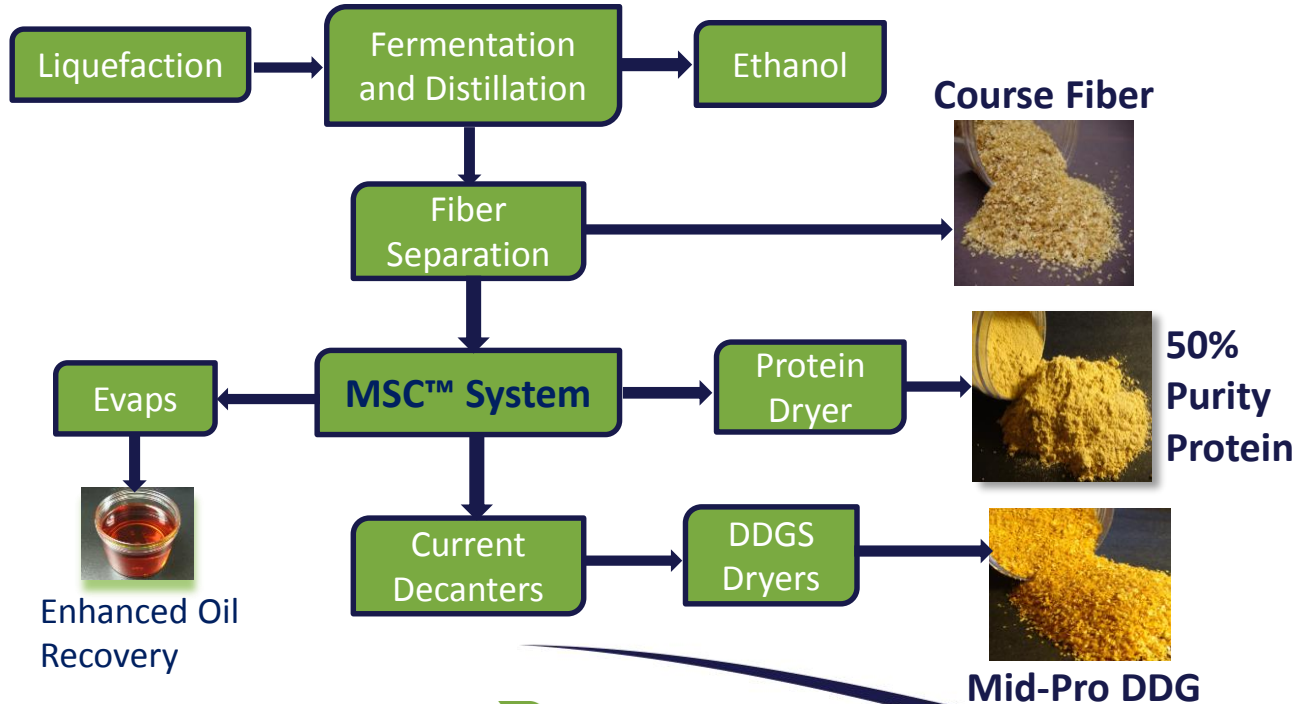
- 1.0 – 1.2 lb/Bu



Fluid-Quip, Inc. MZSA Screens



Maximized Stillage Co-Products (MSC)TM



MSCTM Overview

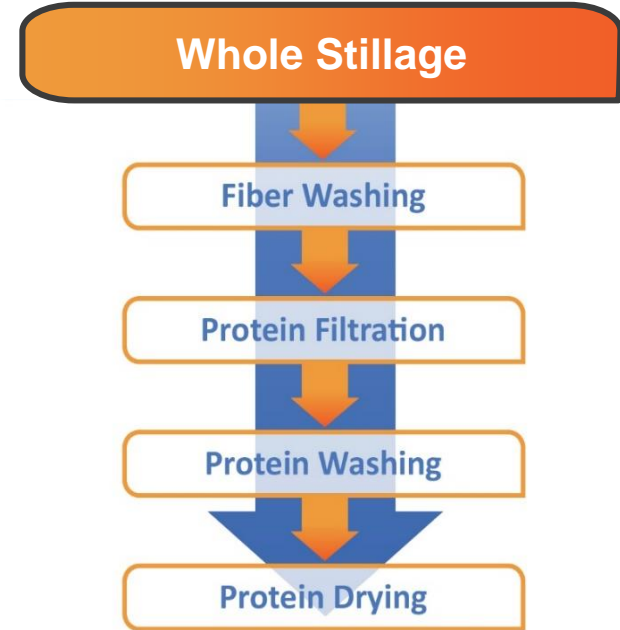
- 4 systems in operations, 3 under constr.
- Throughput gain >10%
- Yields high purity protein
- Increased oil >1.2 #/bu

FLUID QUIP
TECHNOLOGIES

MSC™ Multi-Stag Washing Process

- Whole Stillage washed 4 times
- Course fiber separated in first 2 steps
- Fine fiber separated is subsequent step

US Patent: 8,778,433 8,813,973 10,160,932 10,190,076 10,266,790 10,233,404
Multiple Pending Applications



MSC™ System Yields



Protein

- 4.0+ lb/bu
 - 50% Protein
 - CGM+
- Brewer's Yeast



Mid-Pro DDG

- 5.0 lb/bu
- 38% Protein
- 6% Fat



Clean Fiber

- 5.0 lb/bu
- 17% Protein
- 4% Fat



Oil

- 1.1 – 1.3 lb/Bu



Clean Fiber

Crude	%	10
ADF	%	17
NDF	%	61



Corn Kernel Fiber Technology Landscape

- In-Situ conversion – comingled fermentation
- Whole stillage conversion – excess “other” material
- Wet cake conversion – cleaner stream
- Fiber conversion pre or post fermentation



THE BIOREFINERY DREAM REALIZED



Today

Ethanol facilities with FQT's MSC™ are realizing a **+\$0.10 - \$0.20/gal** uplift

Tomorrow

Biorefinery will see **+\$0.30 - \$0.40/gal** uplift – untethered from regulatory influences



ENERGY



ETHANOL



FIBER



OIL



PROTEIN



SUGAR

FLUID QUIP
TECHNOLOGIES

Technology Selection Process for an Ethanol Facility

FQT White Paper, available at: www.Fluidquiptechnologies.com

1. Ready for Commercial Operations – proven full scale or pilot (scale up issues)
2. Equipment Design and Reliability – novel or not new or operating
3. Marketability of Products – volume and market demand
4. Intellectual Property Rights – FTO an absolute must have
5. Depth of Technology/Experience of Provider – proven record or open promises
6. Risk Adjusted Financial Analysis – proven product sales vs promise of value



Thank You

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