UPDATE ON DUPONT-ADM FDME PROGRAM

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July 24, 2017
RETHINK RENEWABLE PERFORMANCE

DuPont Biomaterials’ differentiated value proposition

INNOVATIVE SCIENCE  →  HIGH PERFORMANCE

SCALABLE SUPPLY  →  ACCESSIBLE & AFFORDABLE

RENEWABLE SOURCING  →  RESPONSIBLE BIOMATERIALS
ADM AND DUPONT ANNOUNCE FDME

A REVOLUTIONARY PARTNERSHIP BETWEEN TWO SCIENTIFIC LEADERS IS BRINGING A NEW MOLECULE TO MARKET

With their combined expertise in agriculture and food science, the two companies developed an innovative new process for turning fructose into biomaterial — specifically, the molecule furan dicarboxylic methyl ester (FDME) — a building-block that can be converted into a number of high-value, bio-based chemicals or materials.

LEADER IN BRINGING WORLD-CLASS SCIENCE AND ENGINEERING TO THE GLOBAL MARKETPLACE

ONE OF THE WORLD’S LARGEST AGRICULTURAL PROCESSORS AND FOOD INGREDIENTS PROVIDERS

THIS SCIENTIFIC BREAKTHROUGH OPENS THE DOOR TO NEW POLYMER GROUPS AND HAS CREATED A MORE EFFICIENT, ECONOMICALLY VIABLE PROCESS.
ADM CORN PROCESSING SUPPORTS A SUSTAINABLE FEEDSTOCK SOLUTION

Yield Improvement Drives the Harvest Higher and Higher

Source: USDA

Relatively Stable Raw Material Pricing

Integrated and Efficient Processing Plants
THE ADM-DUPONT INTEGRATED PROCESS ADVANTAGE

Highlights:

- Elimination of intermediate, on-path product purification steps
- Oxidation converts all on-path products to target molecule
- Energy produced in the oxidation step is integrated into the process

HIGHER YIELDS AND LOWER OPERATING COSTS
WHY FDME?

- The DuPont-ADM process makes FDME, the methyl ester of FDCA
- It seems more efficient to make and sell FDCA (no methanol handling on either end of polymer process)

However:
- FDME allows simpler, more effective final purification to polymer grade material than FDCA
- FDME is more stable for shipping and storage than FDCA
- FDME has some advantages in polymer manufacturing
- The relevant analog is DMT vs TPA in the polyester industry
FDME WILL ENABLE MATERIALS THAT CAN BE USED IN A WIDE VARIETY OF APPLICATIONS

Initial Focus

Packaging

Engineering Polymers

Fibers

- Polyester Resins and Fibers
- Polyamide Resins and Fibers
- Unsaturated Polyester Resins
- Alkyd Resins
- Polyurethane Resin Systems

- Better Barrier Properties
- Improved Chemical Resistance
- Elevated Temperature Performance (HDT)
- Lower Moisture Uptake
- Improved Fire Rating (char yield)
Polytrimethylene Furandicarboxylate (PTF)
A novel polyester made from FDME and Bio-PDO™ (1,3-propanediol)

Superior gas barrier properties
Recyclable polymer
100% renewable polymer

Provides lightweighting and smarter packaging
More packaging with recycled materials
Enables use of more sustainable materials
## BARRIER PERFORMANCE OF SELECTED POLYESTERS RELATIVE TO PET

<table>
<thead>
<tr>
<th>Monomers</th>
<th>PET</th>
<th>Sorona® (PTT)</th>
<th>PEN</th>
<th>PTF</th>
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</thead>
<tbody>
<tr>
<td>O₂ barrier (relative to PET)</td>
<td>1</td>
<td>~2</td>
<td>~6</td>
<td>~8-15</td>
</tr>
<tr>
<td>CO₂ barrier (relative to PET)</td>
<td>1</td>
<td>~2</td>
<td>~6</td>
<td>~8-15</td>
</tr>
</tbody>
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Furan-based polymers like PTF provide significantly differentiated barrier performance
PTF COLOR IMPROVEMENT

Effects of Improved FDME Quality and Polymerization Optimization on PTF Color
Currently constructing market development plant

**Lab/Pilot Scale**
- Process concept and feasibility demonstrated
- Material and energy balances complete
- Focus on highest yield from raw material

✅ Completed

**Market Development Scale**
- Fully integrated process
- Refining commercial estimates
- 60 T/yr
- **Online 4Q 2017**

**Commercial Scale**