

## 3-Hydroxypropionic Acid (3-HP)

### BIOREFINING PROCESS SOURCE

Fermentation of 6-carbon sugars & starches, fermentation of lignocellulosic biomass

### DESCRIPTION

Biobased platform intermediate chemicals can be competitively produced by fermentation; the two most well know examples being lactic (2-hydroxypropionic) acid and succinic (butanedioic) acid.<sup>1</sup> Cargill, Inc. is developing a third building block, 3-hydroxypropionic acid, a platform intermediate that can be produced at a theoretical yield of 100% from glucose.<sup>1</sup> By integrating fermentation with chemical processing, this intermediate may then be used to make other commercially valuable chemicals. These include 1,3-propanediol, acrylic acid, malonic acid, and acrylamide, which are used in large quantities for adhesives, polymers, plastic packaging, fibers, and resins. There is no commercially viable production route of 3-HP from fossil fuel feedstocks; however, proposed derivatives of 3-HP are produced from fossil feedstocks.<sup>2</sup> Cargill is collaborating with Codexis, Inc. and Pacific Northwest National Laboratory on a \$12 million commercialization research project funded in part by the U.S. Department of Energy.<sup>3</sup>

REPRESENTATIVE BIOBASED PRODUCT OPPORTUNITIES

BIOBASED PRODUCT	CLASSIFICATIONS	MARKET OPPORTUNITY	MARKET SIZE
Acrylic Acid	Adhesives, polymers	Acrylates (e.g., coatings, adhesives), comonomer, superabsorbent polymers, detergent polymers <sup>2</sup>	Markets for acrylic acid derivatives in the previous column are 2 billion pounds per year, at a market price of \$0.48 per pound. <sup>2</sup>
Acrylonitrile	Polymers	Acrylic fibers (carpets, clothing), acrylonitrile-butadiene-styrene and styrene-acrylonitrile (pipes and fittings, automobiles, furniture, packaging), nitrile rubber copolymers, adiponitrile, acrylamide <sup>2</sup>	Markets for acrylonitrile derivatives in the previous column are 3.13 billion pounds per year, at a market price of \$0.31 to \$0.37 per pound. <sup>2</sup>
Acrylamide	Resins	Polyacrylamide, comonomers (styrenebutadiene latex, acrylic resins, and many others) <sup>2</sup>	Markets for acrylamide derivatives in the previous column are 206 million pounds per year, at a market price of \$1.76 to \$1.86 per pound. <sup>2</sup>

REFERENCES

<sup>1</sup> Rich Zvosec. May 2003. 3-hydroxypropionic Acid—A New Intermediate Platform, Cargill Inc.; 15407 McGinty Road West; Wayzata, MN 55439; Phone: 952-742-4991.

<sup>2</sup> Energetics Incorporated. 2003. Industrial Bioproducts: Today and Tomorrow. U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Office of the Biomass Program, Washington, D.C.

<sup>3</sup> Cargill, Inc. May 2003. Cargill and Codexis launch research collaboration to develop industrial bioproducts platform, [http://www.cargill.com/today/releases/2003/03\\_05\\_19codexis.htm](http://www.cargill.com/today/releases/2003/03_05_19codexis.htm) (23 April 2004).