

**PEP Review 2011-09
BIO-BASED ISOPRENE**

**By
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ABSTRACT

Isoprene is an essential starting material for a variety of synthetic polymers, most notably synthetic rubbers. A major portion of the isoprene produced globally is converted into polyisoprene, which is used in products such as footwear, mechanical instruments, medical appliances, sporting goods, and most extensively in rubber tires. Currently, isoprene is produced almost exclusively from petroleum-derived feedstocks, which in itself has inherent risks due to price volatility and the supply/demand situation of oil. Additionally, the processing of oil tends to be both expensive and environmentally unfriendly. Therefore, there is significant interest in developing technology that will produce isoprene in a cost-effective, environmentally friendly way, utilizing renewable sources.

One methodology that has been receiving increased attention is the use of genetically-engineered microorganisms to produce bio-based isoprene. Genencor (a division of Danisco USA, Inc., now owned by DuPont) and The Goodyear Tire & Rubber Company have teamed up to produce a product called Biolsoprene™. Their technology enhances the fermentative capabilities of a bacterial microorganism by genetically engineering its DNA, which subsequently improves enzyme activity leading to increased overall yield of isoprene. This technology also allows tremendous flexibility in terms of the type of carbon substrate used. With a global industrial production of isoprene at 1 million tons per year, a bio-based isoprene method has great commercial value.

This PEP review discusses and provides a detailed techno-economic analysis for bio-based isoprene production with a capacity of 100 thousand metric tons/year (220 million lb/yr). Additionally, it covers information regarding genetic engineering mechanisms, regulation of specific enzymes, and purification of isoprene to provide a cost-competitive alternative to petroleum-based isoprene.



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CONTENTS

INTRODUCTION	1
CHEMISTRY	3
INDUSTRY STATUS	4
TECHNOLOGY OVERVIEW.....	7
Background Information—Genencor.....	7
Type of Substrate/Microorganism Used.....	7
Process Schematic/Description.....	8
Genetic-Engineering.....	8
Biolsoprene™ Recovery	9
PEP PROCESS SUMMARY AND DESIGN.....	10
Fermentation	10
Recovery and Purification	10
SECTION 100—FERMENTATION	17
Media Preparation	17
Fermentor Sterilization	17
Fermentor Inoculation	17
Bio-Based Isoprene Production.....	18
SECTION 200—BIO-BASED ISOPRENE PURIFICATION.....	18
PROCESS DISCUSSION	18
Capacity.....	18
Fermentation	19
Biomass Separation	19
Materials of Construction.....	19
Biomass	19
CAPITAL AND PRODUCTION COSTS	19
DISCUSSION OF CAPITAL AND PRODUCTION COSTS	23

CONTENTS (Concluded)

DISCUSSION OF PROCESS COSTS	26
Raw Material Costs	26
Capital Costs	27
CONCLUSIONS	27
CITED REFERENCES	29

FIGURES

1	MEP and MVA Pathways—Carbon Metabolism in <i>Escherichia Coli</i>	3
2	World Consumption of High-Purity Isoprene—2010	5
3	Schematic Representation of Genencor’s Technology	8
4	Sensitivity of Bio-Based Isoprene Product Value to Glucose Feedstock Price (¢/lb)	26
5	Sensitivity of Bio-Based Isoprene Product Value to Glucose Feedstock Price (\$/MT)	27
6	Bio-Based Isoprene Production Process Flow Diagram	31

TABLES

1	Global Supply/Demand for Isoprene—2010	4
2	Global Consumption and Applications of Isoprene—2010	5
3	Bio-Based Isoprene from Glucose Design Bases	12
4	Bio-Based Isoprene from Glucose Major Stream Flows.....	13
5	Bio-Based Isoprene from Glucose Major Equipment	15
6	Bio-Based Isoprene from Glucose Utilities Summary.....	16
7	Bio-Based Isoprene from Glucose Total Capital Investment.....	21
8	Bio-Based Isoprene from Glucose Capital Investment by Section.....	22
9	Bio-Based Isoprene from Glucose Production Costs	24