Abstract
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1-HEXENE PRODUCTION BY AXENS ALPHAHEXOL™ PROCESS
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ABSTRACT

This review presents a technoeconomic representation of a 1-hexene production process based on technical data extracted from the patents of IFP Energies nouvelles (IFPEN). The best possible engineering judgment has been used in the conceptualization and design of the process presented; however, a commercial Axens 1-hexene plant may or may not have the exact construct presented in this review. We, nevertheless, strongly believe that our process design and economic evaluation present a reasonably good picture of the actual process, and the two should be well within the marginal boundaries of error.

The process involves oligomerization of high-purity ethylene gas in the presence of a homogeneous catalyst system. The reaction conditions are 284°F at 435 psia. The catalyst system consists of a proprietary chromium-based catalyst, a cocatalyst based on magnesium, and an activator aluminum salt dissolved in a hydrocarbon solvent. Ethylene per-pass conversion is kept at 33%. The reaction yield of C6 olefins is over 85% with some C4 as well as higher carbon number olefins as by-products. The selectivity of the alpha-olefins in the C6 fraction is very high, at over 99%. The reactant mixture is flashed in a flash drum and the ethylene recovery column to recover unconverted ethylene which is recycled to the reactor after compression. The bottoms from the ethylene column are separated in a distillation column to obtain the desired 1-hexene product as liquid distillate. The bottoms from the product column contain solvent to be recycled to the reactor system and C8+ olefinic oligomers that are not purified further in this study.

Our cost analysis is based upon a 25 thousand metric t/yr plant. We estimate that a plant of that capacity will require a capital investment of about $25.7 million at a US Gulf Coast location. The product value (as defined in the text) is about $0.74/lb and the production cost is $0.62/lb. Cost details and relevant assumptions are given in the process description section of this review.
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INTRODUCTION ........................................................................................................ 1
COMMERCIAL OVERVIEW ....................................................................................... 1
TECHNICAL REVIEW ................................................................................................ 2
Catalyst System .......................................................................................................... 3
PROCESS DESCRIPTION ........................................................................................ 4
Section 100—1-Hexene Reaction and Purification Section ....................................... 4
PROCESS DISCUSSION ........................................................................................... 11
Feedstock ................................................................................................................... 11
Reaction System ........................................................................................................ 11
Product Recovery ...................................................................................................... 11
Process Waste Effluents ............................................................................................ 11
Materials of Construction .......................................................................................... 11
COST ESTIMATES .................................................................................................... 15
Fixed-Capital Costs .................................................................................................. 15
Production Costs ....................................................................................................... 15
REFERENCES ........................................................................................................... 20
FIGURES

1  1-Hexene Production by Axens AlphaHexol™ Process
Process Flow Diagram ........................................................................................................21

2  1-Hexene Production by Axens AlphaHexol™ Process
Net Production Cost and Product Value of 1-Hexene as a Function of
Ethylene Price (For Base-Capacity Plant) ........................................................................19

3  1-Hexene Production by Axens AlphaHexol™ Process
Product Value of 1-Hexene as a Function of Plant Operating Level and Plant
Capacity ................................................................................................................................19
### TABLES

1. **1-Hexene Production by Axens AlphaHexol™ Process**  
   Design Bases........................................................................................................... 6

2. **1-Hexene Production by Axens AlphaHexol™ Process**  
   Stream Flows......................................................................................................... 8

3. **1-Hexene Production by Axens AlphaHexol™ Process**  
   Major Equipment .................................................................................................. 13

4. **1-Hexene Production by Axens AlphaHexol™ Process**  
   Utilities Summary.................................................................................................. 14

5. **1-Hexene Production by Axens AlphaHexol™ Process**  
   Total Capital Investment...................................................................................... 16

6. **1-Hexene Production by Axens AlphaHexol™ Process**  
   Production Costs .................................................................................................. 17