Hydrocarbon Resins

The Origin of the Species
Argus Media: global, market-focused, independent

- World’s largest independently held energy PRA – 750 staff, 23 countries
- Publish > 8,000 daily commodity price assessments + energy market intelligence
- Argus DeWitt C5 Hydrocarbon Resin Report
  - Established in 1980s
  - The only global report of the kind
- Indexation examples
  - US refined products (incl. VGO)
  - Global crude oil
- Recent acquisitions
  - DeWitt, JJ&A (Petrochemicals)
  - FMB (Fertilizers)
  - Metalprices.com, Metal Pages (Metals)
- Services
  - Price reporting & indexation
  - Conferences & Events
  - Consulting
C5 and Hydrocarbon Resins Newsletter

- Provides essential information on supply and demand fundamentals, trade flows and industry news of global C5 monomers and polymers, as well as complementary and competitive products.

- Markets Covered
  - Resin formers, isoprene monomer and polyisoprene, DCPD, piperylenes, tackifying resins, crude oil, natural gas, ethylene and polyethylene, EVA and polypropylene, butadiene and SBR

- Key Features
  - Market and price analysis, including overview of the Asia Pacific, Europe and North American markets
  - Market moving news
  - US trade data for pertinent categories

- Value-Added
  - Indispensable resource for marketers and consumers of C5 monomers, polymers, as well as downstream users of articles manufactured with C5 derivatives.
Why Hydrocarbon Resins?
The Rosin and HCR competitive space

- Pulls on hydrocarbon and natural resins create price/supply dynamics
- Some applications very flexible, others much less
- Some markets have significantly higher affordability
Hydrocarbon Resins vs Rosin Resins

Monomers
- C5 Piperylenes (PIPs)
- C9 Monomers
- DCPD C9 Mixed C5’s

Polymers/HCR Resins
- C5 HCR
- C9 Aromatic HCR
- Hydrogenated HCR

End-use Markets
- Tapes & Labels Road marking
- Packaging Inks Road marking
- Non-wovens Packaging Polymod
- Possible Rosin Opportunity

Rosin Opportunity

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Upstream Petrochemical Drivers
One Barrel (42 Gal.) of Oil Yields:

- Gasoline: 43%
- Distillate: 21.5%
- Residual: 11.5%
- Jet fuel: 6.9%
- Feedstocks: 4.7%
- Still gas: 3.8%
- Asphalt: 3.1%
- Coke: 2.6%
- LPG: 2.3%
- Kerosene: 1.3%
- Lubricants: 1.3%
- Miscellaneous: 0.67%

93% Motor Gasoline, Lubes and Heating Fuels

70% Commodities: Plastics, Rubber Products

30% (2.1%) Intermediates: Isoprene, DCPD, Piperylenes, Styrene, VAM, Isocyanates, Acrylates, Polyols

20% (0.4%) Specialty Raw Materials: C5, C9 and DCPD resins, BCP, EVA

7% Naphtha Gas Oil

Ethylene, Propylene, Butadiene
Isoprene and all hydrocarbon tackifying resins are roughly 1.3mn tons each, or roughly 100 times less than ethylene market.
Byproducts of the Ethylene Cracking Process

Steam Cracking Process

- Ethylene
- Propylene
- Benzene
- Butadiene
- Isoprene
- Cyclopentadiene
- Aromatics

Gas Feed

Liquid Feed

Drive Cracking Slate

Byproducts of Ethylene Production utilizing Liquid Feeds

Critical to Resins, Inks, BCP’s
Can only get tackifier resin feeds from Naphtha and gas oil

Isoprene is the key driver for recovery of Crude C5 stream

Supply Chain is Dependent on Ethylene Feeds for Crude Streams (C9 ARO or CC5)
Gas feeds are much more economically attractive for production of ethylene
Ethylene cracking slate continues to lighten up, leading to a shortage of heavier molecules in the US.
NR and IR are generally said to be analogs, so IR demand is directly affected by NR market.

IPM also goes into making of SIS, but volume is small and low growth – not a factor.
• Synthetic rubber (SR) growth has a higher growth potential
• SR growth driven by performance attributes
• Isoprene rubber, a synthetic rubber, is a small proportion of entire SR demand, <1M tons out of ~14.5M tons in 2015
Isoprene monomer requires further costly processing to be converted to polyisoprene rubber. Cannot compete with natural rubber which is used as is.
Isoprene (and DCPD and PIPs) Capacity Overbuild

China overbuilds IPM/IR Capacity

Asia (mostly China)

5-10 kt/yr

50-60 kt/yr

10-20 kt/yr

Taiwan Adds 60 kta IPM Capacity in 2015

Korea Started up new 25 kta unit Q2 2016 with another ready in Q4

Braskem considers stopping IPM production in 2016
C5 Global Supply

<table>
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<th>Positive/Negative</th>
<th>GROSS OVERSUPPLY against POOR DEMAND</th>
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<td>Trade Flows</td>
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THANK YOU!

Vitaly Rogachevsky
Vice President – C5 Monomers and Polymers

Email: Vitaly.Rogachevsky@argusmedia.com
Phone: 713-360-7536
Office: Houston
Web: www.argusmedia.com