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**GLOBAL EPOXY**

**RESIN MARKET**

**FORECAST & OPPORTUNITIES, 2030**

**PUBLISHED: September 2021**

**MARKET INTELLIGENCE. CONSULTING**

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| --- | --- | --- | --- | --- | --- |
| **S. No.** | **Contents** | | | | **Page No.** |
| **1.** | Executive Summary | | | | **5** |
|  | **1.1** | Overview of the Company | | | 4 |
|  | **1.2** | Brief Profile of Board of Directors | | | 4 |
|  | **1.3** | Brief Project summary & Key Highlights of The Project | | | 5 |
| **2.** | Product Profile | | | | 9 |
| **3.** | Market Outlook and Relevance of the Project | | | | 15 |
|  | **3.1** | Demand Supply Outlook – Global Epoxy Resin Market | | | 15 |
|  |  | 3.1.1. | Capacity By Company | |  |
|  |  | 3.1.2. | Production By Company | |  |
|  |  | 3.1.3. | Capacity By Location / Country | |  |
|  |  | 3.1.4. | Operating Efficiency | |  |
|  |  | 3.1.5. | Demand By Grade | |  |
|  |  | 3.1.6. | Demand By Type | |  |
|  |  | 3.1.7. | Demand By Application | |  |
|  |  | 3.1.8. | Demand By Sales Channel | |  |
|  |  | 3.1.9. | Demand By Region- Global | |  |
|  |  |  | 3.1.9.1. | Demand By Country- Asia Pacific |  |
|  |  |  | 3.1.9.2. | Demand By Country- Europe |  |
|  |  |  | 3.1.9.3. | Demand By Country- North America |  |
|  |  |  | 3.1.9.4. | Demand By Country- South America |  |
|  |  |  | 3.1.9.5. | Demand By Country- Middle East & Africa |  |
|  |  | 3.1.10. | Sales By Company | |  |
|  | **3.2** | Demand Supply Outlook – Regional Market | | |  |
|  |  | 3.2.1. | India Epoxy Resin Demand Supply Outlook | | 26 |
|  |  |  | 3.2.1.1. | Capacity, Production |  |
|  |  |  | 3.2.1.2. | Operating Efficiency |  |
|  |  |  | 3.2.1.3. | Demand By Application |  |
|  |  |  | 3.2.1.4. | Demand By Type |  |
|  |  |  | 3.2.1.5. | Demand By Grade |  |
|  |  |  | 3.2.1.6. | Demand By Sales Channel |  |
|  |  |  | 3.2.1.7. | Sales By Company |  |
|  |  | 3.2.2. | APAC Epoxy Resin Demand Supply Outlook | | 33 |
|  |  |  | 3.2.2.1. | Demand By Application |  |
|  |  |  | 3.2.2.2. | Demand By Grade |  |
|  |  |  | 3.2.2.3. | Demand By Type |  |
|  |  | 3.2.3. | Europe Epoxy Resin Demand Supply Outlook | | 41 |
|  |  |  | 3.2.3.1. | Capacity, Production |  |
|  |  |  | 3.2.3.2. | Operating Efficiency |  |
|  |  |  | 3.2.3.3. | Demand By Application |  |
|  |  |  | 3.2.3.4. | Demand By Type |  |
|  |  |  | 3.2.3.5. | Demand By Sales Channel |  |
|  |  |  | 3.2.3.6. | Demand By Grade |  |
|  |  |  | 3.2.3.7. | Sales By Company |  |
|  |  | 3.2.4. | North America Epoxy Resin Demand Supply Outlook | | 48 |
|  |  |  | 3.2.4.1. | Capacity, Production |  |
|  |  |  | 3.2.4.2. | Operating Efficiency |  |
|  |  |  | 3.2.4.3. | Demand By Application |  |
|  |  |  | 3.2.4.4. | Demand By Type |  |
|  |  |  | 3.2.4.5. | Demand By Sales Channel |  |
|  |  |  | 3.2.4.6. | Demand By Grade |  |
|  |  |  | 3.2.4.7. | Sales By Company |  |
|  |  | 3.2.5. | South America Epoxy Resin Demand Supply Outlook | | 57 |
|  |  |  | 3.2.5.1. | Capacity, Production |  |
|  |  |  | 3.2.5.2. | Operating Efficiency |  |
|  |  |  | 3.2.5.3. | Demand By Application |  |
|  |  |  | 3.2.5.4. | Demand By Type |  |
|  |  |  | 3.2.5.5. | Demand By Sales Channel |  |
|  |  |  | 3.2.5.6. | Demand By Grade |  |
|  |  |  | 3.2.5.7. | Sales By Company |  |
|  |  | 3.2.6. | Middle East & Africa Epoxy Resin Demand Supply Outlook | | 63 |
|  |  |  | 3.2.6.1. | Capacity, Production |  |
|  |  |  | 3.2.6.2. | Operating Efficiency |  |
|  |  |  | 3.2.6.3. | Demand By Application |  |
|  |  |  | 3.2.6.4. | Demand By Type |  |
|  |  |  | 3.2.6.5. | Demand By Sales Channel |  |
|  |  |  | 3.2.6.6. | Demand By Grade |  |
|  |  |  | 3.2.6.7. | Sales By Company |  |
|  | **3.3** | Market Dynamics | | | 69 |
|  | **3.4** | Market Trends and Developments | | | 72 |
|  | **3.5** | Technology Evaluation | | | 73 |
|  | **3.6** | Pricing Analysis | | | 80 |
|  | **3.7** | Value Chain Analysis | | | 81 |
|  | **3.8** | Cost of Production | | | 85 |
|  | **3.9** | Customer Analysis | | | 86 |
|  | **3.10** | Global Foreign Trade Analysis | | | 91 |
|  | **3.11** | Global Demand-Supply Gap Analysis | | | 93 |
|  | **3.12** | Suggested Capacities | | | 97 |
|  | **4.3.5** | Major Equipment List | | | 99 |
|  | **4.3.7** | Raw Materials Required | | | 101 |
|  |  |  | | |  |

**Executive Summary**

**1. Brief insight about the company and project:**

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**Established - 1973 Turnover (Consolidated) - INR 5,39,238 Crore (FY Year 2020-21)**

* 1. **Overview of the Company:**
* Reliance Industries Limited is Indian based, one of the well-known brands involved in manufacturing and sales of diverse range of products including polymers, aromatics, elastomers etc. globally.
* The company caters customers and various industries viz., healthcare, automotive, packaging etc across over 70 countries worldwide.
* The company’s total production capacity of PE, PP and PVC is 2.3, 2.9 and 0.7 million MT per annum as of 2019.
* The company exported 1.1 million MT of polymers globally in 2019.
* The company has 6 state-of-the-art manufacturing facilities to produce polymers.

**1.2 Brief Profile of Board of Directors:**

**Mukesh Ambani:** Mr. Mukesh D. Ambani is a Chemical Engineer from the Institute of Chemical Technology, Mumbai (erstwhile the University Department of Chemical Technology, University of Mumbai). He pursued an MBA from Stanford University in the US. He has been on the Board of Reliance since 1977.

**Nita M. Ambani:** Mrs. Nita M. Ambani (DIN 03115198) is a Commerce Graduate from Mumbai University and a diploma holder in Early Childhood Education.

**Hital R. Meswani:** Mr. Hital R. Meswani (DIN 00001623) is a Management & Technology graduate from the University of Pennsylvania (UPenn) in the USA.

**Nikhil R. Meswani:** Nikhil Meswani is an Executive Director on the Board of Reliance. A chemical engineer from the University Institute of Chemical Technology (UICT) Mumbai, he joined Reliance in 1986.

**P.M.S. Prasad:** PMS Prasad is an Executive Director at Reliance and one of the longest serving members on the Board and the company.

**P.K. Kapil:** PK Kapil is an Executive Director on the Board of Reliance. With experience spanning four decades, he is a driving force in the HSE, Technology, Reliability and Operations of all manufacturing sites.

**R.A. Mashelkar:** RA Mashelkar is an independent Director on the Board of Reliance. An eminent scientist and champion of the Innovation Movement in India, he is the Chairman of Reliance Innovation Council.

**Adil Zainulbhai:** Adil Zainulbhai is an independent Director on the Board of Reliance. One of the world’s foremost consultants, he is a mechanical engineering graduate from IIT and holds an MBA from Harvard University.

**Mansingh L. Bhakta:** Mansingh Bhakta is an independent Director on the Board of Reliance. An advocate par excellence, he has almost six decades of experience.

**Dipak C. Jain:** Dipak Jain is an independent Director on the Board of Reliance. One of the world’s top educationalists, he is a former Dean of Kellogg School of Management and INSEAD.

**Dharam Vir Kapur:** Dharam Vir Kapur is an independent Director on the Board of Reliance. A technology, industrial development and project implementation expert, he has a long and illustrious career in the Indian government.

**Mahesh P. Modi:** Mahesh Modi is an independent Director on the Board of Reliance. He has in-depth management experience in the petrochemical, telecommunications, energy and insurance industries.

**Yogendra P. Trivedi:** Yogendra Trivedi is an independent Director on the Board of Reliance. He is an expert in the fields of economics, politics, education, sports, and social and professional services.

**Ashok Misra:** Ashok Misra is an independent Director on the Board of Reliance. An IIT Director from 2000-2008, Misra was the driving force behind its transformation into leading research and development institute.

* 1. **Brief Project summary**

The project is a greenfield project and for manufacturing of various types of epoxy resins such as Bisphenol-A and Bisphenol-F epoxy resin, cycloaliphatic epoxy resins, dimer acid modified epoxy resin and multifunctional epoxy resins (Epoxy-phenol Novolac resins and Epoxy-cresol Novolac resins. It falls under Category 5 (f) B, thereby the Environmental Clearance has to be obtained from SEAC, Gujarat.

**1.4. Key Highlights of the Project**

Considering the growing market scenario, Reliance Industries Limited proposes to enter into epoxy resin business. With the increasing demand (within India and across the globe, there is urgent need to world class epoxy resin manufacturing unit in India. The market of this product has gained pace tremendously and there are greater opportunities in the indigenous as well as export markets. Due to increasing demand of this product and to reduce the gap between demand and supply, the company proposes to manufacture various grade of epoxy resins.

Epoxy Resin (base liquid and blend), though produced indigenously, is also imported in substantial quantities into India. Moreover, the technology is totally proven and safe in all aspects. The project will help in bridging demand-supply gap and analyse its industrial development on a global scale. Various formulated resins have export potential.

Success for the project includes:

* Ease of Availability of skilled and non-skilled workers
* Cost Competitiveness
* Availability of well-developed infrastructure facility
* Positive impact on the socio-economic condition of the area in terms of direct and indirect employment due to the proposed project during construction / operation phase.
* India being the Top 10 preference for FDI Inflows in the country.
* India being the 4th largest producer of Chemicals in Asia Pacific region.
* India is 3rd largest consumer of polymers globally.
* Development of Industrial Corridors across the country.
* “AatmaNirbhar Bharat” and “Make in India” policies are pushing domestic manufacturer to come up with green field capacity.

**India Competitiveness for Setting Up Epoxy Resin Manufacturing Market**

*Source: TechSci Research*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Region / Country** | **Raw Material Sourcing** | **Product Demand** | **Capital Cost** | **Operating Cost** | **Project Implementation** | **Overall Attractiveness** |  |
| **Middle East** |  |  |  |  |  |  |  |
| **US** |  |  | Icon, bubble chart  Description automatically generated |  |  |  |  |
| **Europe** |  |  |  |  |  |  |  |
| **India** |  |  |  |  |  |  |  |
| **China** |  |  |  |  |  |  |  |
|  |  |  |  |  |  | Highly Attractive |  |
|  |  |  |  |  |  |  |  |

**Real GDP Growth Forecast for Major Economies**

|  |  |  |
| --- | --- | --- |
| **Country** | **2023** | **2025** |
| **India** | **7.95%** | **7.52%** |
| China | 5.75% | 5.60% |
| France | 2.32% | 1.76% |
| United Kingdom | 1.94% | 1.67% |
| Germany | 1.87 | 1.22% |
| United States | 2.35% | 1.86% |
| Russia | 2.15% | 1.85% |
| Japan | 1.26% | 0.72% |
| World | 3.84% | 3.56% |

*Source: TechSci Research*

**2. Product Profile**

**2.1. Product Overview (Introduction and Characteristics):**

Epoxy resins have a set of unique combinations of properties and performance characteristics. These are thermosetting polymer, which crosslink & polymerize when mixed with the catalytic agent or “Hardener”.

Epoxy resin is classified into standard epoxy resin and specialized epoxy resins. Standard epoxy resins include Bisphenol-A and Bisphenol-F epoxy resin, while specialized epoxy resins include cycloaliphatic epoxy resins, dimer acid modified epoxy resins and multifunctional epoxy resins (Epoxy phenol Novolac resins and Epoxy cresol Novolac resins).

**Bisphenol-A Type Epoxy Resin:** The most common epoxy resins are produced by reacting Epichlorohydrin (ECH) with Bisphenol A (BPA). This reaction produces BADGE or DGEBA (Bisphenol A DiGlycidyl Ether), which represents the smallest unit of a typical Epoxy Resin. Bisphenol A liquid epoxy resins are used in broad applications including coatings, civil engineering, adhesives, electrical insulating materials, and reactive intermediates.

**Bisphenol-F Epoxy Resin:** This can be manufactured from Bisphenol F by similar methods to those used for bisphenol A and epichlorohydrin with a catalyst such as NaOH. These resins have lower viscosities than the equivalent DGEBA. EEW (Epoxy Equivalent Weight (g/eq) value of Bisphenol F resin lies between 158-175 & viscosity 5000-7000 CPA at 25 degree Celsius.

**Multi-functional Epoxy Resins (Epoxy Phenol / Cresol Novolac Resins):** Epoxy phenol/cresol novolac (EPN) resins contain more than two epoxy groups per molecule and are therefore described as multifunctional epoxy resins. EPN resins are recommended in formulations for high-performance applications requiring excellent chemical resistance, solvent resistance and high temperature resistance than the standard bisphenol-based epoxy resin. These EPN resins are also used in blends with Bisphenol-A and F epoxy resins to improve the performance. Novolac resins, which are the reaction products from formaldehyde and excess phenol under acidic catalysis, when co-cured with high molecular weight solid bis-A epoxy resins result in coatings with excellent adhesion, film strength, flexibility, and chemical resistance. They are especially useful in powder coatings applications for corrosion resistant pipe reinforcing bars (rebars) and with brominated epoxy resins for FR3 electrical laminate production.

**Cycloaliphatic Epoxy Resins:** Cycloaliphatic epoxy resins are characterized by non-aromatic saturated rings in their molecular structures. These resins are ideally suited for applications where inherently low viscosity, excellent weathering and electrical performance are required. In India, Cycloaliphatic epoxy resins are mainly used in weather resistant solvent-based coatings for outdoor applications.

**2.2. Production Routes and Related Details**

Epoxy resin is usually synthesized by bulk polymerization. The material is available commercially at 98% purity & colourless. Many commercial liquid resins consist essentially of low molecular weight diglycidyl ether of Bisphenol A together with small quantity of higher molecular weight polymer. In general, production of bisphenol A epoxy resin is divided into one step method & two-step process method.

In one-step method, Bisphenol A reacts directly with epichlorohydrin in order to prepare epoxy resin, which commonly used for the synthesis of low to medium molecular weight (MW) epoxy resins.

The two-step method require continuation the reaction of low molecular weight resin with bisphenol A (BPA). High molecular weight (MW) epoxy resins can be synthesized via one step or in a two-step process.

**One Step Process (BADGE):** The one-step process proceeds via polycondensation reaction of epichlorohydrin (ECH) with bisphenol A (BPA)/

**Two Step Process:** The two-step process is the reaction of bisphenol A (BPA)

and epichlorohydrin (ECH) in presence of a catalyst (such as a quaternary ammonium salt). The first step is an addition reaction to form a diphenol-propane chlorohydrin ether as an intermediate. This closed loop reaction produces an epoxy resin.

**Production process of Solid Bisphenol A Epoxy Resin :**

**Taffy Process:** In taffy process,1-3 bisphenol A is reacted at 85–95°C in a controlled excess of epichlorohydrin (ECH) (to give polymer molecules along with glycidyl ether groups, at both ends) in the presence of Caustic and an inert solvent. This reaction is used to produce lower molecular weight (LMW) epoxides.

**Detailed Description of Taffy Process:** A mixture of bisphenol A and 10% aqueous sodium hydroxide solution is introduced in a reactor equipped with high-speed powerful agitator. The mixture is heated up to 45°C and ECH is added rapidly with agitation, giving off heat. The temperature is allowed to rise to 95°C, where it is maintained for approx. 80-85 min for the completion of reaction. Then agitation is stopped, and the mixture gets separate in two layers. The heavier aqueous layer is drawn off from bottom and the molten, taffy-like product is washed with hot water until the wash water gets a neutral pH. The taffy-like product is dried at 135°C to give a solid resin with softening point of 70-75 °C and an EEW value of 500. Alternatively, epichlorohydrin is removed by vacuum distillation at temperatures up to 180 °C approx. The crude resin is then dissolved in a secondary solvent (Toluene or Xylene) to facilitate water washing and salt removal. This secondary solvent is then recovered via vacuum distillation to obtain the resin product.

**Advancement Process:** For manufacturing of higher molecular weight epoxy resins, liquid epoxy resin (LER) is reacted with calculated amount of bisphenol A. Further, catalyst solution is added to boost the reaction and the temperature is maintained at approx. 160 °C. This process is known as "Advancement process". High molecular weight epoxides are manufactured by “Advancement” process using Benzyl trimethyl ammonium hydroxide as a catalyst.

Advancement process is widely practiced by coating producers to facilitate the handling of the high molecular weight, highly viscous epoxy resins used in many paint & coating formulations. The degree of polymerization is calculated by ratio of LER (formed from BADGE Process) to bisphenol A, an excess of the former provides epoxy terminal groups. The actual molecular weight obtained depends on purity of the starting materials, solvents & catalyst used. Reactive mono-functional groups are used as chain terminators to control the molecular weight and viscosity build.

In the advancement process, bisphenol A and a liquid BADGE resin (170–180 EEW) are heated in the presence of a catalyst and reacted (i.e., advanced) to form a high MW resin. This process is exothermic and proceeds rapidly to completion. In the cases of higher MW resins, exotherm temperature can reach >190-205°C. Reaction catalysts facilitate the rapid preparation of medium to high MW linear resins, also control side reactions inherent with epoxy resin preparations, e g, chain branching is done by addition of the epoxy group generated through chain-lengthening process with alcohol group. Nuclear Magnetic Resonance (NMR) spectroscopy method can be used to determine the extent of branching.

**2.3 Properties and Applications**

**Properties of all available grades of Epoxy Resin**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **BISPHENOL-A BASED LIQUID EPOXY RESINS** | | | |  | | **BISPHENOL-A BASED SOLID RESINS** | | | | | | | | |
|  | **EEW** | | **Viscosity @ 25°C** | |  | | **EEW (g/eg)** | | **Viscosity 25°C (mPa∙s)** | | | **Softening point (°C)** | | | |
|  | **g/eq** | | **mPa∙s** | |  | | 653 - 704 | | 375 - 475 | | | 80 - 90 | | | |
|  | 184 – 191 | | 11,000 - 15,000 | |  | | 769 - 847 | | 6,000 - 8,000 @ 150°C | | | Tg = Min 55 | | | |
|  | 213 – 233 | | 20,000 - 26,000 | |  | | 714 - 752 | | 500 - 600 | | | 95 - 101 | | | |
|  | 225 – 280 | | 450 - 800 | |  | | 781 - 855 | | 480 - 580 | | | 85 - 90 | | | |
|  | 180 - 187 | | 8,000 - 11,000 | |  | | 450 - 465 | | 160 - 190 | | | 65 - 75 | | | |
|  | 184 – 191 | | 11,000 - 15,000 | |  | | 833 - 893 | | 550 - 700 | | | 90 - 102 | | | |
|  | 280 – 300 | | 500 - 1,500 | |  | | 1,695 - 1,887 | | 1,800 - 2,600 | | | 110 - 120 | | | |
|  |  | |  | |  | | 2,381 - 2,941 | | 5,000 - 10,000 | | | 125 - 140 | | | |
|  | **BISPHENOL-F AND BISPHENOL-A/F BLENDS** | | | |  | | 847 - 926 | | 430 - 550 | | | 90 - 100 | | | |
|  | **EEW (g/eg)** | | **Viscosity 25°C (mPa∙s)** | |  | | 741 - 800 | | 600 - 700 | | | 95 - 101 | | | |
|  | 159 – 175 | | 2,000 - 5,000 | |  | | 862 - 935 | | 620 - 900 | | | 100 - 110 | | | |
|  | 164 – 172 | | 2,000 - 3,300 | |  | |  | |  | | |  | | | |
|  | 164 – 172 | | 3,300 - 4,100 | |  | | **BROMINATED RESINS** | | | | | | | | |
|  | 159 – 172 | | 5,000 - 7,000 | |  | | **EEW (g/eg)** | | **Viscosity 25°C (mPa∙s)** | | | **Bromine content %** | | | |
|  | 156 – 167 | | 1,200 - 1,600 | |  | | 450 - 500^2 | | 2,200 – 3,000 | | | 19 – 23 | | | |
|  | 172 – 180 | | 6,500 - 8,500 | |  | | 250 - 280 | | 700 – 1,100 @ 70°C | | | 21 – 26 | | | |
|  | 174 – 182 | | 4,500 - 6,500 | |  | | 319 - 410 | | – | | | 44 – 48 | | | |
|  | 185 – 196 | | 6 860 - 960 | |  | |  | |  | | |  | | | |
|  |  | |  | |  | | **SOLVENT CUT RESINS** | | | | | | | | |
|  | **EPOXY PHENOL NOVOLAC RESINS** | | | |  | | **EEW (g/eg)** | | **Viscosity 25°C (mPa∙s)** | | | **Non-volatile content %** | | | |
|  | **EEW (g/eg)** | | **Viscosity 25°C (mPa∙s)** | |  | | – | | 50 - 350 | | | 50 – 55 | | | |
|  | 172 – 179 | | 1,100 - 1,700 @ 52°C | |  | | – | | 50 - 350 | | | 50 – 55 | | | |
|  | 175 – 182 | | 20,000 - 50,000 @ 52°C | |  | | 294 - 323 | | 600 - 850 | | | 79 - 81 (150°C/1h) | | | |
|  | 215 – 231 | | 150 - 350 | |  | | 606 - 702 | | 9,000 - 13,000 | | | 74 - 76 (105°C/2h) | | | |
|  | 215 – 231 | | 800 - 1,500 | |  | | 606 - 741 | | 14,000 - 20,000 | | | 74 - 76 (105°C/2h) | | | |
|  | 167 - 179 | | 35,000 - 55,000 | |  | | 12500 | | 2,000 - 5,000 | | | 49 - 51 (160°C/2h) | | | |
|  | 167 - 182 | | 25,000 - 35,000 | |  | | 300 - 336 | | 3,500 - 7,000 | | | 79 - 81 | | | |
|  |  | |  | |  | |  | |  | | |  | | | |
|  | **CYCLOALIPHATIC RESINS** | | | |  | | **GLYCIDYL AMINE BASED MULTIFUNCTIONAL RESINS** | | | | | | | | |
|  | **EEW (g/eg)** | | **Viscosity 25°C (mPa∙s)** | |  | | **EEW (g/eg)** | | **Viscosity 25°C (mPa∙s)** | | | **HyCl %** | | | |
|  | 159 - 182 | | 500 - 1,100 | |  | | 117 - 134 | | 7,000 - 11,000 @ 50°C | | | Max 0.10 | | | |
|  | 180 - 200 | | 350 - 750 | |  | | 117 - 134 | | 10,000 - 12,000 @ 50°C | | | Max 0.10 | | | |
|  | 220 - 240 | | 2,000 - 4,000 | |  | | 117 - 134 | | 11,000 - 13,000 @ 50°C | | | Max 0.10 | | | |
|  | 210 - 230 | | 1,300 - 2,500 | |  | | 117 - 134 | | 13,000 - 15,000 @ 50°C | | | Max 0.10 | | | |
|  | 130 - 143 | | 250 - 450 | |  | | 117 - 134 | | 17,000 - 19,000 @ 50°C | | | Max 0.10 | | | |
|  |  | |  | |  | | 118 - 134 | | 7,000 - 19,000 @ 50°C | | | Max 0.10 | | | |
|  |  | |  | |  | | 111 - 117 | | 3,000 - 6,000 @ 50°C | | | Max 0.10 | | | |
|  | **ALKYL PHENOLIC RESINS** | | | |  | | 118 - 133 | | 7,000 - 12,000 | | | Max 0.10 | | | |
|  | **Methylol content %** | | **Softening point °C** | |  | | 105 - 115 | | 2,000 - 5,000 | | | Max 0.30 | | | |
|  | 44538 | | 65 - 80 | |  | | 95 - 106 | | 550 - 850 | | | Max 0.20 | | | |
|  | 14 - 17 | | 90 - 100 | |  | | 102 - 110 | | 7,000 - 13,000 | | | Max 0.30 | | | |
|  | 42705 | | 85 - 105 | |  | | 94 -102 | | 1,500 - 4,800 | | | Max 0.20 | | | |
|  | 44538 | | 70 - 90 | |  | | 118 - 135 | | 2,000 - 4,000 @ 50°C | | | Max 0.10 | | | |
|  |  | |  | |  | | 125 -143 | | 2,500 - 4,000 @ 50°C | | | Max 0.10 | | | |
|  |  | |  | |  | |  | |  | | |  | | | |
| **OTHER SPECIALTY RESINS** | | | | |  | **BENZOXAZINE RESINS** | | | | | | | |
| **EEW (g/eg)** | **Viscosity 25°C (mPa∙s)** | | **HyCl %** | |  | **EEW (g/eg)** | | | **Viscosity 25°C (mPa∙s)** | | | **Gel time @ 220°C (secs)** | |
| 168 - 175 | 4,000 - 5,500 | | Max 0.03 | |  | 60 - 80 | | | 1,000 - 7,000^2 @ 100°C | | | 200 - 450 | |
| 133 - 154 | 1,000 - 2,500 @ 50°C | | Max 0.20 | |  | 74% - 76% (solid content) | | | 100 - 400 | | | 380 - 420 | |
| 150 - 170 | 30 - 553 @ 150°C | | Max 0.05 | |  | 60 - 80 | | | 50 - 500^2 @ 125°C | | | 250 - 550 | |
| 225 - 240 | 1,000 - 1,5003 @ 85°C | | Max 0.05 | |  | |  | | |  | | |  | | |

**Major Applications of all available grades of Epoxy Resins**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Paints and Coatings (Coating Ingredients/ Ink Ingredients)** | **Electrical and Electronics (Impregnation/ Lamination/ FRP Molding)** | **Construction (Floor Coating Materials/ Linings/ Civil Engineering Repair Materials)** | **Adhesives/ Adhesive Ingredients** | **Composites** |
| Bisphenol A Liquid | \* |  | \* | \* |  |
| Bisphenol A Solid | \* |  | \* | \* |  |
| Bisphenol F | \* | \* | \* | \* |  |
| Brominated (Flame Retardant Types) |  | \* |  | \* |  |
| Cresol Novolac |  | \* |  | \* |  |
| Phenol/Modified Novolac | \* | \* |  | \* | \* |
| Cycloaliphatic Epoxy based Resin |  | \* |  | \* |  |

*\* Represent use of epoxy resin in the mapped application.*

**2.4 End of Life and Sustainability**

**Health, Safety & Environment (HSE):**

Epoxy resins are classified under different health standard such as Occupational Safety and Health Administration (OSHA)-USA, Workplace Hazardous Material Information System-Canada, EU-OSHA, etc. Health standard hazards are classified and mapped in the table below.

|  |  |
| --- | --- |
| Skin irritation | Category 2 |
| Eye irritation | **Category 2B** |
| Skin sensitisation | **Sub-category 1B** |

Epoxy resins have low potential to volatilize from water to air. Further, the material is toxic to aquatic life which may cause adversely impact the aquatic life.

**End of the life:** Epoxy Resin have shelf life of 24 months when stored in a controlled environment as per guidelines suggested by manufacturers when stored in sealed containers. Epoxy resin may crystallize.

**Chapter 3. Market Outlook and Relevance of the Project**

**3.1. Demand Supply Outlook – Global Epoxy Resin Market**

**Global Epoxy Resin Demand, By Volume (Thousand Tonnes), 2015–2030F**

**2021-2030**

**CAGR**

**5.19% By Volume**

**2015-2020**

**CAGR**

**3.44% By Volume**

*Source: TechSci Research*

**Global Epoxy Resin Demand-Supply Scenario, 2015-2030F (Thousand Tonnes)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameters** | **2015** | **2020** | **2021E** | **2025F** | **2030F** |
| **Installed Capacity** | 3766 | 4484 | 4519 | 4588 | 4588 |
| **Production** | 2866 | 3246 | 3485 | 3724 | 4119 |
| **Total Demand** | 2754 | 3261 | 3494 | 4400 | 5511 |
| **(Y-O-Y Growth Rate**  *(In Percentage)* | 4.25% | -3.08% | 7.14% | 5.45% | 4.37% |
| **Demand – Supply Gap** |  | | -9 | -676 | -1392 |

*Source: TechSci Research*

**Market Overview (Post Covid)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Demand Scenario** | **2020** | **2021E** | **2024F** | **2028F** | **2030F** |
| **Pessimistic** | **3261** | **3395.4** | **3718.2** | **4008.4** | **4120.8** |
| **Realistic** | **3261** | **3493.9** | **4172.3** | **5055.4** | **5511.3** |
| **Optimistic** | **3261** | **3575.7** | **4580.3** | **6100.3** | **6974.0** |

**Global Epoxy Resin Demand Outlook, Realistic,**

Growing Usage for the construction of wind turbine blades

Increased demand of brominated and waterborne epoxy resin

Import disruption and unavailability of feedstock resulted in lower operating rate in 2020 and H1 2021

Sharp recovery in growth across the primary markets like automotive and aerospace

**Optimistic and Pessimistic, 2021E - 2030F**

Market Leader such as Hexion, Olin, Huntsman and Kukdo are leveraging their market position to benefit from secular growth trends in composite sector

*Source: TechSci Research*

* Market Leader such as Hexion, Olin, Huntsman and Kukdo are leveraging their market position to benefit from secular growth trends in composite sector.
* Wind energy segment will be key drivers for specialized epoxy resin. Global wind energy installation is expected to grow in the 8.0 percent range in next 9 years due to rising awareness in developing countries like India and China.
* Technology enhancement, recovery in housing sector and infrastructure developments are likely to drive future growth.
* Specialty epoxy resin used with carbon composites help in weight reduction, fuel saving and CO2 emission from automobiles. Lightweight material usage in auto sector is anticipated to increase from 28% in 2015 to 47% by 2030.
* The growth of the market is majorly attributed to the reviving economy of the India, China, European Union, GCC Nations and Latin American countries and growing focus on infrastructural development by public and private entities.

**3.1.1. & 3.1.2. Capacity By Company & Location**

**Global Epoxy Resin Capacity, By Company (Thousand Tonnes), 2015-2030F**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Company** | **Location** | **Capacity** | | | | |
| **2015** | **2020** | **2021E** | **2025F** | **2030F** |
| Olin Corporation | USA | 170 | 170 | 170 | 170 | 170 |
| Germany | 170 | 245 | 245 | 245 | 245 |
| Brazil | 33 | 33 | 33 | 33 | 33 |
| Italy | 20 | 20 | 20 | 20 | 20 |
| China | 41 | 41 | 41 | 41 | 41 |
| Kukdo Chemical Co., Ltd. | China | 80 | 200 | 200 | 200 | 200 |
| South Korea | 160 | 160 | 160 | 160 | 160 |
| India | 0 | 40 | 40 | 40 | 40 |
| Huntsman Corporation20 | China | 64 | 64 | 64 | 64 | 64 |
| USA | 70 | 70 | 70 | 70 | 70 |
| Switzerland | 50 | 120 | 120 | 120 | 120 |
| Brazil | 10 | 10 | 10 | 10 | 10 |
| Nan Ya Electronic Material (Kunshan) Co. Ltd. | China | 247 | 247 | 247 | 247 | 247 |
| Hexion Inc. | Netherlands | 70 | 100 | 100 | 100 | 100 |
| USA | 127 | 127 | 127 | 127 | 127 |
| Spain | 10 | 32 | 32 | 32 | 32 |
| Jiangsu Sanmu Group | China | 170 | 220 | 220 | 220 | 220 |
| Nan Ya Plastics Co Ltd | China | 210 | 210 | 230 | 230 | 230 |
| The Dow Chemical Company | China | 41 | 41 | 41 | 41 | 41 |
| USA | 60 | 60 | 60 | 60 | 60 |
| South Korea | 30 | 30 | 30 | 30 | 30 |
| Germany | 30 | 30 | 30 | 30 | 30 |
| Japan | 40 | 40 | 40 | 40 | 40 |
| Aditya Birla Chemicals Ltd. | India | 44 | 66 | 66 | 90 | 90 |
| Thailand | 38 | 100 | 100 | 100 | 100 |
| Nantong Xincheng Synthetic Material Co Ltd | China | 120 | 130 | 130 | 130 | 130 |
| Nippon Steel Chemical & Material Co., Ltd. | Japan | 100 | 120 | 120 | 120 | 120 |
| NAMA Chemicals | Saudi Arabia | 120 | 120 | 120 | 120 | 120 |
| Zhuhai Hongchang Electronic Material Co Ltd | China | 117 | 117 | 117 | 117 | 117 |
| Chang Chung Plastics Co Ltd | Taiwan | 50 | 100 | 100 | 100 | 100 |
| Jiangsu Yangnong Kumho Chemical Co., Ltd. | China | 75 | 95 | 95 | 95 | 95 |
| Sinopec Baling Petrochemical Co.,Ltd | China | 60 | 80 | 80 | 80 | 80 |
| Kumho P&B Chemicals | South Korea | 70 | 80 | 80 | 90 | 90 |
| Changchun Chemical (Jiangsu) Co., Ltd. | China | 75 | 75 | 75 | 75 | 75 |
| Spolchemie A.S. | Czech Republic | 60 | 60 | 60 | 60 | 60 |
| Alchemie Ltd. | United Kingdom | 60 | 60 | 60 | 60 | 60 |
| Anhui Shanfu New Material Technology Co., Ltd. | China | 58 | 58 | 58 | 58 | 58 |
| Dalian Qihua New Material Co. Ltd. | China | 50 | 50 | 50 | 50 | 50 |
| Atul Limited | India | 30 | 40 | 40 | 50 | 50 |
| Japan Epoxy Resins | Japan | 40 | 40 | 40 | 40 | 40 |
| LEUNA-Harze GmbH | Germany | 40 | 40 | 40 | 40 | 40 |
| Izel Kimya | Turkey | 40 | 40 | 40 | 40 | 40 |
| Ciech Sarzyna | Poland | 30 | 30 | 30 | 30 | 30 |
| SIR Industriale SpA | Italy | 20 | 20 | 20 | 20 | 20 |
| Meghmani Finechem Limited | India | 0 | 0 | 0 | 25 | 25 |
| Others | Rest of Global | 566 | 653 | 668 | 668 | 668 |
| Total |  | 3766 | 4484 | 4519 | 4588 | 4588 |

*Source: TechSci Research*

Majority of epoxy resin capacities are strategically located in China. Rising industrialization and urbanization in developing nations such as India and China will influence the Epoxy Resin producers to expand the capacity in this region. Also, favorable government policies for renewables influences major epoxy resin producers to setup capacity in these countries. On the other hand, Capacities located in Western European and North American countries will show a moderate growth in expansion due to the market slowly reaching to its maturity in these regions. Also, government regulation to commercialize capacity is more stringent in these regions compared to Asia Pacific.

**Annual Wind Installation Required Under IEA’s NZE2050, (In GW)**

**3.1.4. Production By Company**

**Global Epoxy Resin Production, By Company (Thousand Tonnes), 2015-2030F**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Company** | **2015** | **2020** | **2021E** | **2025F** | **2030F** |
| Olin Corporation | 324 | 337 | 368 | 408 | 442 |
| Kukdo Chemical (Kunshan) Co., Ltd. | 187 | 238 | 258 | 262 | 291 |
| Nan Ya Electronic Material (Kunshan) Co. Ltd. | 201 | 204 | 213 | 210 | 235 |
| Hexion Inc. | 160 | 180 | 196 | 210 | 236 |
| Huntsman Corporation | 144 | 177 | 179 | 188 | 212 |
| Jiangsu Sanmu Group | 137 | 165 | 175 | 172 | 198 |
| Nan Ya Plastics Co Ltd | 158 | 160 | 187 | 196 | 212 |
| The Dow Chemical Company | 149 | 153 | 156 | 162 | 178 |
| Nantong Xincheng Synthetic Material Co Ltd | 99 | 100 | 106 | 101 | 117 |
| Nippon Steel Chemical & Material Co., Ltd. | 82 | 99 | 97 | 106 | 114 |
| Zhuhai Hongchang Electronic Material Co Ltd | 102 | 91 | 98 | 99 | 111 |
| NAMA Chemicals | 91 | 90 | 88 | 94 | 106 |
| Aditya Birla Chemicals (Thailand) Ltd. | 29 | 74 | 81 | 88 | 92 |
| Jiangsu Yangnong Kumho Chemical Co., Ltd. | 61 | 71 | 76 | 74 | 86 |
| Chang Chung Plastics Co Ltd | 37 | 69 | 77 | 80 | 90 |
| Sinopec Baling Petrochemical Co.,Ltd | 51 | 67 | 69 | 68 | 76 |
| Kumho P&B Chemicals | 55 | 57 | 61 | 72 | 79 |
| Changchun Chemical (Jiangsu) Co., Ltd. | 64 | 57 | 60 | 59 | 68 |
| Grasim Industries Ltd. | 28 | 49 | 50 | 77 | 81 |
| Anhui Shanfu New Material Technology Co., Ltd. | 45 | 48 | 50 | 49 | 55 |
| Spolchemie A.S. | 44 | 44 | 45 | 48 | 53 |
| Alchemie Ltd. | 44 | 42 | 47 | 49 | 54 |
| Dalian Qihua New Material Co. Ltd. | 41 | 41 | 40 | 39 | 45 |
| Izel Kimya | 31 | 34 | 35 | 36 | 38 |
| Atul Ltd. | 19 | 29 | 32 | 44 | 45 |
| Japan Epoxy Resins | 30 | 28 | 29 | 30 | 34 |
| LEUNA-Harze GmbH | 30 | 24 | 26 | 28 | 31 |
| Ciech Sarzyna | 20 | 20 | 23 | 24 | 26 |
| Hindustan Speciality Chemicals | 0 | 16 | 21 | 25 | 25 |
| SIR Industriale | 15 | 14 | 15 | 16 | 18 |
| Kukdo Chemical India Private Limited | 0 | 0 | 22 | 80 | 85 |
| Meghmani Finechem Ltd | 0 | 0 | 0 | 13 | 21 |
| Others | 390 | 469 | 507 | 519 | 567 |
| Total | 2866 | 3246 | 3485 | 3724 | 4119 |

*Source: TechSci Research*

**3.1.5. Operating Efficiency By Company**

**Global Epoxy Resin Capacity, Operating Efficiency, By Company (Percentage), 2015-2030F**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Company | Operating Efficiency (%) | | | | |
| 2015 | 2020 | 2021E | 2025F | 2030F |
| Aditya Birla Chemicals (Thailand) Ltd. | 78 | 74 | 81 | 88 | 92 |
| Alchemie Ltd. | 73 | 70 | 79 | 82 | 90 |
| Anhui Shanfu New Material Technology Co., Ltd. | 77 | 83 | 86 | 85 | 95 |
| Atul Ltd. | 62 | 72 | 80 | 88 | 90 |
| Chang Chung Plastics Co Ltd | 73 | 69 | 77 | 80 | 90 |
| Changchun Chemical (Jiangsu) Co., Ltd. | 86 | 76 | 80 | 78 | 90 |
| Ciech Sarzyna | 65 | 68 | 78 | 80 | 88 |
| Dalian Qihua New Material Co. Ltd. | 83 | 81 | 80 | 78 | 90 |
| Grasim Industries Ltd. | 64 | 75 | 75 | 85 | 90 |
| Hexion Inc. | 77 | 70 | 75 | 81 | 91 |
| Huntsman Corporation | 74 | 67 | 68 | 71 | 80 |
| Izel Kimya | 77 | 85 | 87 | 90 | 95 |
| Japan Epoxy Resins | 74 | 71 | 73 | 75 | 85 |
| Jiangsu Sanmu Group | 80 | 75 | 80 | 78 | 90 |
| Jiangsu Yangnong Kumho Chemical Co., Ltd. | 81 | 75 | 80 | 78 | 90 |
| Kukdo Chemical (Kunshan) Co., Ltd. | 78 | 66 | 72 | 73 | 81 |
| Kukdo Chemical India Private Limited | 0 | 0 | 55 | 80 | 85 |
| Kumho P&B Chemicals | 79 | 72 | 76 | 80 | 88 |
| LEUNA-Harze GmbH | 75 | 59 | 65 | 70 | 78 |
| Meghmani Finechem Ltd | 0 | 0 | 0 | 50 | 85 |
| NAMA Chemicals | 76 | 75 | 73 | 78 | 88 |
| Nan Ya Electronic Material (Kunshan) Co. Ltd. | 81 | 83 | 86 | 85 | 95 |
| Nan Ya Plastics Co Ltd | 75 | 76 | 81 | 85 | 92 |
| Nantong Xincheng Synthetic Material Co Ltd | 83 | 77 | 82 | 78 | 90 |
| Nippon Steel Chemical & Material Co., Ltd. | 82 | 82 | 81 | 88 | 95 |
| Olin Corporation | 75 | 66 | 72 | 80 | 87 |
| Sinopec Baling Petrochemical Co.,Ltd | 86 | 84 | 86 | 85 | 95 |
| SIR Industriale | 73 | 72 | 77 | 80 | 90 |
| Spolchemie A.S. | 74 | 74 | 75 | 80 | 88 |
| The Dow Chemical Company | 74 | 76 | 78 | 81 | 88 |
| Zhuhai Hongchang Electronic Material Co Ltd | 87 | 78 | 84 | 85 | 95 |
| Hindustan Speciality Chemicals | 0 | 53 | 70 | 83 | 83 |
| Others | 69 | 80 | 84 | 81 | 87 |

*Source: TechSci Research*

**3.1.6. Demand By Type**

**Global Epoxy Resin Demand, By Type, 2015–2030F**

*.*

*Source: TechSci Research*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Demand by Type (Thousand Tonnes)** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021E** | **2025F** | **2030F** |
| Bisphenol A Based Resin | 2291 | 2401 | 2579 | 2636 | 2780 | 2689 | 2872 | 3585 | 4415 |
| Bisphenol F Based Resin | 95 | 103 | 115 | 118 | 134 | 137 | 150 | 217 | 315 |
| Epoxy Phenol Novolac Based Resin | 64 | 69 | 72 | 78 | 82 | 81 | 89 | 118 | 160 |
| Cycloaliphatic Epoxy Based Resin | 56 | 57 | 61 | 61 | 64 | 59 | 65 | 82 | 116 |
| Others | 248 | 261 | 284 | 294 | 305 | 295 | 319 | 398 | 505 |
| **Total** | **2754** | **2891** | **3110** | **3187** | **3365** | **3261** | **3494** | **4400** | **5511** |

*Source: TechSci Research*

**3.1.7. Demand By Grade**

**Global Epoxy Resin Demand, By Grade, By Volume, 2015–2030F**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Demand by Grade** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021E** | **2025F** | **2030F** |
| Liquid | 1414 | 1493 | 1602 | 1655 | 1748 | 1695 | 1833 | 2315 | 2911 |
| Semi-Solid | 250 | 261 | 275 | 277 | 288 | 284 | 289 | 357 | 430 |
| Solid | 1090 | 1138 | 1234 | 1255 | 1328 | 1283 | 1371 | 1727 | 2170 |
| **Total** | **2754** | **2891** | **3110** | **3187** | **3365** | **3261** | **3494** | **4400** | **5511** |

*Source: TechSci Research*

**3.1.8. Demand By Sales Channel**

**Global Epoxy Resin Demand, By Sales Channel, By Volume, 2015–2030F**

*Source: TechSci Research*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Demand by Sales Channel** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** |
| Direct Company Sale | 1535 | 1615 | 1767 | 1818 | 1931 | 1899 |
| Indirect | 1219 | 1276 | 1343 | 1369 | 1433 | 1362 |
| **Total** | **2754** | **2891** | **3110** | **3187** | **3365** | **3261** |

*Source: TechSci Research*

**3.1.9. Demand By Application**

**Global Epoxy Resin Demand, By Application, By Volume, 2015–2030F**

*.*

*Source: TechSci Research*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Demand by Application** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021E** | **2025F** | **2030F** |
| Paints & Coatings | 1170 | 1238 | 1332 | 1362 | 1440 | 1386 | 1493 | 1902 | 2400 |
| Electrical & Electronics | 699 | 737 | 800 | 821 | 871 | 843 | 911 | 1159 | 1460 |
| Construction | 251 | 262 | 282 | 289 | 307 | 291 | 311 | 394 | 497 |
| Composite Materials | 328 | 347 | 370 | 380 | 400 | 381 | 407 | 506 | 630 |
| Adhesives | 172 | 185 | 198 | 204 | 214 | 208 | 223 | 283 | 356 |
| Others | 134 | 122 | 128 | 131 | 133 | 153 | 148 | 156 | 169 |
| **Total** | **2754** | **2891** | **3110** | **3187** | **3365** | **3261** | **3494** | **4400** | **5511** |

*Source: TechSci Research*

**3.1.10. Sales By Company**

**Global Epoxy Resin Sales, By Company, By Volume, 2020**

*Others include Poliya, Hexion Inc., DIC Corporation, Saudi Arabia Industrial Resins Ltd.., Reinhold GmbH, Interplastic Corporation, Allnex Group, Sewon Chemical, Innovative Resins Pvt. Ltd., Orson Chemicals etc.*

*Source: TechSci Research*

**3.1.11. Demand By Region**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Region/Country** | **2015** | **2020** | **2021E** | **2025F** | **2030F** | **CAGR (2015-2020)** | **CAGR (2021E-2030F)** |
| Asia Pacific | 1594.5 | 2040.1 | 2200.4 | 2870.5 | 3675.0 | 5.1% | 5.9% |
| China | 1204.8 | 1558.9 | 1713.7 | 2279.7 | 2924.4 | 5.3% | 6.1% |
| South Korea | 76.8 | 90.6 | 97.0 | 120.5 | 156.4 | 3.3% | 5.4% |
| India | 65.4 | 88.8 | 98.1 | 139.8 | 207.7 | 6.3% | 8.7% |
| Others | 247.4 | 301.8 | 291.6 | 330.4 | 386.4 | 4.1% | 3.2% |
| Global APAC (Percentage Share) | 57.9% | 62.6% | 63.0% | 65.2% | 66.7% |  |  |
| Europe | 506.8 | 550.6 | 582.0 | 675.1 | 821.8 | 1.7% | 3.9% |
| Germany | 131.0 | 153.0 | 161.4 | 191.6 | 226.2 | 3.2% | 3.8% |
| Spain | 29.2 | 31.4 | 33.0 | 38.2 | 44.4 | 1.5% | 3.4% |
| Italy | 68.5 | 65.1 | 68.8 | 80.7 | 94.0 | -1.0% | 3.5% |
| Others | 278.2 | 301.0 | 318.9 | 364.6 | 457.2 | 1.6% | 4.1% |
| Global Europe (Percentage Share) | 18.4% | 16.9% | 16.7% | 15.3% | 14.9% |  |  |
| North America | 298.9 | 316.6 | 334.7 | 397.0 | 465.3 | 1.2% | 3.7% |
| USA | 240.5 | 253.0 | 260.3 | 291.4 | 326.6 | 1.0% | 2.6% |
| Canada | 36.8 | 47.2 | 56.8 | 84.1 | 112.0 | 5.1% | 7.8% |
| Others | 21.5 | 16.4 | 17.6 | 21.6 | 26.7 | -5.2% | 4.7% |
| Global North America (Percentage Share) | 10.9% | 9.7% | 9.6% | 9.0% | 8.4% |  |  |
| South America | 79.6 | 82.9 | 87.6 | 104.7 | 124.0 | 0.8% | 3.9% |
| Brazil | 58.7 | 62.6 | 65.8 | 78.5 | 93.1 | 1.3% | 3.9% |
| Others | 20.9 | 20.3 | 21.8 | 26.2 | 30.9 | -0.6% | 4.0% |
| Global South America (Percentage Share) | 2.9% | 2.5% | 2.5% | 2.4% | 2.2% |  |  |
| Middle East and Africa | 273.9 | 271.0 | 289.2 | 352.5 | 425.3 | -0.2% | 4.4% |
| Saudi Arabia | 54.6 | 60.1 | 63.5 | 80.5 | 107.7 | 1.9% | 6.1% |
| Turkey | 21.2 | 20.5 | 21.3 | 26.0 | 35.3 | -0.7% | 5.8% |
| Others | 198.0 | 190.4 | 204.4 | 246.0 | 282.3 | -0.8% | 3.7% |
| Global MEA (Percentage Share) | 9.9% | 8.3% | 8.3% | 8.0% | 7.7% |  |  |

*Source: TechSci Research*

Region wise, Asia Pacific holds the major share of the global demand for Epoxy Resin with a market share of 62.6% in 2020, which is expected to rise gradually during the forecast period to around 66.68% in 2030. Epoxy Resin has major applications in areas like wind energy, automotive, electrical & electronics and other areas having a demand for high-performance materials with chemical resistance properties. Asia pacific, being home to the China & India are the developing & world’s most populated country, so demand can directly link to this & simultaneously expected to have high demand in the forecast period. With the countries moving towards more and more sustainable energy solutions, the demand for wind energy is expected to grow exponentially in Asia Pacific during the forecast period; hence the region will keep the lion’s share of global demand for Epoxy Resin.

**India Demand Supply Scenario 2015 – 2030F**

**India Epoxy Resin Capacity & Production, By Volume, 2015 - 2030F (Thousand Tonnes)**

*Source: TechSci Research*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Company | Location | 2015 | 2020 | 2030F |
| Kukdo Chemical India Private Limited | Gujarat | 0 | 40 | 40 |
| Grasim Industries Ltd. | Gujarat | 44 | 66 | 90 |
| Atul Limited | Gujarat | 30 | 40 | 50 |
| Meghmani Finechem Limited | Gujarat | 0 | 0 | 25 |
| Hindusthan Specialty Chemicals Ltd | Gujarat | 0 | 30 | 30 |
| Others |  | 0 | 0 | 0 |
| Total |  | 74 | 176 | 235  *Source: TechSci Research* |

* Apart from Grasim Industries, Atul Ltd., Hindustan Specialty and Kukdo Chemical, who manufacture the Virgin Epoxy Resin in addition to formulations and downstream products, around 10 to 15 small units are also engaged in making formulations of epoxies and epoxy-based products. Epoxy Resin, though produced indigenously, is also imported in substantial quantity into India. Both the raw materials, Bisphenol-A and Epichlorohydrin are imported. Meghmani Finechem Ltd. will become the first manufacturer of ECH with capacity of 50 KTPA.

* + Aditya Birla Epoxy India Ltd, renamed as Grasim Industries India Ltd. (Chemicals Division) is the largest manufacturer of basic Epoxy Resin with installed capacity of 66 KTPA. This project was commissioned during the year 2013.
  + Atul Ltd., part of the Lalbhai Group, is the second largest producer of Epoxy Resins located at Valsad, Gujarat. The company has a capacity of 40 KTPA for manufacturing Epoxy Resin.

**India Epoxy Resin Demand, By Volume (Thousand Tonnes), 2015-2030F**

*Source: TechSci Research*

**2021-2030F**

**CAGR**

**8.69% By Volume**

**2015-2020**

**CAGR**

**6.31% By Volume**

*Source: TechSci Research*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Approach: Growth Forecast Via Factors (Impact Analysis)** | | | | |  |
| **Factors** | **Sources** | **Value** | **CAGR** | **Weightage** |  |
| **GDP Growth Rate (2021-2030 Period\_** | ***World Bank, TechSci Estimates*** | ***Forecast*** | 7.50% | 12% |  |
| **GDP Per Capita (%)** | ***World Bank, TechSci Estimates*** | ***Forecast*** | 5.09% | 3% |  |
| **Average Selling Growth (%)** | ***TechSci Research Estimates*** | ***Forecast*** | 2.50% | 3% |  |
| **Growth in Construction Sector** | ***TechSci Research Estimates*** | ***Forecast*** | 8.85% | 21% |  |
| **Growth in Renewable Sector** | ***TechSci Research Estimates*** | ***Forecast*** | 9.50% | 23% |  |
| **Growth in Automotive Sector** | ***OICA, SIAM*** | ***Forecast*** | 7.80% | 14% |  |
| **Paint & Coating Industry Growth** | ***Industry Sources & TechSci Research Estimates*** | ***Forecast*** | 10.50% | 24% |  |
| **Market Growth in Historical Period (2015-2020)** | ***Industry Sources & TechSci Research Estimates*** | ***Historical*** | 7.11% | 1% |  |
| **CAGR (2021-2030)** | **8.69%** | | | |  |

TechSci Research has followed this approach to calculate the growth rates by understanding the impact of various factors of the industry. These factors were given weightage according to the relative importance of each factor. Finally, each factor was multiplied with its weightage and their sum was used to calculate market growth.

**India Trade Dynamics, By Value (USD million), By Volume (Thousand tonnes), 2019 - 2021**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Imported Country | 2019 | | 2020 | | 2021 | |
|  | Value | Volume | Value | Volume | Value | Volume |
| South Korea | 24.84 | 9.31 | 32.21 | 14.41 | 36.30 | 14.96 |
| China | 8.98 | 2.40 | 8.76 | 2.64 | 5.92 | 2.20 |
| Taiwan | 7.89 | 2.58 | 7.05 | 2.66 | 5.82 | 1.78 |
| Japan | 10.37 | 1.85 | 9.73 | 1.55 | 9.87 | 1.37 |
| Netherland | 4.93 | 1.68 | 5.41 | 1.99 | 4.02 | 1.14 |
| Others | 32.35 | 8.55 | 30.02 | 8.81 | 28.21 | 8.36 |
| Total | 89.36 | 26.37 | 93.18 | 32.05 | 90.14 | 29.81 |
| Exported Country | 2019 | | 2020 | | 2021 | |
|  | Value | Volume | Value | Volume | Value | Volume |
| Germany | 18.92 | 7.18 | 12.07 | 5.59 | 13.10 | 5.61 |
| Italy | 19.70 | 7.89 | 14.51 | 6.96 | 10.64 | 4.51 |
| United Arab Emirates | 13.28 | 5.02 | 7.88 | 3.54 | 4.72 | 1.72 |
| Saudi Arabia | 2.81 | 1.13 | 2.11 | 0.95 | 2.46 | 0.98 |
| Turkey | 1.57 | 0.54 | 2.78 | 0.95 | 2.88 | 0.85 |
| Others | 24.13 | 7.90 | 20.46 | 7.47 | 16.58 | 5.66 |
| Total | 80.41 | 29.66 | 59.81 | 25.47 | 50.38 | 19.32 |

*Source: DGFT*

**3.2.2.1. Demand By Application**

**India Epoxy Resin Demand, By Application, By Volume, 2015–2030F**

*Others Marine, Defence, Encapsulation etc .*

*Source: TechSci Research*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Demand by Application** | **2015** | **2016** | **2017** | **2018** | **2019E** | **2020F** | **2021F** | **2025F** | **2030F** |
| Paints & Coatings | 26 | 29 | 32 | 35 | 39 | 46 | 40 | 57 | 85 |
| Electrical & Electronics | 15 | 17 | 18 | 20 | 23 | 26 | 23 | 33 | 50 |
| Construction | 7 | 7 | 8 | 9 | 10 | 12 | 10 | 15 | 22 |
| Composite Materials | 5 | 5 | 6 | 7 | 8 | 9 | 8 | 11 | 17 |
| Adhesives | 4 | 4 | 4 | 5 | 6 | 6 | 6 | 8 | 13 |
| Others | 3 | 3 | 3 | 4 | 4 | 4 | 3 | 5 | 6 |
| **Total** | **65** | **72** | **80** | **89** | **103** | **89** | **129** | **193** | **208** |

*Source: TechSci Research*

The rapid growth in the Indian paints and coatings industry (mainly automotive, industrial coatings, Medical Sector & wind energy) is expected to propel the growth of the epoxy resins market during the forecast period. Epoxy resin is extensively used in electrical and energy distribution systems as adhesives, coatings and sealants, also in the manufacturing of transformers, insulators and bushings (these are used as protective coatings in large generators & on printed circuit board). In Commercial construction, it provides particularly strong bonding adhesives, sealants and fillers, epoxy resins are suitable for internal and external use given them strength, durability and chemical resistance of mechanical fixings and to repair bridge & decks.

**3.2.2.2. Demand By Grade**

**India Epoxy Resin Demand, By Grade, By Volume, 2015–2030F**

*Source: TechSci Research*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Demand by Grade** | **2015** | **2016** | **2017** | **2018** | **2019E** | **2020F** | **2021F** | **2025F** | **2030F** |
| Liquid | 30 | 33 | 36 | 41 | 47 | 41 | 59 | 90 |  |
| Semi-Solid | 4 | 5 | 5 | 6 | 7 | 6 | 8 | 12 |  |
| Solid | 31 | 34 | 38 | 43 | 49 | 42 | 61 | 91 |  |
| **Total** | **65** | **72** | **80** | **89** | **103** | **89** | **129** | **193** |  |

*Source: TechSci Research*

**3.2.2.3. Demand By Type**

**India Epoxy Resin Demand, By Type, By Volume, 2015–2030F**

*Source: TechSci Research*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Demand by Type** | **2015** | **2016** | | **2017** | | **2018** | | **2019E** | | **2020F** | | **2021F** | | **2025F** | | **2030F** | |
| Bisphenol A Based Resin | 52 | | 57 | | 63 | | 69 | | 78 | | 89 | | 77 | | 110 | | 162 | |
| Bisphenol F Based Resin | 1 | | 1 | | 1 | | 2 | | 2 | | 3 | | 3 | | 4 | | 7 | |
| Epoxy Phenol Novolac Based Resin | 1 | | 1 | | 1 | | 2 | | 2 | | 2 | | 2 | | 3 | | 6 | |
| Cycloaliphatic Epoxy Based Resin | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 2 | | 4 | |
| Others | 4 | | 5 | | 5 | | 6 | | 7 | | 7 | | 6 | | 10 | | 15 | |
| **Total** | **59** | | **65** | | **72** | | **80** | | **89** | | **103** | | **89** | | **129** | | **193** | |

*Source: TechSci Research*

**3.1.10. Sales By Company**

**India Epoxy Resin Sales, By Company, By Volume, 2020**

*Source: TechSci Research*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Demand Volume (Thousand Tonnes)** | **FY 2020** | **2021E** |  | **FY 2020** | **FY 2021** |
| Grasim Industries Ltd. | 68.0 | 71.6 |  | 12.26% | 18.78% |
| Atul Ltd. | 38.7 | 39.2 |  | 41.27% | 41.34% |
| Hindustan Specialty Chemicals Ltd | 20.2 | 32.6 |  | 23.45% | 22.62% |
| Others (Nan Ya Plastics, Kukdo Japan, Aditya Birla Thailand, Hexion) | 38.0 | 29.9 |  | 23.02% | 17.26% |

*Source: TechSci Research*

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**ASIA PACIFIC EPOXY RESIN MARKET OUTLOOK**

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**APAC Epoxy Resin Capacity & Production, By Volume, 2015 - 2030F (Thousand Tonnes)**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | 2015 | 2020 | 2030F |
| Kukdo Chemical (Kunshan) Co., Ltd. | 240 | 360 | 360 |
| Nan Ya Electronic Material (Kunshan) Co. Ltd. | 247 | 247 | 247 |
| Jiangsu Sanmu Group | 170 | 220 | 220 |
| Nan Ya Plastics Co Ltd | 210 | 210 | 230 |
| Nantong Xincheng Synthetic Material Co Ltd | 120 | 130 | 130 |
| Others | 1347 | 1689 | 1773 |
| Total | 2334 | 2856 | 2960 |

*Source: TechSci Research*

**3.2.1. Asia Pacific Demand Supply Outlook**

**Asia Pacific Epoxy Resin Demand, By Volume (Thousand Tonnes), 2015–2030F**

*Source: TechSci Research*

**2021E-2030F**

**CAGR**

**5.86% By Volume**

**2015-2020**

**CAGR**

**5.05%% By Volume**

**3.2.1.2. Operating Efficiency**

**Asia Pacific Epoxy Resin Operating Efficiency (Percentage), 2015-2030F**

**Asia Pacific Growth Trend in Foreign Direct Investment, (USD Billion), 2010, 2019 & 2025F**

**3.2.1.3. Demand By Application**

**Asia Pacific Epoxy Resin Demand, By Application, By Volume, 2015–2030F**

*Others Marine, Defence, Encapsulation etc.*

*Source: TechSci Research*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Demand by Application** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021E** | **2025F** | **2030F** |
| Paints & Coatings | 702 | 747 | 825 | 850 | 907 | 897 | 971 | 1278 | 1646 |
| Electrical & Electronics | 450 | 476 | 529 | 546 | 583 | 578 | 625 | 818 | 1050 |
| Construction | 144 | 153 | 170 | 176 | 190 | 184 | 199 | 260 | 334 |
| Composite Materials | 140 | 147 | 164 | 169 | 181 | 178 | 192 | 252 | 324 |
| Adhesives | 100 | 105 | 116 | 121 | 128 | 128 | 138 | 181 | 233 |
| Others | 58 | 55 | 60 | 62 | 64 | 76 | 77 | 82 | 88 |
| **Total** | **1594** | **1683** | **1864** | **1924** | **2053** | **2040** | **2200** | **2870** | **3675** |

*Source: TechSci Research*

**3.2.1.4. Demand By Type**

**Asia Pacific Epoxy Resin Demand, By Type, By Volume, 2015–2030F**

*Source: TechSci Research*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Demand by Type** | **2015** | **2016** | **2017** | **2018** | **2019E** | **2020F** | **2021F** | **2025F** | **2030F** |
| Bisphenol A Based Resin | 1348 | 1421 | 1573 | 1622 | 1732 | 1718 | 1846 | 2378 | 2979 |
| Bisphenol F Based Resin | 55 | 61 | 71 | 73 | 87 | 93 | 102 | 158 | 237 |
| Epoxy Phenol Novolac Based Resin | 24 | 26 | 28 | 34 | 35 | 37 | 41 | 58 | 79 |
| Cycloaliphatic Epoxy Based Resin | 19 | 20 | 22 | 22 | 24 | 22 | 25 | 34 | 56 |
| Others | 148 | 155 | 169 | 173 | 175 | 170 | 187 | 244 | 325 |
| **Total** | **1594** | **1683** | **1864** | **1924** | **2053** | **2040** | **2200** | **2870** | **3675** |

*Source: TechSci Research*

**3.2.1.5. Demand By Grade**

**Asia Pacific Epoxy Resin Demand, By Grade, By Volume, 2015–2030F**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Demand by Grade** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021E** | **2025F** | **2030F** |
| Liquid | 799 | 849 | 935 | 970 | 1034 | 1032 | 1115 | 1458 | 1872 |
| Semi-Solid | 135 | 142 | 155 | 159 | 168 | 168 | 179 | 229 | 285 |
| Solid | 660 | 692 | 774 | 794 | 851 | 840 | 907 | 1183 | 1519 |
| **Total** | **1594** | **1683** | **1864** | **1924** | **2053** | **2040** | **2200** | **2870** | **3675** |

*Source: TechSci Research*

**3.2.1.7. Demand By Sales Channel**

**Asia Pacific Epoxy Resin Demand, By Sales Channel, By Volume, 2015–2030F**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Demand by Sales Channel** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** |
| Direct Company Sale | 927 | 984 | 1113 | 1165 | 1255 | 1266 |
| Indirect | 668 | 699 | 751 | 758 | 798 | 774 |
| **Total** | **1594** | **1683** | **1864** | **1924** | **2053** | **2040** |

*Source: TechSci Research*

**3.1.9. Sales By Company**

**Asia Pacific Epoxy Resin Sales, By Company, By Volume, 2020**

*Source: TechSci Research*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Region** | **Demand Volume Share (%)** | **2020** | **2021E** |  | **2020** | **2021E** |
| Asia Pacific | Kukdo Chemical | 238 | 221 |  | 11.61% | 10.87% |
| Asia Pacific | Nan Ya Electronic Material (Kunshan) Co. Ltd. | 179 | 189 |  | 8.74% | 9.28% |
| Asia Pacific | Jiangsu Sanmu Group | 148 | 151 |  | 7.22% | 7.44% |
| Asia Pacific | Nan Ya Plastics Co Ltd | 144 | 147 |  | 7.06% | 7.21% |
| Asia Pacific | Nantong Xincheng Synthetic Material Co Ltd | 90 | 87 |  | 4.42% | 4.29% |
| Asia Pacific | Nippon Steel Chemical & Material Co., Ltd. | 82 | 88 |  | 4.04% | 4.32% |
| Asia Pacific | The Dow Chemical Company | 73 | 80 |  | 3.59% | 3.95% |
| Asia Pacific | Others | 1094 | 1073 |  | 53.32% | 52.64% |

*Source: TechSci Research*

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**EUROPE**

**EPOXY RESIN MARKET OUTLOOK**

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**Europe Epoxy Resin Capacity & Production, By Volume, 2015 - 2030F (Thousand Tonnes)**

*Source: TechSci Research*

|  |  |  |  |
| --- | --- | --- | --- |
| Company | 2015 | 2020 | 2030F |
| Olin Corporation | 190 | 265 | 265 |
| Hexion Inc. | 80 | 132 | 132 |
| Huntsman Corporation | 50 | 120 | 120 |
| Alchemie Ltd. | 60 | 60 | 60 |
| Spolchemie A.S. | 60 | 60 | 60 |
| Others | 301 | 301 | 301 |
| Total | 741 | 938 | 938 |

*Source: TechSci Research*

**3.2.3. Europe Epoxy Resin Demand Supply Outlook**

**Europe Epoxy Resin Demand, By Volume (Thousand Tonnes), 2015–2030F**

**2021E-2030F**

**CAGR**

**3.91% By Volume**

**2015-2020**

**CAGR**

**1.67% By Volume**

*Source: TechSci Research*

**Europe Construction Market Size, By Value (USD Billion), 2016-2020**

*Source: Eurostat*

**3.2.3.1. Operating Efficiency**

**Europe Epoxy Resin Operating Efficiency (Percentage), 2015-2030F**

*Source: TechSci Research*

**European Countries Real Estate Investment, 2020 (USD Billion)**

|  |  |
| --- | --- |
| **Countries** | **Investment (USD Billion)** |
| Germany | 57 |
| France | 28 |
| Netherland | 14 |
| Spain | 12 |
| Italy | 9 |

*Source: TechSci Research*

**3.2.3.3. Demand By Application**

**Europe Epoxy Resin Demand, By Application, By Volume, 2015–2030F**

*Others Marine, Defence, Encapsulation etc.*

*Source: TechSci Research*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Demand by Application** | **2015** | **2020** | **2021E** | **2025F** | **2026F** | **2030F** |
| Paints & Coatings | 200 | 216 | 232 | 272 | 283 | 334 |
| Electrical & Electronics | 101 | 113 | 124 | 145 | 151 | 177 |
| Construction | 38 | 38 | 40 | 46 | 48 | 57 |
| Composite Materials | 96 | 106 | 112 | 130 | 135 | 158 |
| Adhesives | 30 | 35 | 37 | 44 | 45 | 54 |
| Others | 42 | 42 | 37 | 38 | 39 | 42 |
| **Total** | **507** | **551** | **582** | **675** | **701** | **822** |

*Source: TechSci Research*

**3.2.3.4. Demand By Type**

**Europe Epoxy Resin Demand, By Type, By Volume, 2015–2030F**

*Source: TechSci Research*

**3.2.3.5. Demand By Sales Channel**

**Europe Epoxy Resin Demand, By Sales Channel, By Volume, 2015–2020F**

*Source: TechSci Research*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Demand by Sales Channel** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** |
| Direct Company Sale | 284 | 295 | 309 | 310 | 322 | 300 |
| Indirect | 222 | 236 | 246 | 264 | 277 | 250 |
| **Total** | **507** | **530** | **555** | **574** | **599** | **551**  *Source: TechSci Research* |

**3.2.2.4. Demand By Grade**

**Europe Epoxy Resin Demand, By Grade, By Volume, 2015–2030F**

*Source: TechSci Research*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Demand by Grade** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021E** | **2025F** | **2030F** |
| Liquid | 251 | 265 | 279 | 297 | 314 | 284 | 317 | 371 | 457 |
| Semi-Solid | 63 | 66 | 67 | 64 | 65 | 63 | 56 | 63 | 73 |
| Solid | 193 | 199 | 209 | 212 | 221 | 203 | 209 | 241 | 292 |
| **Total** | **507** | **530** | **555** | **574** | **599** | **551** | **582** | **675** | **822** |

*Source: TechSci Research*

**3.2.3.7. Sales By Company**

**Figure 38: Europe Epoxy Resin Sales, By Company, By Volume, 2020**

*Source: TechSci Research*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Region** | **Demand Volume Share (%)** | **2020** | **2021E** |  | **2020** | **2021E** |
| Europe | Olin Corporation | 175.11 | 188.92 |  | 24.02% | 24.93% |
| Europe | Huntsman Corporation | 92.80 | 86.92 |  | 12.73% | 11.47% |
| Europe | Hexion Inc. | 76.25 | 85.41 |  | 10.46% | 11.27% |
| Europe | Spolchemie A.S. | 48.70 | 51.76 |  | 6.68% | 6.83% |
| Europe | Alchemie Ltd. | 44.18 | 48.80 |  | 6.06% | 6.44% |
| Europe | Others | 291.96 | 296.00 |  | 40.05% | 39.06% |

*Source: TechSci Research*

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**NORTH AMERICA EPOXY RESIN MARKET OUTLOOK**

A picture containing cup, coffee, indoor, food

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**North America Epoxy Resin Capacity & Production, By Volume, 2015 - 2030F (Thousand Tonnes)**

*Source: TechSci Research*

|  |  |  |  |
| --- | --- | --- | --- |
| Company | 2015 | 2020 | 2030F |
| Hexion Inc. | 127 | 127 | 127 |
| Olin Corporation | 170 | 170 | 170 |
| Huntsman Corporation | 70 | 70 | 70 |
| Dow Chemical | 60 | 60 | 60 |
| Total | 427 | 427 | 427 |

*Source: TechSci Research*

Major Factors Accounting for Growing Demand of Epoxy Resin in North America:

* **Strong Economy (**Low Inflation, Stable Lending Rate, Competitive Tax System, Strong Banking System)
* **Ease of Doing Business**
  + Competitive Business Cost
  + Ease in Establishing and Conducting New Business
* **Better Life Index** (Ranked highest among the G7 countries by OECD based on housing, income, employment, health, safety, etc.)
* Epoxy resin is widely used in green buildings as they significantly reduce the carbon footprint of the building. The demand for sustainable products is increasing owing to the growing trend of ethical consumerism which is boosting the growth of the North America Epoxy Resin Market.
* Renewable energy is the fastest-growing energy source in the US. Renewable energy contributed to more than 17% of the net US electricity generation in 2018, with the bulk coming from hydropower (7.0%) and wind power (6.6%). Currently, 15 US states including California, Hawaii, Maine, Minnesota, Nevada, New Jersey, New Mexico among others have 100% renewable energy/clean energy targets in the next 15-20 years. The increasing use of epoxy-based composites in the manufacturing of rotor blades in wind turbines will boost the North America Epoxy Resin market.

**3.2.4. North America Demand Supply Outlook**

**North America Epoxy Resin Demand, By Volume (Thousand Tonnes), 2015–2030F**

*Source: TechSci Research*

**3.2.4.2. Operating Efficiency**

**North America Epoxy Resin Operating Efficiency (Percentage), 2015-2030F**

*Source: TechSci Research*

**3.2.4.3. Demand By Application**

**North America Epoxy Resin Demand, By Application, By Volume, 2015–2030F**

*Others Marine, Defence, Encapsulation etc.*

*Source: TechSci Research*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Demand by Application** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021E** | **2025F** | **2030F** |
| Paints & Coatings | 127 | 132 | 136 | 139 | 144 | 132 | 141 | 169 | 199 |
| Electrical & Electronics | 58 | 60 | 62 | 64 | 66 | 61 | 66 | 79 | 92 |
| Construction | 25 | 25 | 26 | 27 | 28 | 25 | 27 | 32 | 37 |
| Composite Materials | 57 | 60 | 62 | 63 | 65 | 62 | 65 | 78 | 91 |
| Adhesives | 19 | 21 | 22 | 22 | 23 | 21 | 23 | 27 | 32 |
| Others | 13 | 10 | 10 | 11 | 11 | 14 | 14 | 13 | 13 |
| **Total** | **299** | **309** | **318** | **326** | **337** | **317** | **335** | **397** | **465** |

*Source: TechSci Research*

**3.2.4.4. Demand By Type**

**North America Epoxy Resin Demand, By Type, By Volume, 2015–2030F**

*Source: TechSci Research*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Demand by Type** | **2015** | **2020F** | **2021F** | **2025F** | **2030F** |
| Bisphenol A Based Resin | 5 | 232 | 244 | 288 | 332 |
| Bisphenol F Based Resin | 17 | 18 | 19 | 23 | 29 |
| Epoxy Phenol Novolac Based Resin | 15 | 13 | 14 | 18 | 24 |
| Cycloaliphatic Epoxy Based Resin | 17 | 18 | 20 | 24 | 28 |
| Others | 24 | 35 | 37 | 45 | 52 |
| **Total** | 299 | 317 | 335 | 397 | 465 |

*Source: TechSci Research*

**3.2.4.5. Demand By Sales Channel**

**North America Epoxy Resin Demand, By Sales Channel, By Volume, 2015–2020F**

*Source: TechSci Research*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Demand by Sales Channel** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** |
| Direct Company Sale | 149 | 153 | 159 | 162 | 169 | 158 |
| Indirect | 150 | 156 | 160 | 165 | 168 | 159 |
| **Total** | 299 | 309 | 318 | 326 | 337 | 317 |

*Source: TechSci Research*

**3.2.4.6. Demand By Grade**

**North America Epoxy Resin Demand, By Grade, By Volume, 2015–2030F**

*Source: TechSci Research*

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|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Demand by Grade** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021E** | **2025F** | **2030F** |
| Liquid | 166 | 173 | 178 | 183 | 189 | 178 | 188 | 225 | 266 |
| Semi-Solid | 31 | 32 | 33 | 33 | 34 | 32 | 33 | 39 | 44 |
| Solid | 102 | 104 | 107 | 110 | 114 | 107 | 113 | 133 | 156 |
| **Total** | **299** | **309** | **318** | **326** | **337** | **317** | **335** | **397** | **465** |

*Source: TechSci Research*

**3.2.4.7. Sales By Company**

**North America Epoxy Resin Sales, By Company, By Volume, 2020**

*Source: TechSci Research*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Region** | **Demand Volume Share (%)** | **2020** | **2021E** |  | **2020** | **2021E** |
| North America | Hexion Inc. | 118.49 | 120.86 |  | 27.81% | 27.51% |
| North America | Olin Corporation | 163.09 | 159.57 |  | 38.28% | 36.32% |
| North America | Dow Chemical | 56.49 | 58.96 |  | 13.26% | 13.42% |
| North America | Huntsman Corporation | 61.69 | 68.14 |  | 14.48% | 15.51% |
| North America | Others | 26.29 | 31.81 |  | 6.17% | 7.24% |

*Source: TechSci Research*

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**SOUTH AMERICA EPOXY RESIN MARKET**

**OUTLOOK**

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**South America Epoxy Resin Capacity & Production, By Volume, 2015 - 2030F (Thousand Tonnes)**

*Source: TechSci Research*

|  |  |  |  |
| --- | --- | --- | --- |
| Company | 2015 | 2020 | 2030F |
| Olin Corporation | 33 | 33 | 33 |
| Huntsman Corporation | 10 | 10 | 10 |
| Total | 43 | 43 | 43 |

*Source: TechSci Research*

**3.2.5. South America Epoxy Resin Demand Supply Outlook**

**South America Epoxy Resin Demand, By Volume (Thousand Tonnes), 2015–2030F**

*Source: TechSci Research*

**2021E-2030F**

**CAGR**

**3.94% By Volume**

**2015-2020**

**CAGR**

**0.81% By Volume**

**3.2.5.2. Operating Efficiency**

**South America Epoxy Resin Operating Efficiency (Percentage), 2015-2030F**

*Source: TechSci Research*

**3.2.5.3. Demand By Application**

**South America Epoxy Resin Demand, By Application, By Volume, 2015–2030F**

z

*Others Marine, Defence, Encapsulation etc.*

*Source: TechSci Research*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Demand by Application** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021E** | **2025F** | **2030F** |
| Paints & Coatings | 31 | 33 | 32 | 34 | 34 | 32 | 34 | 41 | 49 |
| Electrical & Electronics | 17 | 18 | 18 | 19 | 19 | 18 | 19 | 23 | 27 |
| Construction | 9 | 9 | 9 | 10 | 10 | 9 | 10 | 12 | 14 |
| Composite Materials | 9 | 10 | 10 | 10 | 10 | 10 | 11 | 13 | 15 |
| Adhesives | 6 | 6 | 6 | 7 | 6 | 6 | 7 | 8 | 10 |
| Others | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 9 |
| **Total** | **80** | **85** | **82** | **86** | **85** | **83** | **88** | **105** | **124** |

*Source: TechSci Research*

**3.2.5.4. Demand By Type**

**South America Epoxy Resin Demand, By Type, By Volume, 2015–2030F**

*Source: TechSci Research*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Demand by Type** | **2015** | **2016** | **2017** | **2018** | **2019E** | **2020F** | **2021F** | **2025F** | **2030F** |
| Bisphenol A Based Resin | 69 | 73 | 71 | 75 | 75 | 73 | 77 | 91 | 106 |
| Bisphenol F Based Resin | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 |
| Epoxy Phenol Novolac Based Resin | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 4 |
| Cycloaliphatic Epoxy Based Resin | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| Others | 7 | 7 | 6 | 6 | 5 | 5 | 5 | 7 | 9 |
| **Total** | **80** | **85** | **82** | **86** | **85** | **83** | **88** | **105** | **124** |

*Source: TechSci Research*

**3.2.5.5. Demand By Sales Channel**

**South America Epoxy Resin Demand, By Sales Channel, By Volume, 2015–2030F**

*Source: TechSci Research*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Demand by Sales Channel** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** |
| Direct Company Sale | 45 | 48 | 47 | 49 | 49 | 47 |
| Indirect | 35 | 37 | 35 | 37 | 37 | 36 |
| **Total** | **80** | **85** | **82** | **86** | **85** | **83** |

**3.2.5.6. Demand By Grade**

*Source: TechSci Research*

**South America Epoxy Resin Demand, By Type, By Volume, 2015–2030F**

*Source: TechSci Research*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Demand by Grade** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021E** | **2025F** | **2030F** |
| Liquid | 46 | 49 | 48 | 51 | 50 | 48 | 51 | 61 | 73 |
| Semi-Solid | 7 | 7 | 6 | 7 | 7 | 7 | 7 | 8 | 10 |
| Solid | 27 | 29 | 28 | 29 | 29 | 28 | 30 | 35 | 42 |
| **Total** | **80** | **85** | **82** | **86** | **85** | **83** | **88** | **105** | **124** |

*Source: TechSci Research*

**3.2.5.7. Sales By Company**

**South America Epoxy Resin Sales, By Company, By Volume, 2020**

*Source: TechSci Research*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Region** | **Demand Volume Share (%)** | **2020** | **2021E** |  | **2020** | **2021E** |
| South America | Olin Corporation | 16.68 | 17.18 |  | 14.84% | 14.80% |
| South America | Huntsman Corporation | 2.27 | 2.44 |  | 2.02% | 2.10% |
| South America | Kukdo Chemical | 9.72 | 9.66 |  | 8.65% | 8.32% |
| South America | Nan Ya Plastics Co Ltd | 8.23 | 8.22 |  | 7.32% | 7.08% |
| South America | Others | 75.51 | 78.61 |  | 67.17% | 67.70% |

*Source: TechSci Research*

A picture containing dome

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**MIDDLE EAST & AFRICA EPOXY RESIN MARKET**

**OUTLOOK**

A picture containing cup, coffee, food, beverage

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**Middle East & Africa Epoxy Resin Capacity & Production, By Volume, 2015 - 2030F (Thousand Tonnes)**

*Source: TechSci Research*

|  |  |  |  |
| --- | --- | --- | --- |
| Company | 2015 | 2020 | 2030F |
| NAMA Chemicals | 120 | 120 | 120 |
| Izel Kimya | 40 | 40 | 40 |
| Others | 60 | 60 | 60 |
| Total | 220 | 220 | 220 |

*Source: TechSci Research*

GCC nations are at the forefront in developing smart cities. Countries such as Saudi Arabia, Qatar and UAE plan to develop smart cities. Saudi Arabia government plans to invest USD100 billion for the development of King Abdullah smart city and the country has initiated plans to convert Jeddah into smart city. Similarly, UAE government also announced plans to expand Masdar smart city, for an investment of USD20 billion, due to be completed by 2030. Lusail City in Qatar is another smart city project that would be capable of accommodating about 450,000 people. The project is estimated to cost USD45 billion and is slated for completion by 2020. A major chunk of investment in developing these smart cities would be used in developing power transmission and distribution networks, thereby acting as a driving force in boosting growth in the region’s epoxy resin market.

|  |
| --- |
| **Key Goals and Objectives of Vision Document** |
| * Boosting the government’s revenue from USD159.99 billion in 2016 to USD1866.52 billion by 2030. * To increase share of non-oil-based exports from around 16% in 2016 to around 50% by 2030. * To increase the share of Foreign Direct Investment (FDI) in GDP from 3.8% in 2020 to 5.7% by 2030. * To boost the share of small and medium scale enterprises from 20% in 2020 to 35% by 2030. * To increase the contribution of private sector to around 65% of GDP by 2030, thereby opening different sectors for private players. * The country aims to set up a sovereign wealth fund amounting to around USD2.00 trillion to support the development projects associated with the Vision. FDI worth USD1.00 trillion during 2021-2032 is anticipated to flow in Saudi Arabia, thereby boosting the growth of private sector. |

**3.2.6. Middle East & Africa Epoxy Resin Demand Supply Outlook**

**Middle East & Africa Epoxy Resin Demand, By Volume (Thousand Tonnes), 2015–2030F**

**2021E-2030F**

**CAGR**

**4.38% By Volume**

**2015-2020**

**CAGR**

**-0.21% By Volume**

*Source: TechSci Research*

**3.2.6.2. Operating Efficiency**

**Middle East & Africa Epoxy Resin Operating Efficiency (Percentage), 2015-2030F**

*Source: TechSci Research*

**3.2.6.3. Demand By Application**

**Middle East & Africa Epoxy Resin Demand, By Application, By Volume, 2015–2030F**

*Others Marine, Defence, Encapsulation etc.*

*Source: TechSci Research*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Demand by Application** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021E** | **2025F** | **2030F** |
| Paints & Coatings | 110 | 115 | 118 | 112 | 117 | 108 | 116 | 142 | 173 |
| Electrical & Electronics | 73 | 76 | 78 | 74 | 78 | 72 | 77 | 94 | 114 |
| Construction | 35 | 37 | 38 | 36 | 38 | 34 | 37 | 45 | 54 |
| Composite Materials | 26 | 27 | 28 | 26 | 28 | 26 | 28 | 34 | 41 |
| Adhesives | 17 | 18 | 18 | 18 | 18 | 17 | 19 | 23 | 28 |
| Others | 13 | 12 | 11 | 11 | 12 | 13 | 14 | 15 | 16 |
| **Total** | **274** | **284** | **292** | **277** | **290** | **271** | **289** | **352** | **425** |

*Source: TechSci Research*

**3.2.6.4. Demand By Type**

**Middle East & Africa Epoxy Resin Demand, By Type, By Volume, 2015–2030F**

*Source: TechSci Research*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Demand by Type** | **2015** | **2016** | **2017** | **2018** | **2019E** | **2020F** | **2021F** | **2025F** | **2030F** |
| Bisphenol A Based Resin | 228 | 235 | 240 | 227 | 237 | 220 | 234 | 282 | 335 |
| Bisphenol F Based Resin | 8 | 8 | 9 | 8 | 9 | 8 | 9 | 12 | 16 |
| Epoxy Phenol Novolac Based Resin | 10 | 11 | 11 | 11 | 12 | 11 | 12 | 16 | 21 |
| Cycloaliphatic Epoxy Based Resin | 8 | 8 | 8 | 7 | 8 | 7 | 8 | 10 | 13 |
| Others | 20 | 22 | 24 | 23 | 25 | 25 | 26 | 33 | 41 |
| **Total** | **274** | **284** | **292** | **277** | **290** | **271** | **289** | **352** | **425** |

*Source: TechSci Research*

**3.2.6.5. Demand By Sales Channel**

**Middle East & Africa Epoxy Resin Demand, By Sales Channel, By Volume, 2015–2030F**

*Source: TechSci Research*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Demand by Sales Channel** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** |
| Direct Company Sale | 130 | 135 | 140 | 132 | 137 | 128 |
| Indirect | 144 | 149 | 152 | 145 | 153 | 143 |
| **Total** | **379** | **402** | **436** | **406** | **414** | **366** |

*Source: TechSci Research*

**3.2.6.6. Demand By Grade**

**Middle East & Africa Epoxy Resin Demand, By Grade, By Volume, 2015–2030F**

*Source: TechSci Research*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Demand by Grade** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021E** | **2025F** | **2030F** |
| Liquid | 152 | 157 | 161 | 154 | 162 | 152 | 163 | 200 | 244 |
| Semi-Solid | 14 | 14 | 15 | 14 | 14 | 14 | 14 | 18 | 19 |
| Solid | 108 | 113 | 116 | 110 | 114 | 105 | 113 | 135 | 163 |
| **Total** | **274** | **284** | **292** | **277** | **290** | **271** | **289** | **352** | **425** |

*Source: TechSci Research*

**3.2.6.7. Sales By Company**

**Middle East & Africa Epoxy Resin Sales, By Company, By Volume, 2020**

*Source: TechSci Research*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Region** | **Demand Volume Share (%)** | **2020** | **2021E** |  | **2020** | **2021E** |
| MEA | NAMA Chemicals | 114.65 | 129.99 |  | 30.04% | 32.82% |
| MEA | Izel Kimya | 36.30 | 47.85 |  | 9.51% | 12.08% |
| MEA | Olin Corporation | 34.92 | 42.14 |  | 9.15% | 10.64% |
| MEA | Hexion Inc. | 31.79 | 22.38 |  | 8.33% | 5.65% |
| MEA | Others | 164.00 | 153.72 |  | 42.97% | 38.81% |

*Source: TechSci Research*

***3.3. MARKET DYNAMICS***

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**Rising investment in building & construction sector**

**Government Support and Initiatives**

**Rising Disposable Income & High Living Standards**

**Focus on renewables**

**Growing usage of specialty resin in automotive and industrial applications aerospace sector**

**Fluctuation In Raw Material Prices**

**Overcapacity in some region**

**Supply Chain Disruption**

**Market Drivers**

***Rising Investments in Building & Construction Sector***

With increasing population and continuing economic growth, infrastructure, as well as construction sector spending is rising across the globe. Factors such as significant rise in purchasing power parity, especially in developing nations, and growing investments in the real estate sector are boosting the growth of construction sector, globally. Various government sponsored projects across the globe such as smart cities, AMRUT, freight corridor and urban transport, etc., are expected to provide a huge boost to the construction activities in the coming years in Southeast Asia, GCC, Central Europe and North Africa, thereby positively impacting the global epoxy resin market.

**European Countries Real Estate Investment, 2020 (USD Billion)**

|  |  |
| --- | --- |
| **Countries** | **Investment (USD Billion)** |
| Germany | 59 |
| France | 29 |
| Netherland | 16 |
| Spain | 13 |
| Italy | 10 |

*Source: Meed Projects*

***Government Support and Initiatives***

Driven by strong demand from various end-use industries such as wind energy, transportation, electrical and electronics, defense, aerospace, pipes and tanks, construction and marine, the composite industry, also known as fiber-reinforced plastics (FRP) industry, will also be supporting government’s initiatives across various developing countries, hence giving a big push to the market of epoxy resin such as, ‘Make in India’ initiative by the Government of India. In 2021, per capita consumption of composites in the United States and China was reported to be 11.4 kg and 2.8 kg, respectively. Additionally, the per capita consumption in India stood at 0.36 kg. The increasing demand for composites manufacturing across the globe for numerous applications including aerospace structure & other composite parts would spur the demand for Epoxy Resins in the coming years.

***Rising Disposable Income & High Living Standard***

The demand for advanced and premium quality paints & coatings is increasing across the housing and construction sector due to high living standards across developed nations, including improving disposable income across developing countries and driving the epoxy resin market in the forthcoming years. This is further supported by increasing per capita expenses on premium cars across the globe. Moreover, the disposable income level of the middle-class population across various countries is increasing and has significantly augmented the demand for epoxy-based lightweight coatings and adhesives over the years, further driving the market worldwide.

***Market Challenges***

***Volatility in Raw Material Prices***

An increase in the cost of raw materials, i.e., ECH and BPA, that are being used in the manufacturing of the epoxy resin is driving down the market sales in recent years due to several disruptions caused by the COVID-19 outbreak worldwide. Moreover, rising crude oil prices directly impact the operating cost and profit margins of the industry, and higher transportation costs, adding up the price of epoxy resins in the global market. Inflation of raw material costs drives down the demand for these films, which is emerging as one of the major constraints for the overall market growth worldwide.

**3.4. Market Trends & Developments**

***Expansion of Production Facilities***

With the growing demand for Epoxy Resin in various sectors such as automotive, construction, electrical & electronics etc., companies have started investing in expanding and setting up manufacturing facilities across multiple locations worldwide. Moreover, companies are increasingly focusing on investing largely across developing nations due to the availability of cheap labor such as in India, China and others. For instance, Kukdo Chemical Pvt Ltd, one of the leading Korea-based companies, has recently set up greenfield epoxy resin production unit in India with a capacity of around 40 KTPA in 2020 and is further planning to expand its capacity by 60 KTPA by 2024 to address the growing demand across the country and to capture the maximum share in Asian market.

***Growing Demand for Lightweight Material in Automotive and Auto Ancillaries Sectors***

Rising demand for polypropylene and other petrochemical derivatives in the automotive sector is increasing as companies are focusing more on the development of new products and reducing the carbon footprint. Most of the automotive manufacturers are launching hybrid and electric vehicles across the globe. Furthermore, with rising investments in new product development and adopting new technologies, companies are focusing on using more light and composite materials for automotive manufacturing, which is leading to a surge in the demand for petrochemicals and their derivatives.

***Emerging Applications***

Ban on the usage of Bisphenol A has increased the consumption of Epoxy Resin in various applications, such as producing intermediates, high performance polymers, heat sensitive developers, etc. Recently, BPS has substituted BPA-based epoxy resins which are generally used in food packaging containers. Epoxy resins are also used in aerospace plastics as a binder for reinforcements such as glass, carbon or Kevlar. Growing utilization of epoxy resin in epoxy resins is likely to increase its foothold in the market over coming years. Besides, it is anticipated that Epoxy Resin might replace BPA in the polycarbonate production, which may further boost the demand for Epoxy Resins in the coming years.

**3.5 Technology Evaluation:**

This section aims to provide the different technologies that are available for the third-party licensing. This would provide you with a brief about the process details, process flow diagram and formulated resins description.

Technology 1 is the technology provided by Nippon Steel & Simikin Chemical Co Ltd. (formerly Tohto Kasei Co. Ltd.). It was established in 2010 whereas Technology 2 is the technology provided by Ciba-Geigy AG of Switzerland that was established in 1943.

Other manufacturing companies like Kukdo Chemical Co., Ltd and Olin Corporation have devised and patented their production technology process and are not open for third party licensing.

A brief introduction about the two technologies has been discussed below:

**Technology 1: Nippon Steel & Simikin Chemical Co Ltd. (formerly Tohto Kasei Co. Ltd.) (Japanese firm)**

**Process Details:**

**Pre-reaction Section**

Reaction starts with adding Excessive quantity of Epichlorohydrin (Fresh & recovered) with prescribed quantity of Bisphenol-A by using NaOH as catalyzer. As result of this reaction, Bisphenol-A chlorohydrin intermediate is formed.

Graphical user interface, text, application

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**Reaction Section**

Bisphenol-A chlorohydrin intermediate formed from the pre-reaction section is further changed to liquid epoxy resin by reaction with NaOH. Optimum process conditions are maintained in the reactor which minimize hydrolysis of ECH and formation of by-product waste polymer and enables the production of high-quality epoxy resin of the required viscosity at high yields.

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**ECH Detachment Section**

After the reaction process is done, excessive quantities of unreacted ECH are separated from the product by increasing the temperature and recovered through a vaporizer, the same is returned to the ECH day tank for reuse. The crude epoxy is then sent to the next refining section. In order to protect the epoxy resin from thermal effect, vaporization of ECH is done under vacuum conditions, at the lowest possible temperature and in the shortest possible time.

**Refining**

In this section washing is done, toluene is added to dissolve resin in it. After continuous stirring, the allowed salt solution is allowed to settle in the gravity settler. The salt solution is then separated from the resin manually by adding water. Again, demineralised water is added to wash the resin and remove the traces of salt from it.

**Filtration**

After refining, filtration is done to remove the impurities, suspended particles and the rest of waste polymer by passing through a multilayer paper filter.

**Product Finishing Section:** Finally, Epoxy resin is filtered to remove suspended filter cake via sparkler filter and is sent to the product tank through mixing tank.

**Dissolvent:** In this section, toluene is recovered via steam stripping at 1200 C. Dissolvent is done to remove the solvent toluene from the resin by passing through falling film thin evaporator & rotary film thin evaporator under vacuum.

**ECH Stripping:** ECH evaporated during reaction contains ECH along with water. The water is stripped off in the distillation unit while recovered pure ECH is recycled for the next batch.

**ECH Distillation:** ECH vapours from the ECH detachment section are recovered and distilled in this section to recover pure ECH which is recycled.

**Process Flow Diagram:**

**Unreacted ECH**

**Reacted ECH**

**ECH Product**

**Evaporator**

**Wash Process**

**Phase Separator**

**Final Reactor**

**Evaporator**

**Phase Separator**

**Accumulator**

**Reactor Vessel**

**Liquid Epoxy Resin**

**H2O Brine**

**Solid Epoxy Resin:**

**Pre-Reaction Section:** In this section, Liquid Epoxy Resin, Bisphenol A & catalyst are added to the reactor (BPA & catalyst are added in 2 Stages then with the progress of the reaction, 2nd lot of BPA & catalyst are added).

**Reaction Section:** Here reaction mixture from the pre-reaction section is added with a solvent in controlled range of pressure (5-7 Bar) & temperature (70-750 C).

**Solidification Section:** Here Epoxy Resin (i.e., formed in the reaction section) is passed through the flaker (with required utilities (chilled water & steam)) & then further pass through the crusher to collect the final solid product.

**Process Flow Diagram:**

**Jacketed Reactor.**

**Pre-Reaction Section**

**Reactor2**

**Reaction Section 70°C-80°C, 4 hrs**

**Flaker, 15°C chilled water**

**Crusher**

**Packer**

**Dust Collector**

**180°C -190°C**

**Xylene**

**Hot Oil, 220°C**

**Oil, 50°C**

**5-7 Bar**

**Solid Epoxy Resin**

**BPA, Liquid Epoxy Resin, NaOH, Methanol, Catalyst**

ss

**Formulated Resins:**

**Mixing:** Different grades of Liquid Epoxy resins are mixed with various types of additives or reactive diluents to meet customer specific applications.

**Technology-2: Ciba-Geigy AG**

**Process Detail:**

**Pre-reaction Section**

Reaction starts with adding Excessive quantity of Epichlorohydrin (Fresh & recovered) with prescribed quantity of Bisphenol-A by using NaOH as catalyzer. As result of this reaction, Bisphenol-A chlorohydrin intermediate is formed.

Graphical user interface, text, application

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**Reaction Section**

Bisphenol-A chlorohydrin intermediate formed from the pre-reaction section is further changed to liquid epoxy resin by reaction with NaOH. Optimum process conditions are maintained in the reactor which minimize the hydrolysis of ECH and formation of by-product waste polymer and enables the production of high-quality epoxy resin of the required viscosity at high yield.

Graphical user interface, text, application

Description automatically generated

**ECH Stripping & Recovery:** ECH Evaporated during reaction contains ECH and water. Water is stripped off in the distilled unit and pure ECH is recycled for the next batch.

**Refining:** In this section, toluene is added to dissolve resin in it and the salt solution is separated from the resin manually by adding water. Three layers are formed; the resin and toluene stay in the upper layer (called organic layer) & NaCl-water in the lower layer & centre one is the unreacted BPA, it is called emulsion layer. Again, DM water is added to wash the resin and remove the traces of salt from it.

**Dissolvent:** After filtration section, epoxy Resin been sent to reboiler & vacuum distillation column for Toluene recovery.

**Product Finishing Section:** Epoxy resin is finally filtered to remove the traces of impurities.

**Process Flow Diagram:**

**Pre-Reactor**

**Reactor**

**Evaporator**

**Washing/Gravity Separation**

**Condensate with stirrer at 60 RPM**

**Filtration Unit**

**ETP Treatment**

**Sludge**

**Salt Packaging**

**Solid Disposal**

**Packer**

**BPA, ECH, NaOH**

**Unreacted ECH**

**NaOH 48%**

**Dehydrated H2O**

**Toluene**

**Water**

**Steam 100°C**

**Note\*: Process for Solid & Formulated Resin is the same for Technology 2.**

**Technology Evaluation:**

* Both the technologies give favorable outcomes qualitatively & quantitatively. Also, both technologies are being used in India by leading epoxy resin manufacturers like Grasim Industries and Atul Ltd.
* As there are 100’s of grades available in all 3 major types (i.e., solid, liquid & semisolid) for different applications, there is no need for a separate reactor for every grade.
* Technology 1 is newer than Technology 2 in terms of ease of process, therefore preferable.
* There are fewer leading companies having their own technology & related patents, but they don’t share same with anyone outside.

|  |  |  |  |
| --- | --- | --- | --- |
| Technology | Plants | Current Capacity | Anticipated Capacity |
| Ciba-Geigy AG | Atul Limited | 40 KTPA | 50 KTPA (By 2024) |
| Hindustan Speciality Chemical Ltd. | 30 KTPA | 30 KTPA |
| Tohto Kasei Co. Ltd. | Grasim Industries Ltd. | 66 KTPA | 90 KTPA (By 2025) |

the most accepted technology is currently Ciba-Geigy AG in India. Grasim licensed the technology from Tohto Kasei Co. Ltd. in 2014-2015 but Hindustan Speciality employed the technology the technology of Ciba-Geigy AG. The manufacturing companies based in APAC region are based on Tohto Kasei Co. Ltd. whereas Ciba-Geigy AG’s technology for epoxy resin production is globally proclaimed.

According to the key opinion leaders, the technology employed by Ciba-Geigy AG has low solvent requirement than the Tohto Kasei Co. Ltd. technology. Other than this, few variations in process parameters are the only observable differences.

**3.6 Pricing Analysis Epoxy Resin (USD/ ton)**

*Source: TechSci Research*

Chemical and petrochemical sector is leading to a drop in prices of Epoxy Resins along with various other products. Market fundamentals of Epoxy Resin revived significantly in 2017 following a sharp rebound in market activities. However, in 2018 and 2019, prices fluctuated in a stable to narrow range amidst the uncertainty prevailing from stable feedstock and muted

demand patterns from several downstream industries. In 2020, Epoxy Resin witnessed a marginal dive again due to a ground-breaking fall in crude values and a devastating hit on the global economy in the wake of the COVID-19 outbreak. Despite the second wave of COVID-19 in India, prices showcased an appreciable rebound in 2021 due to consistent demand pattern and spillover effect of high international prices.

**3.7 Value Chain Analysis**

This section shows the variety of activities that are incorporated to bring epoxy resin from conception, throughout the intermediary stages of production and reaching to final consumer. In epoxy resin value chain analysis, the raw material cost contributes the major share in the selling price of epoxy resin. Through direct sales, the company undergoes more profit margin than indirect sales.

**Value Chain Flow for Captive Liquid Epoxy Resin Manufacturer (Bisphenol A)**

**BPA:** Phenol & Acetone

(Mole Ratio 2:1)

**Manufacturer**

**Percentage Margin 26 %**

**Including Transportation charges**

**Direct Sales**

**ECH**: Propylene, Chlorine Gas & Lime (Mole Ratio 2:2:1)

Raw Material Cost

(USD 1.67/kg)

Overhead + Packaging Cost (USD 0.72 /kg)

Caustic Soda Lye (48%)

Current Selling Price (USD 3.09/kg) Direct Sales

Total Cost Incurred (USD 2.39/ kg)

Current Selling Price (USD 3.01/kg) In-Direct Sales (Inclusive Freight Charges)

**Percentage Margin 29 %**

**In-Direct Sales**

**Epoxy Resin Value Chain**

**Company Website/Direct Export/Direct Sales**

**Distributor/Retailer**

**End User**

**Value Chain Flow for Captive Liquid Epoxy Resin Manufacturer (Bisphenol F)**

**BPF:** Phenol & Formaldehyde

**Manufacturer**

**Percentage Margin 29 %**

**Including Transportation charges**

**Direct Sales**

**Company Website/Direct Export/Direct Sales**

Raw Material Cost

(USD 3.2/kg)

Overhead + Packaging Cost (USD 0.72 /kg)

**ECH**: Propylene, Chlorine Gas & Lime

Caustic Soda Lye

Current Selling Price (USD 5.22/kg) Direct Sales

Total Cost Incurred (USD 3.92/ kg)

Current Selling Price (USD 5.16/kg) In-Direct Sales (Inclusive Freight Charges)

**Percentage Margin 32 %**

**In-Direct Sales**

**Epoxy Resin Value Chain**

**Distributor/Retailer**

**End User**

**Value Chain Flow for Captive Solid Epoxy Resin Manufacturer**

Liquid Epoxy Resin

**Epoxy Resin Value Chain**

**Manufacturer**

**Percentage Margin 22.34%**

**Including Transportation charges**

Current Selling Price (USD 3.49/kg) In-Direct Sales

Raw Material Cost (USD 2.05/kg)

**In-Direct Sales**

**Direct Sales**

**Percentage Margin 24.01%**

**Company Website/Direct Export/Direct Sales**

Bisphenol-A

Overhead + Packaging Cost (**USD** 0.72 /kg)

Xylene

Catalyst (Recoverable)

Current Selling Price (USD 3.57/kg) Direct Sales

Total Cost Incurred (USD 2.77/Kg)

**Distributor/Retailer**

**End User**

**Value Chain Flow for Non-Captive Liquid Epoxy Resin Manufacturer**

BPA: USD 1.4/kg

**Manufacturer**

**Percentage Margin 10.5%**

**Including Transportation charges**

**Percentage Margin 12.36 %**

ECH: USD 1.6/kg

Overhead + Packaging Cost

(USD 0.72/Kg)

Raw Material Cost (USD 2.03/kg)

Caustic Soda Lye(48%): USD 0.15/kg

Current Selling Price (USD 3.09/kg) Direct Sales

Total Cost Incurred (USD 2.75/kg)

Current Selling Price

(USD 3.03/kgIn-Direct Sales (Inclusive Freight Charges)

**Direct Sales**

**In-Direct Sales**

**Epoxy Resin Value Chain**

**Company Website/Direct Export/Direct Sales**

**Distributor/Retailer**

**End User**

**Value Chain Flow for Non-Captive Solid Epoxy Resin Manufacturer**

Liquid Epoxy Resin: USD 2.75/kg

**Epoxy Resin Value Chain**

**Manufacturer**

**Percentage Margin 8.3 %**

**Including Transportation charges**

Current Selling Price (USD 3.49/kg) In-Direct Sales

Current Selling Price (USD 3.57/kg) Direct Sales

Raw Material Cost (USD 2.48/kg)

**In-Direct Sales**

**Direct Sales**

**Percentage Margin 10.17%**

**Company Website/Direct Export/Direct Sales**

Bisphenol-A: USD 1.4/kg

Overhead + Packaging Cost (USD 0.72 /kg)

Xylene: USD 0.55/kg

Catalyst (Recoverable)

Total Cost Incurred (USD 3.2/kg)

**Distributor/Retailer**

**End User**

**3.8 Cost of Production**

This section aims to provide you with an overview on the production costs that is the total cost incurred by a manufacturer to produce a specific quantity of a product. It includes fixed cost that consists of repair & maintenance, salaries & wages, research & development, corporate overheads whereas variable costs consist of raw material, packaging materials, catalyst and chemicals and other utilities costs. Variable Costs are subject to variation depending on market conditions and production volume modifications.

Table mentioned below provides a comparison between the two technologies and the variations incurred in fixed and variable costs:

**3.8 Cost of Production (Fixed & Variable Cost- By Technology):**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **PARAMETERS** | | **COST OF PRODUCTION: Technology 1** | | | **COST OF PRODUCTION: Technology 2** | | |
|  |
|  | | **Quantity** | **Unit Rate** | **Amount** | **Quantity** | **Unit Rate** | **Amount** |  |
| **Tonne** | **USD/Tonne** | **USD** | **Tonne** | **USD/Tonne** | **USD** |  |
| **A** | **VARIABLE COST** |  | | | | | |  |
| 1 | Raw Materials |  |
| BPA | 0.7 | 1400.0 | 974.4 | 0.7 | 1400.0 | 974.4 |  |
| ECH | 0.6 | 1600.0 | 900.6 | 0.6 | 1600.0 | 900.6 |  |
| Caustic Soda | 0.5 | 150.0 | 75.0 | 0.5 | 150.0 | 75.0 |  |
| Sub-Total (1) | **1.8** | **3150.0** | **1950.0** | **1.8** | **3150.0** | **1950.0** |  |
| 2 | Packing Materials, Catalyst & Chemicals, Utilties |  | | 260.0 |  | | 255.0 |  |
|  | **TOTAL VARIABLE COST** | **2210.0** | **2205.0** |  |
|  | |  |  |  |
| **B** | **FIXED COST** |  |
| 1 | Repair & Maintenance | **454.4** | **415.0** |  |
| 2 | Salaries & Wages |  |
| 3 | Research & Development |  |
| 5 | Corporate Overheads |  |
|  | **TOTAL FIXED COST** | **454.4** | **415.0** |  |
|  | |  |  |  |
| **C** | **VARIABLE + FIXED COST** | **2664.4** | **2620.0** |  |
|  | |  |  |  |
| **D** | **INTEREST ON WORKING CAPITAL** | **35.0** | **35.0** |  |
|  | |  |  |  |
| **E** | **CASH MANUFACTURING COST** | **2699.4** | **2655.0** |  |
|  | |  |  |  |
| **F** | **DEPRECIATION (5.28%)** | **52.0** | **52.0** |  |
|  | |  |  |  |
| **G** | **PRODUCTION COST** | **2751.4** | **2707.0** |  |

**3.9. Customer Analysis**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year** | **Product Description** | **Customer / Distributor Name** | **Destination Country** | **Plant Location** | **Supplier Name** | **Shipment Origin** | **Annual Off-take Quantity (Tonnes)** | **Price(USD/KG)** | **Incoterms** |
| 2020 | Liquid | Champion Advanced Materials Pvt Ltd | India | Bangalore | Kuk  do Chemical Co Ltd | South Korea | 237.60 | 2.25 | Delivered at place – tax and duties |
| 2020 | Solid | Fasto Advance Adhesive Technologies | India | Bangalore | Fastfix-It Enterprise Co Ltd | Taiwan | 24.30 | 5.82 | Delivered at place – tax and duties |
| 2020 | Liquid | Huntsman International India Pvt Ltd | India | Mumbai, Bangalore, New Delhi | Huntsman Advanced Materials Europe Bvba | United Kingdom, Germany | 764.25 | 5.95 | Delivered at place – tax and duties |
| 2020 | Solid | Jotun India Private Limited | India | Mumbai | Kukdo Chemical Co Ltd | South Korea | 1237.50 | 2.25 | Delivered at place – tax and duties |
| 2020 | Solid | Jotun India Private Limited | India | Mumbai, Kanchipuram | Kukdo Chemical Co Ltd | South Korea | 967.50 | 3.24 | Delivered at place – tax and duties |
| 2020 | Liquid | Kansai Nerolac Paints Limited | India | Mumbai, Bangalore, New Delhi | Kukdo Chemical Co Ltd, Aditya Birla Chemicals Thailand Ltd. | South Korea, Thailand, Japan | 5093.10 | 3.22 | Delivered at place – tax and duties |
| 2020 | Solid | Kansai Nerolac Paints Limited | India | Mumbai, Bangalore, New Delhi | Kukdo Chemical Co Ltd, Aditya Birla Chemicals Thailand Ltd. | South Korea, Thailand, Japan | 5008.95 | 2.50 | Delivered at place – tax and duties |
| 2020 | Solid | Napino Auto Electronics Ltd | India | Mumbai, New Delhi | Shindengen Electric Manufacturing | Japan | 856.80 | 4.81 | Delivered at place – tax and duties |
| 2020 | Liquid | Ppg Asian Paints Private Limited | India | Mumbai, Bangalore, New Delhi, Chennai | Ppg Industries Korea Ltd, Kumho P & G Chemicals Ltd. | South Korea | 6231.75 | 1.62 | Delivered at place – tax and duties |
| 2020 | Liquid | Precision Electronic Component Mfg Co | India | Mumbai | Synresalmoco Bv | Netherlands | 27.00 | 9.50 | Delivered at place – tax and duties |
| 2020 | Liquid | Siegwerk India Private Limited | India | Mumbai, Bangalore, New Delhi | Qualipoly Chemical Corporation, Eternal Materials Co., Ltd. | Taiwan | 1176.00 | 3.15 | Delivered at place – tax and duties |
| 2020 | Solid | Stonera Systems Pvt Ltd | India | Mumbai, Bangalore, New Delhi | Isep Srl | Italy | 608.55 | 4.05 | Delivered at place – tax and duties |
| 2020 | Liquid | Vimal Intertrade Pvt Ltd | India | Mumbai | Evonik Ressource Efficiency Gm | Germany | 588.00 | 8.24 | Delivered at place – tax and duties |
| 2020 | Liquid | Yamaha Motor Electronics India Private Limited | India | Mumbai, Bangalore | Yamaha Motor Electronics Taiwan Co., Towa Denki Trading (S) Pte Ltd | Taiwan, Singapore | 227.46 | 24.13 | Delivered at place – tax and duties |
| 2020 | Liquid | Pt. Sika Indonesia | Indonesia | Bekasi, West Java | Aditya Birla ChemicalsLtd., Nan Ya Plastics Corporation | Thailand, Taiwan | 1366.26 | 4.99 | Delivered at place – tax and duties |
| 2020 | Liquid | Pt. Nipsea Paint And Chemicals | Indonesia | Jakarta | Aditya Birla Chemicals(Thailand)Ltd., Nan Ya Plastics Corporation | Thailand, Taiwan | 2163.02 | 2.71 | Delivered at place – tax and duties |
| 2020 | Liquid | Pt. Panasonic Industrial Devices Batam | Indonesia | Jakarta | Panasonic Industrial Devices Singapore | Singapore, Thailand | 989.94 | 12.37 | Delivered at place – tax and duties |
| 2020 | Liquid | Pt. Propan Raya Industrial Coating Chemicals | Indonesia | Tangerang, Banten | Aditya Birla Chemicals (Thailand) Ltd. | Thailand | 816.00 | 4.08 | Delivered at place – tax and duties |
| 2020 | Liquid | Pt. Hempel Indonesia | Indonesia | Jawa Barat | Chang Chun Plastics Co.,Ltd | Taiwan | 1056.00 | 4.35 | Delivered at place – tax and duties |
| 2020 | Liquid | Berger Paints Pakistan Limited. | Pakistan | Karachi | Hls Technology Development | China | 208.80 | 3.14 | Delivered at place – tax and duties |
| 2020 | Liquid | Awan Sports Industries (Pvt) Ltd | Pakistan | Sialkot | Kukdo Chemical Co.Ltd. | South Korea | 184.80 | 4.20 | Delivered at place – tax and duties |
| 2020 | Liquid | Famsa Polymers Industry Private Limited | Pakistan | Karachi | Jubail Chemical Industries Co. (Jana)., | Saudi Arabia | 92.88 | 2.12 | Delivered at place – tax and duties |

*Source: TechSci Research*

**Global Epoxy Resin Trade Dynamics – Import (USD Million and Thousand Tonnes), 2018-2020**

**3.10. Global Epoxy Resin Foreign Trade Analysis, 2018-2020**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Country** | **2018** | | **2019** | | **2020** | |
| **Import** | **Value** | **Volume** | **Value** | **Volume** | **Value** | **Volume** |
| China | 776.66 | 235.42 | 995.15 | 288.77 | 1255.09 | 404.81 |
| Germany | 550.57 | 169.86 | 570.11 | 155.49 | 491.00 | 142.12 |
| United States | 318.08 | 94.97 | 451.16 | 108.62 | 351.99 | 88.55 |
| Italy | 166.56 | 70.50 | 190.60 | 64.02 | 164.31 | 58.16 |
| Turkey | 107.77 | 44.33 | 168.58 | 56.39 | 154.10 | 52.96 |
| Netherlands | 100.26 | 41.98 | 134.65 | 42.40 | 157.70 | 45.77 |
| Russia | 109.71 | 38.84 | 151.31 | 47.90 | 145.13 | 45.74 |
| United Kingdom | 201.33 | 55.63 | 214.34 | 55.56 | 155.62 | 45.43 |
| Japan | 137.89 | 48.41 | 169.31 | 50.05 | 149.23 | 44.35 |
| India | 153.81 | 57.77 | 170.82 | 55.05 | 132.67 | 44.20 |
| Others | 333.35 | 125.33 | 510.46 | 219.76 | 390.56 | 136.69 |
| **Total** | **2955.98** | **983.04** | **3726.49** | **1143.98** | **3547.41** | **1108.77** |

*Source: TechSci Research*

**Global Epoxy Resin Trade Dynamics – Export (Thousand Tonnes), 2018-2020**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Country** | **2018** | | **2019** | | **2020** | |
| **Export** | **Value** | **Volume** | **Value** | **Volume** | **Value** | **Volume** |
| **South Korea** | 531.18 | 174.35 | 515.11 | 192.77 | 508.36 | 206.53 |
| **Germany** | 709.79 | 170.67 | 646.04 | 161.96 | 599.19 | 161.67 |
| **Taiwan** | 406.23 | 131.75 | 395.48 | 145.36 | 408.98 | 153.53 |
| **USA** | 414.40 | 95.21 | 445.60 | 123.36 | 413.17 | 105.89 |
| **Netherlands** | 225.08 | 79.40 | 210.66 | 79.99 | 210.31 | 74.36 |
| **Thailand** | 110.80 | 34.13 | 105.40 | 35.19 | 104.84 | 38.01 |
| **Czech Republic** | 96.63 | 32.77 | 86.29 | 33.90 | 79.73 | 34.00 |
| **China** | 108.68 | 34.66 | 83.56 | 28.88 | 78.38 | 28.31 |
| **Switzerland** | 207.28 | 37.91 | 178.97 | 33.56 | 133.35 | 26.45 |
| **Japan** | 300.07 | 29.64 | 288.44 | 26.68 | 298.14 | 24.84 |
| **Others** | 667.44 | 263.15 | 612.34 | 282.33 | 640.37 | 255.17 |
| **Total** | **3777.59** | **1083.63** | **3567.88** | **1143.98** | **3474.82** | **1108.77** |

**3.8. Global Demand-Supply Gap**

**Global Epoxy Resin Market Demand-Supply Analysis, By Volume, 2015-2030F (Thousand Tonnes)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021E** | **2025F** | **2030F** |
| **Capacity** | 3765.50 | 3795.50 | 4048.00 | 4284.00 | 4419.00 | 4484.00 | 4519.00 | 4648.00 | 4648.00 |
| **Production** | 2866.28 | 2986.35 | 3150.56 | 3328.00 | 3470.41 | 3246.33 | 3485.36 | 3723.96 | 4119.41 |
| **Total Demand** | 2753.56 | 2891.29 | 3110.44 | 3187.00 | 3364.65 | 3261.08 | 3493.88 | 4400.00 | 5511.29 |
| **Demand Supply Gap** |  | | | | | | -8.52 | -675.75 | -1391.88 |

*Source: TechSci Research*

**Asia-Pacific Epoxy Resin Market Demand-Supply Analysis, By Volume, 2015-2030F (Thousand Tonnes)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021E** | **2025F** | **2030F** |
| **Capacity** | 2334.5 | 2364.5 | 2607.0 | 2701.0 | 2816.0 | 2856.0 | 2891.0 | 2960.0 | 2960.0 |
| **Production** | 1819.3 | 1908.0 | 2062.0 | 2142.3 | 2261.9 | 2134.8 | 2302.8 | 2444.9 | 2711.9 |
| **Import** | 382.5 | 417.2 | 463.6 | 446.3 | 474.0 | 555.6 |  | | |
| **Export** | 607.3 | 642.2 | 661.9 | 665.0 | 682.9 | 650.3 |
| **Total Demand** | 1594.5 | 1683.0 | 1863.8 | 1923.5 | 2053.0 | 2040.1 | 2200.4 | 2870.5 | 3675.0 |
| **Demand Supply Gap** |  | | | | | | 102.3 | -425.5 | -963.1 |

*Source: TechSci Research*

**Europe Epoxy Resin Market Demand-Supply Analysis, By Volume, 2015-2030F (Thousand Tonnes)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021E** | **2025F** | **2030F** |
| **Capacity** | 741.0 | 741.0 | 751.0 | 893.0 | 913.0 | 938.0 | 938.0 | 938.0 | 938.0 |
| **Production** | 525.5 | 541.8 | 562.9 | 670.0 | 695.9 | 621.1 | 676.8 | 741.0 | 812.2 |
| **Import** | 241.4 | 261.1 | 273.7 | 199.6 | 213.9 | 200.0 |  | | |
| **Export** | 260.1 | 272.6 | 281.9 | 295.9 | 310.4 | 270.4 |
| **Total Demand** | 506.8 | 530.3 | 554.7 | 573.7 | 599.4 | 550.6 | 582.0 | 675.1 | 821.8 |
| **Demand Supply Gap** |  | | | | | | 94.8 | 66.0 | -9.6 |

*Source: TechSci Research*

**North America Epoxy Resin Market Demand-Supply Analysis, By Volume, 2015-2030F (Thousand Tonnes)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021E** | **2025F** | **2030F** |
| **Capacity** | 427.0 | 427.0 | 427.0 | 427.0 | 427.0 | 427.0 | 427.0 | 427.0 | 427.0 |
| **Production** | 321.4 | 325.4 | 318.5 | 311.9 | 320.2 | 287.4 | 299.0 | 319.9 | 356.6 |
| **Import** | 79.5 | 89.4 | 111.4 | 119.5 | 129.3 | 116.2 |  | | |
| **Export** | 102.0 | 105.9 | 111.7 | 105.0 | 112.9 | 86.9 |
| **Total Demand** | 298.9 | 308.9 | 318 | 326.4 | 336.6 | 316.6 | 334.7 | 397.0 | 465.3 |
| **Demand Supply Gap** |  | | | | | | -35.6 | -77.2 | -108.7 |

*Source: TechSci Research*

**South America Epoxy Resin Market Demand-Supply Analysis, By Volume, 2015-2030F (Thousand Tonnes)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021E** | **2025F** | **2030F** |
| **Capacity** | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 |
| **Production** | 33.5 | 35.8 | 35.2 | 34.5 | 33.2 | 31.8 | 33.0 | 34.6 | 38.2 |
| **Import** | 52.1 | 55.1 | 52.6 | 57.1 | 56.3 | 54.2 |  | | |
| **Export** | 6.0 | 6.2 | 5.7 | 5.4 | 4.2 | 3.1 |
| **Total Demand** | 79.6 | 84.7 | 82.0 | 86.2 | 85.3 | 82.9 | 87.6 | 104.7 | 124.0 |
| **Demand Supply Gap** |  | | | | | | -54.6 | -70.1 | -85.8 |

*Source: TechSci Research*

**MEA Epoxy Resin Market Demand-Supply Analysis, By Volume, 2015-2030F (Thousand Tonnes)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021E** | **2025F** | **2030F** |
| **Capacity** | 220.0 | 220.0 | 220.0 | 220.0 | 220.0 | 220.0 | 220.0 | 220.0 | 220.0 |
| **Production** | 166.6 | 175.5 | 172.1 | 169.8 | 159.2 | 171.4 | 173.8 | 183.6 | 200.6 |
| **Import** | 141.5 | 157.1 | 181.8 | 162.7 | 177.1 | 144.1 |  | | |
| **Export** | 34.2 | 48.2 | 62.1 | 55.2 | 45.9 | 44.4 |
| **Total Demand** | 273.9 | 284.4 | 291.7 | 277.3 | 290.4 | 271.0 | 289.2 | 352.5 | 425.3 |
| **Demand Supply Gap** |  | | | | | | **-115.4** | **-168.9** | **-224.7** |

*Source: TechSci Research*

**India Epoxy Resin Market Demand and Gap Analysis, By Volume, 2021, 2024, 2028 and 2030 – Optimistic, Pessimistic and Realistic**

**India Epoxy Resin Market Supply Analysis, By Volume, 2015-2030F (Thousand Tonnes)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021** | **2025F** | **2030F** |
| **Capacity** | 84.0 | 84.0 | 106.0 | 136.0 | 176.0 | 176.0 | 235.0 | 235.0 | 235.0 |
| **Production** | 55.7 | 68.6 | 89.1 | 89.7 | 101.6 | 93.9 | 119.8 | 193.5 | 210.0 |
| **Import** | 42.1 | 37.5 | 26.4 | 32.1 | 29.8 | 27.5 |  |  |  |
| **Export** | 26.4 | 28.2 | 29.7 | 25.5 | 19.3 | 26.6 |  |  |  |
| **Inventory** | 5.9 | 6.1 | 6.2 | 6.8 | 9.1 | 6.0 |  |  |  |
| **Total Demand** | 65.4 | 71.8 | 79.7 | 89.5 | 103.0 | 88.8 | 98.1 | 139.8 | 208.0 |
| **Demand Supply Gap** |  |  |  |  |  |  | 21.7 | 53.7 | 2.0 |

*Source: TechSci Research*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Demand Scenario** | **2020** | **2021E** | **2024F** | **2028F** | **2030F** |
| **Pessimistic** | **88.83** | **92.09** | **110.92** | **137.53** | **168.44** |
| **Gap** |  | **27.71** | **79.08** | **67.47** | **41.56** |
| **Realistic** | **88.83** | **98.11** | **128.53** | **178.41** | **207.44** |
| **Gap** |  | **21.69** | **61.47** | **26.59** | **2.56** |
| **Optimistic** | **88.83** | **103.25** | **144.75** | **220.08** | **255.62** |
| **Gap** |  | **16.55** | **45.25** | **-15.08** | **-45.62** |

**3.12 Suggested Capacities (Idea Product Mix and Capacity recommendation)**

**Salient Features of the Study**

***Global Scenario:*** The current global capacity of Epoxy Resin is approximately 4.5 million tonnes. Top ten producers account for 55 percent of the total capacity in 2021. In 2021, global consumption of Epoxy Resin was approximately 3.5 million tonnes. Regional analysis indicates surplus in Western Europe, Middle East & North America and deficit in APAC, North America, South America, Oceania and Africa, resulting in heavy trade within the region as well as international trade. Within Asia, India (In optimistic case), Pakistan, Indonesia, Malaysia and Vietnam are expected to remain deficit areas while China, Japan, South Korea and Taiwan are expected to be surplus.

***Indian Scenario:*** Present capacity in the country is 0.18 million tonnes per annum. Entire capacity is shared by four manufacturers – Grasim Industries Ltd, Atul Ltd, Hindusthan Specialty and Kukdo Chemicals. The annual average consumption growth over the last five years period has remained 6.31 percent per annum and over the last 10 years, 8.4 percent per annum, indicating a healthy trend in consumption. It is expected that, based on individual end-use sector growth, consumption of Epoxy Resin will register an overall growth of about 8.8 percent per annum average growth over the next ten years’ period.

India is expected to remain a deficit area despite capacity additions by existing suppliers in optimistic scenario.

Considering demand – supply situation and export market, enough scope exists in the country for a 100 thousand tonnes per annum epoxy resin unit by 2028 in two phases. Setting up a dedicated unit is advisable so that niche grades can be produced. Adequate export market also exists, if required. However, exports are not advisable from realization point of view as domestic sale is more lucrative than exports.

**Recommendations**

* RIL may consider setting-up a 100 thousand tonnes Epoxy Resin (base resin, formulated resin, hardener and diluent) unit by the year 2025 as enough scope exists from demand – supply point of view. However, before taking up this decision, RIL should also consider the project from economic viability point of view.
* Considering capacity utilization of 60 percent in first year and 90 percent in second year onwards, 60 percent quantity is likely to be absorbed within the country itself.
* The company can use one third of epoxy resin (liquid and solid) to produce vinyl ester resin.
* RIL needs to explore export market for both standard and specialized epoxy resin.

**Suggested Epoxy Resin plant capacity in MT / Annum**

*Source: TechSci Research*

|  |  |  |
| --- | --- | --- |
| **Name of the Product** | **2025** | **2030** |
| **Liquid Epoxy Resin\*** | 20,000 | 20,000 |
| **Solid and Semi Solid Epoxy Resin\*** | 12,000 | 12,000 |
| **Solvent Based Epoxy Resin** | 5000 | 5000 |
| **Formulated Epoxy Resin** | 5000 | 5000 |
| **Total** | **42,000** | **42,000** |
| **Epoxy System Plant Capacity** | | |
| **Hardeners** | 5000 | 5000 |
| **Reactive diluents** | **3000** | **3000** |
| **Total** | **8000** | **8000** |

**4. Project Description**

**4.3.5 Major Equipment List (List of major equipment in terms of value & importance)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Technology 1:**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | S No | Equipment | Type | Tag No | MOC | | 1 | Caustic Preparation Solution Tank (48% Caustic) | FRP Vessel | V-101 | FRP | | 2 | Caustic transfer pump | Gear Pump | P-101 | FRP/PTFE | | 3 | BPA Storage Vessel Or Hopper (if Solid) |  | V-102 | SS304 | | 4 | BPA Transfer Pump (if Solid, pump is not required) | Centrifugal Pump | P-102 | SS304 | | 5 | ECH Storage Tank |  | V-103 | SS304 | | 6 | ECH Transfer Pump | Centrifugal Pump | P-103 | SS304 | | 7 | Pre-Reactor | Horizontal Reactor | R-101 | SS304 | | 8 | Reaction solution Transfer pump | Gear pump | P-104 | SS304 | | 9 | Reactor |  | R-102 |  | | 10 | Reaction solution Transfer pump 2 |  | P-104-1 |  | | 12 | Distillation Tower | Vacuum Distillation | X-101 | SS304 | | 13 | Solvent Storage Tank (Toluene) |  | V-105 | SS304 | | 14 | Solvent transfer pump | Centrifugal Pump | P-105 | SS304 | | 15 | Washing Tower |  | V-104 | SS304 | | 16 | Gravity Separator |  | Y-01 |  | | 17 | Soln Transfer pump |  | P-106 |  | | 18 | Ditillation Tower | Vaccum Distillation | X-102 |  | | 19 | Soln Transfer pump 2 |  | P-107 |  | | 20 | Sparkler Filter |  | F-101 |  | | 21 | Mixing Tank |  | M-101 |  | | 22 | Product Tank |  | PR-101 |  | | 23 | UF/RO System |  | T-101 |  | | 24 | DG (2 No's) |  | DG-101 & 102 |  | | 25 | Adsorption Column (5 No's) |  |  |  | | 26 | Dust Collector (5 No's) |  |  |  | | 27 | Cooling Tower |  | C-101 |  | |  |  |  |  |  | | **1.2** | **Equipment list for SER** |  |  |  | | 1 | LER Storage tank |  | V-201 |  | | 2 | Pump | Gear Pump | P-201 |  | | 3 | Reactor |  | R-201 |  | | 4 | Hopper |  | H-201 |  | | 5 | Chiller |  | X-201 |  | | 6 | Heat Exchanger | Shell & tube Heat Exchanger | E-201 |  | | 7 | Pump | Centrifugal Pump | P-202 |  | | 8 | Flaker (Hammer Crosser & Hand Crosser Type) |  | S-201 |  |   **Technology 2**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | S No | Equipment | Type | Tag No | MOC | | 1 | Caustic Preparation Solution Tank (48% Caustic) | FRP Vessel | V-301 | FRP | | 2 | Caustic transfer pump | Gear Pump | P-301 | FRP/PTFE | | 3 | BPA Storage Vessel Or Hopper (if Solid) |  | V-302 | SS304 | | 4 | BPA Transfer Pump (if Solid, pump is not required) | Centrifugal Pump | P-302 | SS304 | | 5 | ECH Storage Tank |  | V-303 | SS304 | | 6 | ECH Transfer Pump | Centrifugal Pump | P-303 | SS304 | | 7 | Pre-Reactor | Horizontal Reactor | R-301 | SS304 | | 8 | Reaction solution Transfer pump | Gear pump | P-R-304 | SS304 | | 9 | Reactor |  | R-302 |  | | 10 | Reaction solution Transfer pump 2 |  | P-R-305 |  | | 12 | Distillation Tower | Vacuum Distillation | X-301 | SS304 | | 13 | Solvent Storage Tank (Toluene) |  | V-305 | SS304 | | 14 | Solvent transfer pump | Centrifugal Pump | P-305 | SS304 | | 15 | Dehydration tank |  | V-306 | SS304 | | 16 | Solution transfer pump 3 |  | P-306 |  | | 17 | Gravity Separator |  | Y-301 |  | | 18 | Soln Transfer pump 4 |  | P-Y-106 |  | | 19 | Ditillation Tower | Vaccum Distillation | X-102 |  | | 20 | Soln Transfer pump 5 |  | P-107 |  | | 21 | Washing tank |  | W-101 |  | | 22 | Reboiler |  | M-101 |  | | 24 | UF/RO System |  | T-101 |  | | 25 | DG (2 No's) |  | DG-101 & 102 |  | | 26 | Adsorption Column (5 No's) |  |  |  | | 27 | Dust Collector (5 No's) |  |  |  | | 28 | Cooling Tower |  | C-101 |  | |  |  |  |  |  | | **1.2** | **Equipment list for SER** |  |  |  | | 1 | LER Storage tank |  | V-201 |  | | 2 | Pump | Gear Pump | P-201 |  | | 3 | Reactor |  | R-201 |  | | 4 | Hopper |  | H-201 |  | | 5 | Chiller |  | X-201 |  | | 6 | Heat Exchanger | Shell & tube Heat Exchanger | E-201 |  | | 7 | Pump | Centrifugal Pump | P-202 |  | | 8 | Flaker (Hammer Crosser & Hand Crosser Type) |  | S-201 |  | |

**4.3.8 Raw Material Required (Detail list of all raw major raw material used for the manufacturing of Epoxy Resin):**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Chemical Name | Molecular Weight | Flash Pt.(°C) | Boiling Pt (°C) | Melting pt. (°C) | Density (g/cm³) | Autoignition temp. (°C) | Solubility in water |
| Epichlorohydrin | 92.5 | 31 | 117.9 | -25.6 | 1.1812 | 385 | Insoluble |
| Isopropyl alcohol | 60.1 | 11.7/13 | 82.5 | -89 | 0.786 |  | Soluble |
| Bisphenol-F | 200.24 | 177.1 | 362.5 °C at 1 atm |  | 1.208g/cm³ |  | Low |
| Bisphenol-A | 228.9 | 227 | 360 | 158 | 1.2 | 600 | Insoluble |
| Caustic soda lye | 40 |  | 1390 | 318 | 2.1 (Solid) |  | Soluble |
| Toluene | 92.14 | 4.4/16 | 110.6 | -95 | 0.8636 | 1.53 | Insoluble |
| Phenol | 94.11 | 79 |  | 40.5 | 1.07 |  | 8.3g/100ml |
| o-cresol | 108.14 | 81 | 191 | 29.8 | 1.05(solid) 1.03(liq.) |  | 2.5g/100ml |
| 1,4-Butanediol | 90.12 | 121 | 235 | 20.1 | 1.0171 at | 350 | Soluble |
|  |  |  |  |  | 20° C |  |  |
| Cardanol | 300 |  |  | 57-65 | 1 at 25° C |  | Less than 1g/L at 25° C |
| Polypropylene glycol | 76.09 | 99 | 188.2 | -59 | 1.036 at 20° C | 371 |  |
| Hexahydropthalic anhydride | 154.2 | 152 | 296 | 37.5 | 1.18 | 395 | 7g/L at 20° C |