Phenolic resins, also known as phenol–formaldehyde resins, are synthetic polymers that are produced from the reaction of phenol or substituted phenol with formaldehyde at high temperatures. These are widely used in wood adhesives, molding compounds, and laminates. The resins are flame-retardant, demonstrate high heat resistance, high tensile strength, and low toxicity, and generate low smoke. In the report, the phenolic resins market is segmented on the basis of product type, application, and region.

Phenolic Resin Market size estimated to reach at USD 19.13 billion in 2026. Alongside, the market is anticipated to grow at a CAGR of 5.4% during the forecast period. The global phenolic resins market has experienced a notable growth and it has been projected that the global market will see stable growth during the forecast period. The high mechanical strengths, low toxicity, heat resistance, low smoke and other several properties has made the phenolic resins to make their use in the applications such as in laminations, wood adhesives, molding compound, construction, automobile and others. Growing demand of these applications has increased the production of phenolic resins to meet the current market demand. Also, phenolic resins is used in flame retardant which is very crucial for automobiles and aircrafts.

This book basically deals with general reaction of phenols with aldehydes, the resoles, curing stages of resoles, kinetics of a stage reaction, chemistry of curing reactions, kinetics of the curing reaction, the novolacs, decomposition products of resites, acid cured resites, composition of technical resites, mechanisms of rubber vulcanization with phenolic resins, thermosetting alloy adhesives, vinyl phenolic structural adhesives, nitrile phenolic structural adhesives, phenolic resins in contact adhesives, chloroprene phenolic contact adhesives, nitrile phenolic contact adhesives, phenolic resins in pressure sensitive adhesives, rubber reinforcing resins, resorcinol formaldehyde latex systems, phenolic resin chemistry, bio-based phenolic resins, flexibility of phenolic resins, floral foam (Phenolic Foam) with resin manufacturing, lignin-based phenol formaldehyde (LPF) resins, phenol formaldehyde resin, alkaline phenol formaldehyde resin, furfuryl alcohol phenol urea formaldehyde resin, phenol formaldehyde resin (Shell Sand Resin), phenol formaldehyde resin (Cold Box Resin), effluent treatment plant, standards and legislation, marketing of thermoset resins, process flow sheet, sample plant layout and photographs of machinery with supplier’s contact details.

A total guide of phenolic resins and entrepreneurial success in one of today's most lucrative resin industry. This book is one-stop guide to one of the fastest growing sectors, where opportunities abound for manufacturers, retailers, and entrepreneurs. This is the only complete handbook on Phenolic resins.
Contents

1. HISTORICAL DEVELOPMENT OF PHENOLIC RESINS

2. RAW MATERIALS
   Phenols, Physical Properties of Phenol, Cumene Process (Hock Process), Cresols and Xylenols â€“
   Synthesis Methods, Alkylphenols, Phenols from Coal and Petroleum, Other Phenolic Compounds,
   Resorcinol, Bisphenol-A, Formaldehyde, Properties and Processing, Paraformaldehyde, Trioxane and Cyclic
   Formals, Hexamethylenetetramine, HMTA, Furfural, Other Aldehydes

3. CHEMICAL STRUCTURE
   General Reaction of Phenols with Aldehydes, The Resoles, Curing Stages of Resoles, Kinetics of A-Stage
   Reaction, Chemistry of Curing Reactions, Kinetics of the Curing Reaction, The Novolacs, Decomposition
   Products of Resites, Acid-Cured Resites, Composition of Technical Resites

4. PHENOLIC RESINS FROM HIGHER ALDEHYDES
   Acetaldehyde, Butyraldehyde, Chloral, Furfural, Acrolein

5. PHENOLIC RESINS FROM POLYHYDRIC PHENOLS

6. REACTION MECHANISMS
   Molecular Structure and Reactivity of Phenols, Formaldehyde-Water and
   Formaldehyde-Alcohol Equilibria, Phenol-Formaldehyde Reaction under Alkaline Conditions, Inorganic
   Catalysts and Tertiary Amines, Ammonia, HMTA and Amine-Catalyzed Reactions, Reaction Kinetics of the
   Base-Catalyzed Hydroxymethylation, Prepolymer Formation, Resole Cross-Linking Reactions. Quinone
   Methides, Acid Curing, Heat Curing, Phenol-Formaldehyde Reactions under Acidic Conditions, Reaction
   Kinetics in Acidic Medium, Reaction under Weak Acidic Conditions. â€œHigh-Orthoâ€œ-Novolak Resins,
   Novolak Cross-Linking Reaction with HMTA, Reaction with Epoxide Resins, Reactions with Diisocyanates

7. THE PHYSICAL STRUCTURE OF PHENOLIC RESINS
   Introduction, X-Ray Examination, Electron Microscope Examination, The Isogel Theory of Phenoplast
   Structure, The Spherocolloid Theory of Phenoplast Structure, Further Swelling Experiments, Development of
   Structure in A-Stage Resin, General Picture of Phenoplast Structure, Structure of Cast Phenoplasts

8. RESIN PRODUCTION

9. FILLERS FOR PHENOLIC RESIN MOULDING POWDERS
   Types of Filler, Effect of Filler on Impact Strength and Damping, Microscopic Structure of Fillers, Ratio of
   Resin to Filler, Standard Classification of Phenoplast Molding Powder According to Filler, Properties of
   Individual Fillers, Cellulose Derivatives, Wood Flour, Walnut-Shell Flour, Cottonseed Hulls, Cellulosic Fibers,
   Textile By-Products, Proteinaceous Fillers, Carbon Fillers, Mineral Fillers

10. FILLERS AND RESINS FOR LAMINATES
Classification of Laminates, Laminated Phenolic Sheets, Laminated Phenolic Tubes (NEMA Classification), High Strength Paper Laminates, Plastic Bonded Cotton Fiber, Glass Fabric Filler, Resins used for Laminates

11 PHYSIOLOGY AND ENVIRONMENTAL PROTECTION

12. DEGRADATION OF PHENOLIC RESINS BY HEAT, OXYGEN AND HIGH ENERGY RADIATION
Thermal Degradation, Oxidation Reactions, Degradation by High Energy Radiation

13. MECHANICAL PROPERTIES OF MOLDED PHENOLIC RESINS

14. MECHANICAL PROPERTIES OF LAMINATED PHENOLIC RESINS

15. MODIFIED AND THERMAL-RESISTANT RESINS
Etherification Reactions, Esterification Reaction, Boron-Modified Resins, Silicon-Modified Resins, Phosphorus-Modified Resins, Heavy Metal-Modified Resins, Nitrogen-Modified Resins, Sulfur-Modified Resins

16. COMPOSITE WOOD MATERIALS

17. MOULDING COMPOUNDS
Standardization and Minimum Properties, Composition of Molding Powders, Resins, Fillers, Reinforcements and Additives, Wood Flour and Cellulose Fibers, Asbestos, Mineral Flour, Other Fillers and Fibers, Colorants,
Lubricants and Release Agents, Production of Molding Powders, Thermoset Flow, Manufacturing of Molded Parts, Compression Molding, Transfer Molding, Injection Molding, Selected Properties, Thermal Resistance, Shrinkage and Post-Mold Shrinkage, Thermal Expansion

18. HEAT AND SOUND INSULATION MATERIALS

19. THERMAL PROPERTIES OF PHENOLIC RESINS
Introduction, Coefficient of Expansion, Flame Resistance

20. CHEMICAL RESISTANCE OF PHENOLIC RESINS
Introduction, Water Absorption, Effect of Reagents, Chemical Applications for Phenoplasts, Resistance to Microorganisms

21. OIL SOLUBLE PHENOLIC RESINS
Introduction, Pure Oil-Soluble Phenoplasts, The Modified Phenoplasts, Reactions of the Phenoplasts with Oils

22. FRICTION MATERIALS

23. PHENOLIC RESINS IN RUBBERS AND ADHESIVES

24. PHENOLIC ANTIOXIDANTS

25. OTHER APPLICATIONS
Carbon and Graphite Materials, Phenolics for Chemical Equipment, Phenolic Resin/Fiber Composites, Phenolic Resin Fibers, Blast Furnace Taphole Mixes, Photo-Resists, Socket Putties, Brush Putties, Tannins, Ion-Exchange-Resins, Casting Resins

26. TECHNICAL MANUFACTURE OF PHENOLIC RESINS
Resin Manufacture, Cast Resins, Resin Varnishes, Resin Compound, Molding Powder, Phenoplast Molding Laminates

27. MOULDING TECHNIQUE FOR PHENOLIC RESINS
Introduction, Compression Molding, Transfer Molding, Injection Molding, Molding Practice, Preheating
28. MISCELLANEOUS TECHNICAL APPLICATIONS OF PHENOLIC RESINS

29. FOUNDRY RESINS

30. PHENOLIC RESIN CHEMISTRY
Resoles Chemistry
Novolacs Chemistry
Manufacturing Plant and Procedure
Properties

31. BIO-BASED PHENOLIC RESINS
Tannin

32. FLEXibilIZATION OF PHENOLIC
Tests Performed on Unmodified Phenolic Resin
Physical-Mechanical Characteristics
IR-Tests
NMR-Tests

33. FLORAL FOAM (PHENOLIC FOAM) WITH RESIN MANUFACTURING
When Working with Floral Foams
Types of Floral Foam
Wet Foam
Liquid Foam Process
Dry Foam
Foam Ingredients
Dry Hard Foam Process
Color Foam
Products
Foam Brick
Foam Dome
Properties of Floral Foam
Manufacturing Process
Resol Resin Preparation
Floral Foam Production
Process Flow Diagram

34. LIGNIN-BASED PHENOL FORMALDEHYDE (LPF) RESINS
Lignin
Lignin Modification Techniques
Methylolation and Phenolation
Lignin Thermolysis Techniques
Pyrolysis
Hydrogenolysis
Oxidation
Hydrolysis

35. PHENOL FORMALDEHYDE RESIN
Phenol Formaldehyde Resin
PF Resole Synthesis
Properties
Physical Properties
Chemical Properties
1. Overview of PF Cure
2. Action of Heat
3. Action of Acids
4. Stability
5. Toxicity
6. Ecological Effects
7. Flammability
Applications
Manufacture of Phenol Formaldehyde Resin Using Alkaline Catalyst
Manufacture of Phenol Formaldehyde Resin Using Acid Catalyst
Process
Step: 1
Step: 2
Overall Reaction
Manufacturing Process
Technology
Pollution Potential
PF Resole Synthesis and Curing
PF Synthesis and Curing Parameters

36. ALKALINE PHENOL FORMALDEHYDE RESIN
Manufacturing Process
Material Balance
Reaction Chemistry
Process Flow Diagram

37. FURFURYL ALCOHOL PHENOL UREA FORMALDEHYDE RESIN
Manufacturing Process
Material Balance
Reaction Chemistry
Process Flow Diagram

38. PHENOL FORMALDEHYDE RESIN (SHELL SAND RESIN)
Manufacturing Process
Material Balance
Reaction Chemistry
Process Flow Diagram

39. PHENOL FORMALDEHYDE RESIN (COLD BOX RESIN)
Manufacturing Process
Material Balance
Reaction Chemistry
40. EFFLUENT TREATMENT PLANT
   Description of ETP Unit
   ETP Flow Diagram
   Water Balance

41. STANDARDS AND LEGISLATION
   Standards
   British Standards Relating to Thermosets
   British/European Norm Standards Relating to Thermosets
   British/European/International Standards Relevant to Thermosets

42. MARKETING OF THERMOSET RESINS
   Acrylics
   Alkyds
   Amino Resins
   Bismaleimides
   Epoxy
   Furane
   Hybrids
   Phenolics
   Polyimides
   Unsaturated Polyester
   Polyurethanes
   Vinyl Esters
   Transport
   Environment and Recycling

43. PROCESS FLOW DIAGRAM

44. SAMPLE PLANT LAYOUT

45. MACHINERY SUPPLIERS FOR PHENOLIC RESIN
   Distillation Column
   Vertical & Horizontal Condenser
   Chemical Storage Tank
   Jacketed Reactor
   Chemical Process Reactor
   Stainless Steel Mixing Vessel/Mixing Tank
   Fractional Distillation Column
   Oil Water Separators
   Chemical Storage Tank
   Chemical Reactor
   Reaction Vessel
   Heat Exchanger
   Jacketed reaction Vessel
   Reaction Kettle
   Blending Tank
   Buffer Tank
   Condenser
About NIIR

NIIR PROJECT CONSULTANCY SERVICES (NPCS) is a reliable name in the industrial world for offering integrated technical consultancy services. NPCS is manned by engineers, planners, specialists, financial experts, economic analysts and design specialists with extensive experience in the related industries.


NPCS also publishes varies process technology, technical, reference, self employment and startup books, directory, business and industry database, bankable detailed project report, market research report on various industries, small scale industry and profit making business. Besides being used by manufacturers, industrialists and entrepreneurs, our publications are also used by professionals including project engineers, information services bureau, consultants and project consultancy firms as one of the input in their research.

NIIR PROJECT CONSULTANCY SERVICES, 106-E, Kamla Nagar, New Delhi-110007, India. Email: npcs.india@gmail.com Website: NIIR.org