Phenolic Resins Technology Handbook (2nd Revised Edition)

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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, flexibilization 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.

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€•-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
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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
Introduction, Mechanical Properties Covered, Pheno-plast Properties at Room Temperature, Effect of Degree of Cure on Physical Properties, Tensile Strength, Modulus of Elasticity, Compressive Strength, Flexural Strength, Shear Strength, Bearing Strength, Impact Resistance, Creep and Stress Endurance, Fatigue Resistance, Influence of Temperature on Mechanical Properties, Influence of Temperature on Creep, Theoretical Discussion of Strength Properties of Phenoplasts, Strength-Weight Comparisons with Metals

14. MECHANICAL PROPERTIES OF LAMINATED PHENOLIC RESINS
Introduction, Mechanical Properties at Ordinary Temperatures, Tensile Strength, Modulus of Elasticity, Compressive Strength, Flexural Strength, Shear Strength, Bearing Strength, Impact Resistance, Creep and Stress Endurance, Fatigue Resistance, Abrasion Resistance, Influence of Temperature on Mechanical Properties, Effect of Resin Content on Mechanical Properties, Effect of Moisture Content of Paper Filler Before Lamination, Effect of Laminating Pressure, Effect of Degree of Cure, Effect of Moisture Content on Physical Properties, Mechanical Properties of Post-Formed Laminates, Tensile Strength, Flexural Strength, Shear Strength, Impact Strength, Water Absorption

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
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16. COMPOSITE WOOD MATERIALS

Wood, Residues of Annual Plants, Adhesives and Wood Gluing, Phenol Resins, Urea and Melamine Resins, Diisocyanates, Lignosulfonates, Bark Extracts, Physical Properties of Composite Wood Materials, Particle Boards, Wood Chips, Resins and Additives, Wood Chips, Resins, Hydrophobic Agents, Fungicides and Insecticides, Flame Retardants, Production of Particle Boards, Chip Blending, Pressing of Particle Boards, Properties of Particle Boards, Plywood, Resins, Additives and Formulations, Production of Plywood, High-Densified Plywood, Fiber Boards, Wood Fibers, Resins and Additives, Production of Fiber Boards, Structural Wood Gluing, Resorcinol Adhesives

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
Inorganic Fiber Insulating Materials, Inorganic Fibers and Fiber Production, Resins and Formulation, Properties of Fiber Mats, Phenolic Resin Foam, Resins and Additives, Blowing Agents, Surfactants, Foaming Equipment, Foam Properties, Sound Insulating Textile Fiber Mats.

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
Friction and Wear of Thermosets, Formulation of Friction Materials, Fibers, Fillers, Resins, Manufacturing of Brake- and Clutch Linings, Impregnation Process, Wet Mix â€œDoughâ€• Process, Dry Mix Process

23. PHENOLIC RESINS IN RUBBERS AND ADHESIVES
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27. MOULDING TECHNIQUE FOR PHENOLIC RESINS
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28. MISCELLANEOUS TECHNICAL APPLICATIONS OF PHENOLIC RESINS
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29. FOUNDRY RESINS
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Buffer Tank
Condenser
Boiler
Resin Kettle
Weighing Machine
Resin Storage Tank
Distillation Column
High Speed Disperser
Double Cone Blender
Jacketed Reactorsses

About NIIR

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