Pines are known to mankind from the time immemorial. It offers both direct uses, as well as indirect uses specially soil conservation. Initially it was used mainly for fuel; their branches were used for festivals etc. Pines besides being a source of valuable timber, pulpwod, yield pitch, tar, rosin, colophony and turpentine, collectively known as naval stores, a term coined to these owning to their use for construction and maintenance of sailing vessels as sealing compounds for their wooden hulls. The genius pine species tapped for their oleoresin in different countries. A variety of oleoressins are extracted from various plants. Pine oleoresin being the most important one is extracted from pine trees. Turpentine and rosin are two constituent parts of the pine oleoresins. The composition of turpentine varies considerably according to the species of pine exploited. More and more specialised uses are being found for pine resin products, particularly those of high quality. Turpentine derived from pine resin is also used as a source of aroma chemicals in flavour and fragrance industry. Pinewood chemicals are effectively gained from the trees in three principal ways; treatment of exuded gum from living pines, processing the wood stumps and wastes of aged trees and treatment of black liquor obtained as a byproduct in wood pulp industry. There are two steps involved in production of oleoresin; olustee gum cleaning process and recovery of turpentine and rosin: batch and continuous process. The panorama of base catalysed isomerisations of terpenes is an important part of aroma chemistry. Major contributions in this area are presented here under sections on hydrocarbons, alcohols, aldehydes, ketones, acids, esters and epoxides. Tall oil is a by product of the pine wood use to make sulfate pulp. Tall oil products find use in many product applications because of their economy and ready availability. The principal industrial applications of tall oil products are numerous; adhesives, carbon paper, detergents, driers, drilling fluids, oils, gloss oils, paper size, plasticizers, printing inks, soaps, textile oils etc. Some of the fundamentals are pine oleoresin extraction methods, occurrence, formation and exudation of oleoresin in pines, processing of oleoresin, rosin derivatives and its potential, new developments in rosin ester and dimer chemistry, terpene based adhesives, effect of solvent, ozone concentration and temperature on yields were investigated, sylvestrene and some of its derivatives, homopolymers and copolymers of acrylates, polymers and copolymers of vinyl pinolate, base catalysed isomerisations of terpenes, components
of pine roots, insecticides based on turpentine, the general characteristics of dimer acids, structure and properties of dimer acids etc.
The present book has been published having in views the important uses of pines. The book contains manufacturing process of different products extracted from pines like oleoresin, rosin, turpentine derivatives, tall oil, resins and dimer acids etc. This is the first book of its kind which is very resourceful for all from researchers to professionals.

Contents

1. PINUS
   Introduction
   Distribution
   Distribution in India
   Morphology
   Key to the Identification of Indian Species
   Anatomy
   Root
   Root-Stem Transition
   Shoot Apex
   Stem
   Leaf
   Embryology
   Male Cones
   Female Cones
   Pollination
   Receptive Spot
   Fertilization
   Embryogeny
   Seed Coat
   Wing
   Germination
   Cytology
   Seed Testing
   Seed Production and Dormancy
   Breeding
   Diseases
   Mycorrhiza
   Pests

2. PINE OLEORESIN EXTRACTION METHODS
   Introduction
   Cup the Larger-Diameter Trees for Increased Yields and Greater Profits
   Double-Facing
   Gum Yield from Shoulders
   Use Correct Tin Lengths
   First-Year Installation of Spiral Gutters with Double-Headed Nails
   Shaving the Bark
   Attach the Apron First
   Attaching the Spiral Gutter
   Completed Installation
   Use of the Advanced Streak
   Turpentining and Growth
Bark Chipping
Mounting and Sharpening the Bark Hack
Treating the Streak
Acid Penetration Above the Streak
Wounding the Tree for Gum Production
Metal Cups, Acid Corrosion and Gum Grades
Raising Tins Installed with Double-Headed Nails
Bark Pulling and Acid Treatment
How to Use the Spray-Puller
Acid Paste Method
Applying the Paste
Chipping and Paste Treatment
Streak Height
Turpentinined Section Suitable for Other Wood Products
Beetle Attacks and Control Measures
The Black Turpentine Beetle
The Ips Beetle
Solutions for Beetle Control
3. PINES FOR THEIR OLEORESIN
Occurrence, Formation and Exudation of Oleoresin in Pines
Oleoresin Tapping
French Methods
Spanish Method
Greek Method
Indian Method
Mexican Method
American Bark-Chipping Method
The Austrian and German “Herringbone” Methods
Russian Methods
Methods in Other Countries
Felled Pine Wood as Source of Rosin and Turpentine
Composition of Oleoresin
Summary
4. PROCESSING OF OLEORESIN
Processing of Oleoresin
Olustee Gum Cleaning Process
Recovery of Turpentine and Rosin
Stripping Column
Multiple Tube Column
Luwa Columns
Fractionation of Turpentine
Batch Operation
Semi-Continuous Operation
Continuous Operation
Column Packings
Isomerisation of α-pinene
Camphene Via Bornyl Chloride
Catalytic Isomerisation of α-pinene
Reaction Mechanism
Design Aspect of an Isomerisation Reactor
Liquid Phase
Vapor Phase
5. ROSIN DERIVATIVES AND ITS POTENTIAL
6. HYDROGENLESS HYDROGENATION OF RESIN ACIDS
Experimental
Results and Discussion
Transfer Hydrogenation of Isopimaric/Pimaric Acids
Transfer Hydrogenation of Abietic Acids
Reaction Mechanism
7. NEW DEVELOPMENTS IN ROSIN ESTER AND DIMER CHEMISTRY
New Rosin Esters
Chemistry of Rosin Dimers
8. TERPENE RESINS
Physical Properties
Chemical Properties
Manufacture
Uses
9. TERPENE BASED ADHESIVES
Introduction
Chemistry
Beta-Pinene Resins
Initiation
Propagation
Termination
Dipentene Resins
Alpha-Pinene Resins
Physical Characteristics of Resins
Pressure Sensitive Adhesives
Hot Melt Adhesives
Analytical Methods
Commercial Resins and Their Uses
Commercial Production
Applications in Pressure Sensitive Adhesives
Applications in Hot Melt Adhesives
10. OZONOLYSIS OF ALPHA-PINENE
Effect of Solvent, Ozone Concentration and Temperature on Yields were Investigated
Experimental Conditions are Discussed
11. Ï•-BROMOLONGIFOLENE
Steam Distilled Products
Residue
Chromic Acid Oxidation of Dilongifolenyl Ether
Lead Tetraacetate Oxidation of Longifolene
12. PEROXIDES FROM TURPENTINE
Peroxide Number and Degree of Unsaturation are Tests of Product Quality
Catalytic Hydrogenation of Pinene to Pinane is First Step in Hydroperoxide Production
Small and Large Scale Techniques of Pinane Oxidation are Investigated
Cold-Rubber Polymerization
Decomposition of Pinane Hydroperoxide
Over-all Yield of 85% is Realized in Production of High Purity Hydroperoxide
Peroxidation
Stripping of Oxidates
Polymerization
Heavy Metal Salts Accelerate Decomposition of Pinane Hydroperoxide
Decomposition
Summary

13. PINONIC ACID
Ozonolysis of α-Pinene in Acetic Acid Solution Proved Best Method
Yields were Determined by Partition Chromatography
Ozone Source
Reagents
Ozonization
Calculations and Analyses
Direct Ozonolysis was not Successful
Ozonization in Methanol
Ozonization and Decomposition in Aqueous Acetic Acid at Room Temperature
Ozonization in Aqueous Acetic Acid at 0°C. Decomposition in the Presence of Oxidants
Ozonization in Nitromethane

14. SYLVESTRENE AND SOME OF ITS DERIVATIVES
Sylvestrene
Sylvestrene Nitrosochloride
Sylvestrene Oxide
m-Terpineols
Sylvedihydrocarvone

15. 8-ACETOXYCARVOTANACETONE

16. RECOVERY OF 3-CARENE FROM CHINESE TURPENTINE AND SYNTHESIS OF ACETYL-CARENES
Introduction
Distillation of Wood and Sulfate Turpentines
Material and Methods
Distillation Results
Synthesis of Acetyl-Carene
Materials and Methods
Results and Discussion
Synthesis Products

17. HOMOPOLYMERS AND COPOLYMERS OF ACRYLATES
Introduction
Results and Discussion
Monomers
Homopolymerization
Copolymerization
Terpolymerization
Epoxidation
Curing
Hydrolysis of Polymethacrylate of I
Experimental
Reduction of α-Campholene Aldehyde
Typical Preparation of a Monomer: Methacrylate of II
Typical Homopolymerization Recipe: Homopolymer Methacrylate of II
Typical Copolymerization Recipe: Copolymer of the Methacrylate of II and Acrylate of I
Solution Copolymer of the Methacrylate of II and Fumaronitrile
Typical Terpolymerization Recipe: Terpolymer of the Acrylate of I, Acrylonitrile and Butadiene
Typical Epoxidation Procedure

18. POLYMERS AND COPOLYMERS OF VINYL PINOLATE
Preparation of Vinyl Pinolate
Polymerization
Reaction of Vinyl Pinolate Copolymers with Isocyanates
Experimental
Preparation of Vinyl Pinolate
Polymerization of Vinyl Pinolate in Solution
Polymerization of Vinyl Pinolate in Suspension
Polymerization of Vinyl Pinolate in Emulsion
Copolymerization of Vinyl Pinolate and Vinyl Acetate in Solution
Copolymerization of Vinyl Pinolate and Vinyl Chloride in Solution
Copolymerization of Vinyl Pinolate and Vinyl Chloride in Emulsion
Reaction of Polymers with Isocyanates
Evaluation of Vinyl Pinolate and Vinyl Chloride Copolymers

19. HOMOPOLYMERIZATION OF HYDRONOPYL VINYL ETHER
Discussion
Experimental
Materials
Preparation of 2-Hydronopyoxyethyl Vinyl Ether
Polymerization of HVE and HEVE
X-Ray Analysis of Poly (HVE)
Evaluation of Poly (HEVE)

20. TERPOLYMERS OF ETHYLENE AND PROPYLENE WITH d-LIMONENE AND iÅ¢-PINENE
Introduction
Results and Discussion
Experimental
Materials
Preparation of EPT Rubber
Analysis of Unsaturation
Determination of Gel Content
Determination of Methyl Group Content in Polymer

21. LOW MOLECULAR WEIGHT POLYMERS OF d-LIMONENE
Experimental
Materials
General Procedure
Results
Infrared Spectra
Nuclear Magnetic Resonance Spectra
Optical Activity
Perbenzoic Acid Oxidation
Discussion

22. BASE-CATALYSED ISOMERISATIONS OF TERPENES
Hydrocarbons
Alcohols
Aldehydes
Ketones
Acids
Esters
Epoxides
Conclusion

23. COPOLYMERS OF VINYL CHLORIDE OF PINENE
Experimental
Homopolymerization
Copolymerization
Test of Heterogeneity of a Copolymer
Evaluation of New Polymers
24. POLYALLOÖCIMENE
Experimental
Monomer
Polymerizations
Polymer
Ozonolysis
Discussion of Results
25. ESSENTIAL OIL IN CHLOROPHYLL-CAROTENE
PASTE FROM PINE NEEDLES AND TWIGS
Abstract
26. ESSENTIAL OIL OF THE CONE OF PINUS
SYLVESTRIS VAR. MONGOLICA
27. COMPONENTS OF PINE ROOTS
Conclusions
Composition of the Remaining Neutral Fraction
Composition of the Carbonyl Fraction
Composition of the Hydroxyl Fraction
Results and Discussion
Composition of Turpentine
Composition of the Resin Acid Fraction
28. WOOD TURPENTINE OIL FROM PINE STUMPS
29. BLENDING OF TURPENTINE PRODUCTS
Lilac
Pine Bouquet
Cuir De Russe (for leather)
Violet
Lavender Bouquet
Oriental
Gardenia
Fougere
Eau De Cologne
Amber
Chypre
Ylang Syn
Sweet Pea
30. BIOLOGICALLY ACTIVE COMPOUND FROM
TURPENTINE
Terpenoids as Antimicrobials
Terpenoids as Anthelmintics
Terpenoids as Insecticides
Terpenoids as Plant Growth Hormones
Terpenoids as Anticancer Agents
Terpenoids as Pharmacological Agents
Terpenoid Derivatives as Biodynamic Agents
Terpenoids as Intermediates for Synthesis of Bio¬dynamic Agents
31. INSECTICIDES BASED ON TURPENTINE
Toxaphene (C10H10 Cl8)
Strobane (C10H11Cl7)

NIIR Project Consultancy Services (NPCS) 7/9
32. TALL OIL

History of Tall Oil
Production Processes for Tall Oil
Recovery of Tall Oil
Acid Refining of Tall Oil
Fractionation of Tall Oil
Composition and Properties of Tall Oil
Crude Tall Oil
Distilled Tall Oil
Acid Refined Tall Oil
Fractionated Tall Oil
Analysis and Testing of Tall Oil Products
Shipping, Storage and Handling of Tall Oil Products
Crude Tall Oil
Acid Refined Tall Oil
Tall Oil Fatty Acids and Distilled Tall Oils
Tall Oil Heads
Tall Oil Pitch
Tall Oil Rosin
Safety Notes
Applications of Tall Oil
The Chemistry of Tall Oil Fatty and Rosin Acids
Chemical Composition of Tall Oil Fatty Acids
General Reactions of Tall Oil Fatty Acids
Chemical Composition of Tall Oil Rosin
General Reactions of Tall Oil Rosin
Tall Oil Products in Surface Coatings
Tall Oil in Alkyd Resins
Tall Oil Formulations in Alkyd Resins
Esters of Tall Oil Products
Tall Oil Formulations in Esters
Other Uses for Tall Oil Products
Tall Oil in the Plasticizer Field
Esterification of Tall Oil for Plasticizers
Tall Oil in Adhesives and Linoleum Cement
Tall Oil in Rubber-based Adhesives
Tall Oil in Hot-Melt Adhesives
Tall Oil Products in Linoleum Cements
Formulation with Tall Oil
Formulation with Tall Oil Esters

33. DIMER ACIDS

The General Characteristics of Dimer Acids
Introduction
Dimer Acids Manufacture and Feedstock
By Products of the Dimerization Reaction
Monomer Acids
Trimer Acids
Structure and Properties of Dimer Acids
Structure of Dimer Acids
Analysis of Dimer Acids
Physical Properties of Dimer Acids
Chemical Reactions of Dimer Acids
Reactions of the Double Bonds and at the \(i\)-Carbon Atoms
Reactions of the Carboxyl Groups to Produce Monomeric Derivatives
Reactions of the Carboxyl Groups to Produce Polymeric Derivatives
Commercial Applications of Dimer Acids and Their Derivatives
Introduction
Applications of Dimer Acids
Applications of Monomer Acids and Derivatives
Applications of Trimer Acids and Derivatives
Applications of Low-Molecular Weight Derivatives of Dimer Acids
Applications of High-Molecular Weight Dimer Acids Derivatives
Applications of Other Polymeric Nitrogen Derivatives of Dimer Acids

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.

Our Detailed Project report aims at providing all the critical data required by any entrepreneur vying to venture into Project. While expanding a current business or while venturing into new business, entrepreneurs are often faced with the dilemma of zeroing in on a suitable product/line.

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