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Original Article

A Review on Role of Colophony in Different Formulation

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ABSTRACT

Colophony, commonly known as rosin, is a natural resin derived from the oleoresin of pine trees and other coniferous plants. Historically, it has been valued for its adhesive, waterproofing, and protective properties, with early applications in shipbuilding, musical instruments, sealing wax, and traditional medicine. Extraction in the past relied on simple tapping and distillation methods, producing material of variable purity and limited industrial scope. In the present era, colophony has become a versatile industrial raw material, utilized in adhesives, varnishes, printing inks, soldering fluxes, pharmaceuticals, and cosmetics. Advances in extraction and refining techniques have improved quality and consistency, while chemical modifications such as hydrogenation, esterification, and polymerization have enhanced its performance in specialized applications. Its role in pharmaceuticals—as a coating agent, encapsulation material, and film former—has expanded due to its biocompatibility. However, allergenic potential in sensitive individuals remains a challenge. Future prospects for colophony are promising, driven by the need for renewable, biodegradable, and sustainable alternatives to petroleum-derived products. Green chemistry approaches, nanotechnology-based modifications, and development of hypoallergenic derivatives are expected to broaden its applications in advanced coatings, biomedical devices, and eco-friendly packaging. Thus, colophony remains a material of both historical significance and future potential.

Keywords: Colophony, rosin, resin acids, industrial applications, green chemistry, future prospects

INTRODUCTION

Colophony:

Colophony, also known as rosin, is a natural solid resin obtained from the oleoresin of pine trees (Pinus species). It is produced by distillation of crude turpentine, where the volatile fraction (turpentine oil) is removed, leaving behind the brittle, glassy solid known as colophony. It is widely used in pharmaceuticals, adhesives, varnishes, inks, and biomedical applications due to its adhesive, film-forming, and emulsifying properties. [1]

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Synonyms: Rosin, Greek pitch, Gum rosin, Yellow resin, Resin of pine.[5]

Biological Source: Colophony is the solid resin obtained from the oleoresin of various Pinus species (family: Pinaceae). Common commercial sources include: Pinus palustris (Longleaf pine) Pinus elliottii (Slash pine) Pinus pinaster (Maritime pine) Pinus roxburghii (Chir pine – widely tapped in India) It is produced by distilling crude oleoresin to remove volatile turpentine oil, leaving behind the resinous mass.[4]

Chemical Constituents: Colophony primarily contains resin acids (90–95%) and small amounts of neutral matter.

Major resin acids: Abietic acid, Neoabietic acid, Levopimaric acid, Palustric acid, Pimaric acid, Dehydroabietic acid, Neutral fraction: fatty acids, terpenes, and oxidation products.[7]

Uses:

1) Pharmaceutical applications: Tablet coating, microencapsulation, and sustained-release formulations and Component of plasters and ointments as a film-forming agent.[6]
2) Industrial applications: Manufacture of adhesives, varnishes, sealing wax, and linoleum, Printing inks and paper sizing, Flux in soldering to remove metal oxides, Applied to bows of string instruments to increase friction.[2]

Advantages:

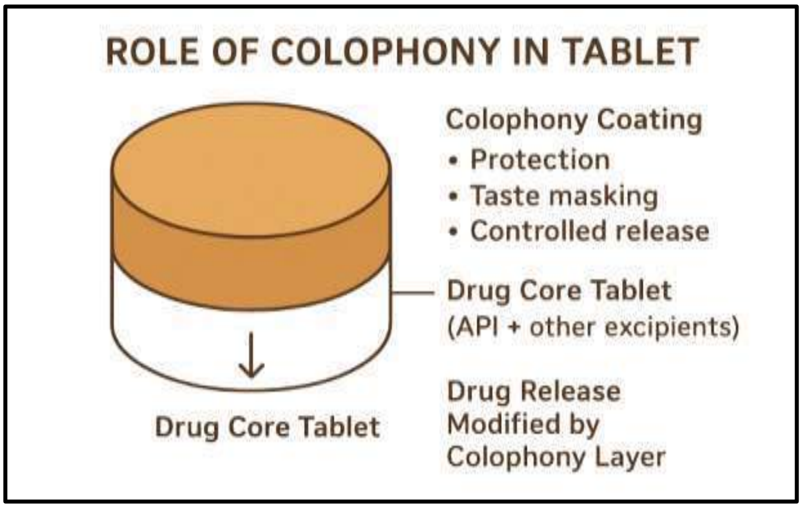
1) Renewable and biodegradable natural resin
2) Good adhesive and hydrophobic film-forming properties
3) Can be chemically modified for specialized uses
4) Cost-effective and widely available.[5]

Disadvantages:

1) Allergenic potential can cause contact dermatitis in sensitive individuals
2) Limited oxidation and heat stability unless modified
3) Brittle without plasticizers
4) Susceptible to yellowing on aging.[3]

Role of Colophony in Tablets:

Colophony, also known as rosin, is a natural resin obtained from Pinus species. It contains resin acids (mainly abietic acid) and neutral substances, which make it highly versatile in pharmaceutical formulations, including tablets.



1. As a Film-Forming Agent in Tablet Coating

Colophony and its derivatives (rosin esters) are used as film-formers in coating tablets.

These coatings protect tablets from moisture, light, and oxidation, thereby enhancing shelf life. In some cases, colophony is incorporated in sustained-release coatings, where its hydrophobic nature helps control drug release.[11]

Example: Rosin-based films have been explored for enteric coatings, resisting gastric fluids but dissolving in intestinal pH.

2. As a Binder in Tablet Formulations

Powdered colophony can act as a binder during granulation, helping compressibility and tablet hardness. It provides cohesion among powder particles, improving tablet integrity. [9]

3. As a Matrix Former in Sustained Release Tablets

Colophony is used to prepare matrix tablets, where it controls the release of drug molecules over time. Its resinous and hydrophobic character slows drug diffusion, making it suitable for sustained or controlled release formulations.

Example: Studies have shown colophony-based microspheres and matrix tablets controlling release of drugs like diclofenac sodium and theophylline.[10]

4. As a Plasticizer and Excipient Modifier

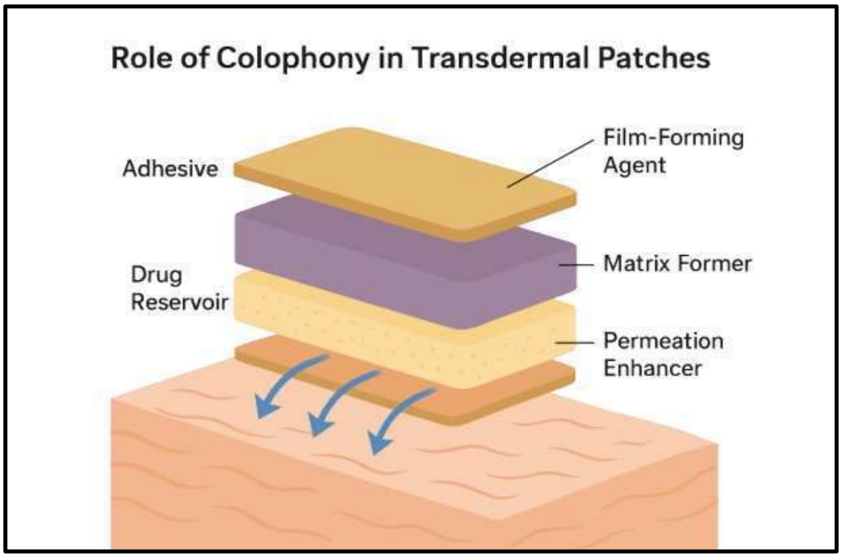
Modified colophony derivatives improve film flexibility and reduce brittleness in tablet coatings. It can be combined with other polymers (e.g., ethylcellulose, shellac) to optimize mechanical strength and release kinetics.[8]

5. Limitations in Tablet Formulations

Colophony can cause allergic reactions in sensitive individuals, especially in oral mucosa. Excess use may affect tablet disintegration time due to its hydrophobic nature. Requires careful modification or blending with hydrophilic excipients for optimal performance.[12]

Role of Colophony in Transdermal Patches

Colophony, also known as rosin, is a natural resin obtained from Pinus species. It is primarily composed of resin acids (abietic acid and related compounds) and neutral materials. Due to its adhesive and film-forming properties, colophony has found significant use in transdermal drug delivery systems (TDDS).



1. As an Adhesive Agent

The main function of colophony in transdermal patches is as a pressure-sensitive adhesive (PSA). It ensures that the patch sticks properly to the skin surface for a prolonged duration without causing irritation. Modified forms like esterified rosin (rosin esters) improve adhesion strength, flexibility, and stability of patches.[15]

2. Film-Forming & Matrix-Forming Agent

Colophony is incorporated in the polymeric matrix of patches to provide mechanical strength and uniform distribution of the drug. Its hydrophobicity helps in controlling drug release rates, maintaining patch integrity, and reducing moisture loss.[13]

3. Permeation Enhancer

Resin acids in colophony may act as skin permeation enhancers by disturbing the stratum corneum lipid structure, thereby improving drug penetration. Studies have suggested that when used with other polymers (EVA, HPMC, PVP), colophony can significantly modulate drug diffusion.[16]

4. Stabilizer in Patch Formulations

Colophony contributes to stability of drug-polymer blends, preventing phase separation. Its compatibility with a wide range of polymers makes it suitable in matrix-type and reservoir-type patches.[17,15]

5. Advantages

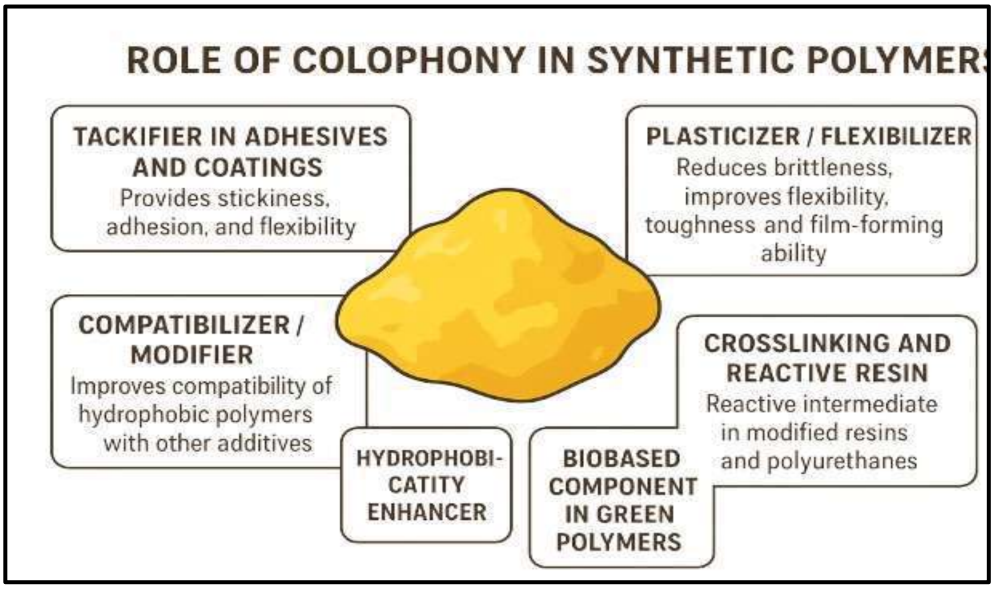
Natural, biodegradable, and inexpensive. Provides strong adhesion without requiring synthetic adhesives. Can be chemically modified (esterification, hydrogenation) to enhance properties.[14]

6. Limitations

May cause allergic contact dermatitis in sensitive individuals. Requires purification or modification before use in pharmaceutical-grade patches.[17]

Role of Colophony in Synthetic Polymers

Colophony, also called rosin, is a natural resin obtained from pine trees, mainly composed of resin acids such as abietic acid, levopimaric acid, and their isomers. Because of its unique hydrophobic skeleton with reactive carboxyl groups, colophony has attracted considerable attention in polymer science. Its dual nature—hydrophobic carbon framework with a functional group—makes it a valuable raw material for green, bio-based polymer development.



1. Modifier in Synthetic Polymer Blends

Colophony and its derivatives are often used as plasticizers, tackifiers, and compatibilizers in synthetic polymers such as polyethylene, polypropylene, polystyrene, and polyvinyl chloride. The hydrophobic resin backbone interacts with non-polar synthetic polymers, improving miscibility and adhesion. Rosin esters are commonly incorporated in hot-melt adhesives, pressure-sensitive adhesives, and coatings.[18]

2. Monomer for Bio-based Polymers

Resin acids (especially abietic acid) from colophony contain conjugated double bonds and carboxyl groups that can be chemically modified into acrylates, maleates, or epoxides, which act as bio-based monomers. These derivatives are copolymerized with synthetic monomers (e.g., styrene, acrylates, methacrylates) to produce rosin-based copolymers with enhanced thermal stability, mechanical strength, and biodegradability.[20]

3. Improvement of Thermal and Mechanical Properties

Colophony-derived polymers exhibit rigid hydrophobic structures that increase the glass transition temperature (Tg) and mechanical hardness of synthetic polymers. For example, rosin-modified phenolic resins and epoxy resins show superior chemical resistance, hardness, and adhesive strength compared to unmodified systems.

4. Eco-friendly Alternative to Petroleum Feedstock

The growing demand for sustainable polymers has led to interest in colophony as a renewable alternative to petroleum-based modifiers. Its derivatives can replace phthalate plasticizers or petroleum-derived tackifiers in adhesives and coatings, thus reducing environmental hazards.[19]

5. Applications in Polymer Industries

Adhesives: Rosin esters blended with synthetic polymers act as tackifiers.

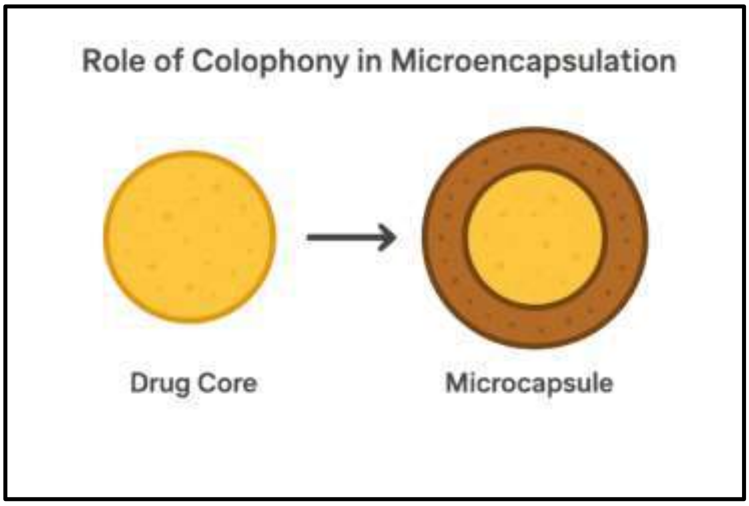
Coatings: Modified rosin used in alkyd resins and epoxy systems for corrosion resistance.

Biomedical polymers: Rosin-based copolymers have shown potential in drug delivery and tissue engineering due to biocompatibility.

Composites: Rosin improves interfacial bonding between synthetic polymer matrices and natural fibers.[21,22]

Role of Colophony in Microencapsulation

Microencapsulation is a widely used technique in pharmaceuticals, food, and agriculture for entrapping active substances within a coating material to provide controlled release, stability, and protection. Colophony (rosin), a natural resin obtained from Pinus species, has gained significant attention as a coating and film-forming material in microencapsulation due to its hydrophobicity, adhesive property, and compatibility with different drugs.



1. Film-Forming and Coating Agent

Colophony acts as an effective coating material in microencapsulation because of its good film-forming ability. It creates a protective shell around core materials (like drugs, vitamins, or essential oils), which: Protects active ingredients from oxidation, light, and moisture. Prevents premature release and degradation. Improves the stability and shelf life of encapsulated materials.[27]

2. Controlled & Sustained Release

Colophony is slightly hydrophobic, making it suitable for sustained and controlled drug release formulations. Microcapsules prepared with colophony provide a slow release of the active core material, which is beneficial in: Reducing frequent dosing in pharmaceuticals. Providing extended therapeutic effect. Minimizing side effects by avoiding drug burst release.[25]

3. Compatibility with Additional Polymers

Colophony is often blended with other natural or synthetic polymers (e.g., ethylcellulose, gelatin, starch derivatives) to modulate release profiles. Its combination enhances encapsulation efficiency and improves mechanical strength of microcapsules.[23]

4. Biodegradability & Safety

Being a natural resin, colophony is biodegradable, relatively safe, and cost-effective compared to synthetic polymers. This makes it suitable for encapsulating pharmaceuticals, nutraceuticals, agrochemicals, and flavors.[23,24]

5. Application

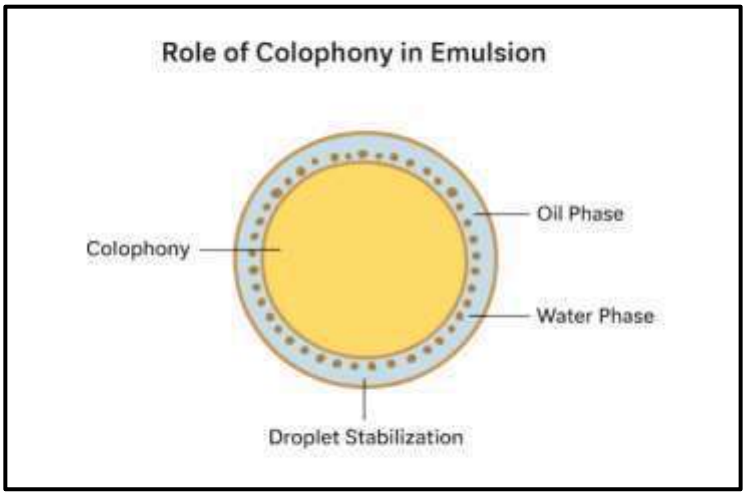
Pharmaceuticals: Encapsulation of bitter drugs, antibiotics, and NSAIDs to mask taste and prolong release.

Food Industry: Encapsulation of flavors, vitamins, and antioxidants for improved stability.

Agriculture: Controlled release of pesticides and fertilizers using colophony-based microcapsules.[26]

Role of Colophony in Emulsions

Colophony (rosin) is a natural resin obtained from the oleoresin of Pinus species, mainly composed of abietic acid and its isomers. Due to its amphiphilic nature, colophony and its derivatives (such as rosin esters and rosin soaps) have been widely used in emulsion formulations across pharmaceuticals, cosmetics, food, and agrochemical industries.



1. Emulsifying Agent

Colophony, when saponified with alkali metals (e.g., sodium, potassium), forms rosin soaps that act as surface-active agents. These reduce interfacial tension between oil and water phases, stabilizing oil-in-water (O/W) or water-in-oil (W/O) emulsions. They are especially used in emulsified ointments and cosmetic creams.[29]

2. Stabilizer of Emulsions

Colophony derivatives (e.g., glycerol esters of rosin) provide steric stabilization, preventing coalescence of dispersed droplets. This improves the shelf-life and physical stability of emulsions. In agrochemicals, such stabilization helps in controlled delivery of pesticides and fertilizers.[29]

3. Film-Forming Property

Due to its adhesive and hydrophobic nature, colophony forms a thin protective film around dispersed droplets, protecting them against oxidation, moisture, and microbial degradation. This is particularly useful in pharmaceutical emulsions containing sensitive drugs, or in food emulsions to preserve flavors.[23]

4. Controlled Release in Emulsions

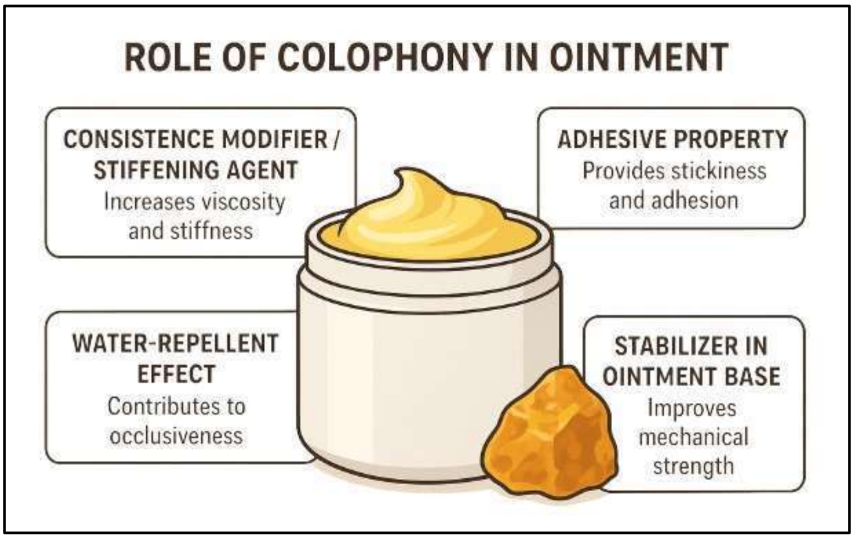
Colophony resins, when incorporated in multiple emulsions (e.g., W/O/W), enable sustained release of drugs by slowing diffusion from the inner aqueous phase. This is advantageous in topical formulations and cosmetic emulsions where prolonged effect is desired.[24]

5. Compatibility with Other Emulsifiers

Colophony can be blended with natural or synthetic surfactants (like Tween, Span, or lecithin) to improve emulsification efficiency. Such synergistic effects provide better droplet size control and enhanced stability.[26,28]

Role of Colophony in Ointments

Colophony (rosin) is a natural solid resin obtained from the Pinus species. It is composed primarily of abietic acid and related resin acids, which contribute to its adhesive, hydrophobic, and film-forming properties. Because of these unique characteristics, colophony and its derivatives are widely incorporated in pharmaceutical ointments for therapeutic, protective, and formulation purposes.



1. As a Base Modifier

Colophony is frequently used to modify ointment bases to provide consistency and adhesiveness. It helps to improve the spreadability of ointments on the skin while maintaining an occlusive effect. Its hydrophobic nature makes ointments more water-resistant, beneficial for topical formulations that need prolonged retention.[23]

2. Adhesive Property

The strong tackiness of colophony is exploited in plasters, ointment dressings, and medicated adhesive bases. It helps ointments adhere to the skin surface, ensuring longer contact time of the drug with the site of application, thus enhancing therapeutic effect.[32]

3. Antimicrobial and Healing Effects

Colophony has been reported to possess antibacterial and antifungal activity, making it useful in ointments intended for wound healing and skin protection. Traditional ointments containing rosin have been applied to chronic wounds, ulcers, and skin infections for their protective and antimicrobial action.[31,34]

4. Film-Forming & Protective Barrier

Colophony forms a thin protective film over the skin when used in ointments, reducing exposure to external irritants and aiding in healing. This property is particularly useful in protective ointments for dermatitis and minor wounds.[30]

5. Role in Specialized Ointments

In veterinary and folk medicine, rosin-based ointments are used for treating hoof diseases, boils, and abscesses. In modern pharmaceutics, colophony is also employed in transdermal ointment bases where prolonged adhesion and drug release are required.[33]

CONCLUSION

Due to its distinct physicochemical features, colophony, also known as rosin, plays a crucial and adaptable role in a wide range of pharmaceutical, cosmetic, and industrial compositions. As a natural resin produced from pine trees, it offers a sustainable, biocompatible, and affordable substitute for many synthetic excipients. Colophony is frequently employed in pharmaceutical compositions as a tablet binder, where it promotes regulated medication release, enhances mechanical strength, and improves cohesion. Its hydrophobic and film-forming properties make it especially beneficial in transdermal patches, microencapsulation, and emulsions, guaranteeing the continuous release and stability of active pharmaceutical components. Furthermore, colophony functions as a stabilizer, adhesive, and protective agent in ointments and topical treatments, enhancing therapeutic effectiveness and patient adherence. Colophony's versatility is demonstrated by its uses outside of pharmaceuticals, such as in cosmetics, adhesives, coatings, and emulsifiers. Its capacity to interact with oils and polymers enhances its use in drug delivery systems and formulation creation. But caution must be exercised when considering its allergenic potential in susceptible people, which can be reduced by purification or chemical alteration.

REFERENCE

1. Rowe, R. C., Sheskey, P. J., & Quinn, M. E. (Eds.). (2009). Handbook of Pharmaceutical Excipients. Pharmaceutical Press.
2. Allen, N. S., Edge, M., Ortega, A., Liauw, C. M., Stratton, J., & McIntyre, R. B. (2011). Colophony-based resins: Chemistry, technology and applications. Polymer Degradation and Stability, 96(9), 1681–1691.
3. Basketter, D. A., White, I. R., McFadden, J. P., & Kimber, I. (2003). Rosin (colophony): a review. Contact Dermatitis, 48(2), 63–67.
4. Coppen, J. J. W., & Hone, G. A. (1995). Gum naval stores: Turpentine and rosin from pine resin. FAO Forestry Paper 80. Rome: FAO.
5. Martín, C., Martín, S., García, A., & Alfaro, M. J. (2020). Rosin and rosin derivatives: Renewable materials for eco-friendly applications. Industrial Crops and Products, 155, 112823.
6. Rowe, R. C., Sheskey, P. J., & Quinn, M. E. (2012). Handbook of Pharmaceutical Excipients (6th ed.). Pharmaceutical Press.
7. Zinkel, D. F., & Russell, J. (1989). Naval Stores: Production, Chemistry, Utilization. Pulp Chemicals Association.
8. Jain R, et al. Colophony: A versatile excipient for drug delivery. Int J Pharm Sci Rev Res. 2021.
9. Ekundayo E. Natural resins and their pharmaceutical applications. J Pharm Bioallied Sci. 2019.
10. Rowe RC, Sheskey PJ, Quinn ME (Eds.). Handbook of Pharmaceutical Excipients, 6th ed. Pharmaceutical Press, 2009.
11. PubMed: Use of rosin and derivatives in drug delivery
12. Drugs.com: Inactive ingredient – Colophony
13. Aqil, M., Sultana, Y., & Ali, A. (2004). Matrix type transdermal drug delivery systems of metoprolol tartrate: In vitro characterization. Acta Pharmaceutica, 54(1), 63–70.
14. Kumar, V., & Sharma, A. (2012). Role of natural resins in transdermal drug delivery systems. International Journal of Pharmacy and Pharmaceutical Sciences, 4(3), 1–6.
15. Thakur, R. R. S., & Price, R. D. (2009). Current trends in transdermal drug delivery systems: Adhesion and bioavailability. International Journal of Pharmaceutics, 371(1-2), 1–6.
16. Sharma, N., & Agarwal, G. (2011). Role of natural polymers in transdermal drug delivery system. International Journal of Research in Pharmacy and Chemistry, 1(4), 1139–1144.
17. U.S. Patent No. 5,656,286. (1997). Pressure-sensitive adhesive compositions using rosin esters.
18. Feng, J., Wang, X., & Guo, Z. (2013). Rosin-based chemicals and polymers: Recent advances in synthesis and applications. Progress in Polymer Science, 38(8), 1132–1165. https://doi.org/10.1016/j.progpolymsci.2013.04.002
19. Gandini, A. (2008). Polymers from renewable resources: a challenge for the future of macromolecular materials. Macromolecules, 41(24), 9491–9504.
20. Isikgor, F. H., & Becer, C. R. (2015). Lignocellulosic biomass: a sustainable platform for the production of bio-based chemicals and polymers. Polymer Chemistry, 6(25), 4497–4559.
21. Liu, J., & Chen, Y. (2014). Rosin-derived polymers and their biomedical applications. Journal of Applied Polymer Science, 131(4), 39872.
22. Zhang, C., Ding, K., & Xu, J. (2017). Rosin-based polymers for sustainable applications. Green Chemistry, 19(12), 2771–2787.

23. Rowe RC, Sheskey PJ, Quinn ME. Handbook of Pharmaceutical Excipients. 6th Edition. Pharmaceutical Press; 2009.
24. Banker GS, Rhodes CT. Modern Pharmaceutics. 4th Edition. Marcel Dekker; 2002.
25. Ghosh TK, Jasti BR. Theory and Practice of Contemporary Pharmaceutics. CRC Press; 2005.
26. Pachuau L, Das SC. "Colophony and its applications in drug delivery systems." Journal of Applied Pharmaceutical Science, 2017; 7(10): 227–232.
27. Jyothi NVN, Prasanna PM, Sakarkar SN, Prabha KS, Ramaiah PS, Srawan GY. "Microencapsulation techniques, factors influencing encapsulation efficiency." Journal of Microencapsulation. 2010; 27(3): 187–197.
28. Tadros T. Emulsion Formation and Stability. Wiley-VCH; 2013.
29. Shukla RK, Tiwari A. "A review on role of natural resins in drug delivery." Int. J. Pharm. Sci. Rev. Res. 2012; 12(1): 85–90.
30. Karlberg AT, Magnusson K, Nilsson U. "Colophony revisited." Contact Dermatitis. 1997; 36(1): 1–6.
31. Dragland IS, Senning A, Borchgrevink CF. "The effect of rosin ointment on chronic wounds." Scandinavian Journal of Caring Sciences. 2011; 25(2): 341–347.
32. Allen, L. V., Popovich, N. G., & Ansel, H. C. (2013). Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems (10th ed.). Lippincott Williams & Wilkins.
33. Uddin, M. S., Sarker, M. Z. I., Ferdosh, S., Akanda, M. J. H., & Easmin, S. (2011). Pharmaceutical and biomedical applications of natural resins: A review. Journal of Pharmaceutical Sciences and Research, 3(6), 1427–1433.
34. Rutuja V. shelke, Vikram S. Sarukh Int. J. Sci. R. Tech., 2024 1(11) "Wound Healing Pathways and Treatment: A Comprehensive Review.

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