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Preparation of White Phenyl Floor Cleaner: A Sustainable Approach to Household Hygiene

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Abstract: White phenyl is a common disinfectant and floor cleaner that contains mostly pine oil emulsified in water. In this research, the formulation, stability, and confirmation testing of white phenyl are emphasized using pine oil and cutting oil or Sulfonated Castor oil as major components. The main aim is to prepare an efficient, stable, and cost-effective formulation and confirm its disinfectant nature.

The process of formulation entails emulsifying the pine oil with cutting oil or Sulfonated castor oil acting as an emulsifier and later diluting it in water to form a stable milky white solution. The emulsion is then tested for stability through phase separation analysis, and a good formulation should be homogeneous without oil separation after 24 hours. In addition, solubility tests validate its miscibility with water, and pH testing verifies a slightly alkaline character (6.5–8.0) appropriate for efficient cleaning. The disinfectant activity of the synthesized phenyl is assessed through microbial growth inhibition tests, determining its capacity to inhibit bacterial colonies on treated surfaces.

This research seeks to maximize the long-term stability of the formulation without compromising its high efficacy as a cleaning agent. The findings give light to the function of cutting oil as an emulsifier in phenyl manufacture and set scientific procedures to assure the performance of the product. This work helps in the sustainable development of low-cost disinfectants with real-world applications in household and industrial cleaning.

Keywords: White phenyl, Pine oil, Cutting oil, Sulfonated Castor oil, Disinfectant, Cost-effective Disinfectant

I. INTRODUCTION

The research project titled "Preparation of White Phenyl Floor Cleaner: A Sustainable Approach to Household Hygiene" explores the formulation and production of white phenyl as an effective and eco-friendly cleaning solution. Submitted as part of the Master of Science in Organic Chemistry program at the University of Mumbai, this study aims to address key concerns regarding household and commercial cleaning products.

Phenyl-based disinfectants are widely used in homes, hospitals, and industries due to their strong antimicrobial properties and effectiveness in eliminating dirt, grease, and harmful microorganisms. Traditionally, black phenyl, derived from coal tar distillates, has been the predominant choice, but its toxicity and strong odor have led to the increased demand for white phenyl, which offers a safer and more pleasant alternative.

The study emphasizes cost-effective and sustainable production of white phenyl, particularly for lower-income households and rural communities. The project aligns with the Swachh Bharat Abhiyan initiative, aiming to make hygiene products affordable and accessible. It focuses on biodegradable ingredients, ensuring eco-friendliness while maintaining high cleaning efficiency. Additionally, it explores formulation techniques to improve stability, shelf life, and ease of large-scale production.

By optimizing raw material selection, formulation ratios, and emulsification techniques, the research seeks to develop a commercially viable white phenyl that meets regulatory safety standards while catering to a growing market. This project serves as a foundation for future advancements in green cleaning technologies and supports small-scale manufacturers in developing economical yet effective disinfectants.

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II. METHODOLOGY

Sulfonation of castor oil

- Set up a 500 mL beaker in an ice bath to regulate the temperature.
- Take 100 mL of castor oil in the beaker.
- Slowly add 25–30 mL of concentrated sulfuric acid dropwise with continuous stirring.
- Maintain the reaction temperature below 30–35°C to prevent excessive oxidation.
- Stir continuously for 1-2 hours until the reaction reaches completion.
- Slowly add a 10% NaHCO₃ or NaOH solution while stirring.
- Maintain pH at 7–8 to neutralize any excess acid.
- Transfer the mixture into a separating funnel and let it settle.
- Remove the acidic lower layer.
- Wash the organic layer with warm distilled water 3 times to remove residual acid.









Preparation of white phenyl Materials Required:

• Pine Oil (50 mL) - Antimicrobial and deodorizing agent.

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- Sulfonated Castor oil (50 mL) Helps in emulsification and stability.
- Distilled Water (900 mL) Acts as a diluent.
- Measuring Cylinder & Beaker For accurate measurement and mixing.

Preparation Steps:

- Step 1: Measuring Ingredients Accurately measure pine oil, Sulfonated Castor oil, and distilled water.
- Step 2: Preparing Pine Oil Solution Mix 50 mL pine oil with 450 mL distilled water, stir for 5-10 minutes.
- Step 3: Preparing Sulfonated Castor Oil Solution Mix 50 mL Sulfonated Castor oil with 450 mL distilled water, stir for 5-10 minutes.
- Step 4: Final Mixing Slowly combine both solutions and stir continuously for 15-20 minutes until a milky white emulsion forms.
- Step 5: Storage & Maturation Store in a dark, airtight container for 24-48 hours to stabilize.







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III. LITERATURE REVIEW

Discovery of Phenol:

- Phenol was discovered in 1834 by Friedlieb Ferdinand Runge, extracted from coal tar.
- Auguste Laurent (1841) obtained it in pure form and coined the term "phène", later forming the root of "phenol" and "phenyl".
- Charles Gerhardt (1843) officially named it "phénol".

Historical Applications:

- Sir Joseph Lister (1827–1912) introduced phenol as an antiseptic in surgery.
- Used in the Carbolic Smoke Ball, a failed influenza remedy, leading to the famous Carlill v Carbolic Smoke Ball Co. legal case.

Chemical Properties of Phenol:

- Aromatic compound (C6H5OH) a white crystalline solid, volatile, and mildly acidic.
- Originally extracted from coal tar, now mainly produced from petroleum (7 billion kg/year).
- Used in plastics, epoxies, detergents, herbicides, and pharmaceuticals.
- More acidic than alcohols due to resonance stabilization and inductive effects.

Phenol in Cleaning Products:

- Black phenyl: Made from coal tar oils and phenols, strong but toxic and irritating.
- White phenyl: Safer, non-toxic, pleasant-smelling, and biodegradable, making it a preferred choice.

Market Demand & Growth:

- India's surface disinfectant market is worth ₹5 billion/year, with phenyl accounting for 60% of sales.
- Increasing urbanization and hygiene awareness are driving higher demand for white phenyl.

IV. RESULTS AND DISCUSSION

Formulation Efficiency:

- The optimized white phenyl formulation successfully produced a stable, milky emulsion.
- Emulsification process was effective, preventing phase separation after 24-48 hours of storage.
- The final product had a pleasant fragrance, smooth texture, and good dispersibility in water.

Quality Control and Stability Tests:

- Emulsion Stability Check: No phase separation observed, ensuring long shelf life.
- pH Testing: Maintained within the ideal range (6-7) for safety and effectiveness.
- Viscosity Check: The product was non-greasy, smooth, and easy to apply on different surfaces.
- Microbial Testing (Optional): Ensured absence of bacterial or fungal contamination for hygiene and safety.

Cleaning and Disinfection Performance:

- The formulated white phenyl effectively removed dirt, grease, and microbial contaminants from floors.
- Exhibited strong antimicrobial activity due to pine oil and Sulfonated castor oil components.
- Suitable for various surfaces like tiles, wood, marble, and concrete, making it a versatile cleaning agent.

Cost-Effectiveness and Market Feasibility:

- The estimated production cost was ₹15-20 per liter, significantly lower than commercial alternatives (₹50 per liter).
- This affordability makes it accessible for rural and economically weaker sections, supporting Swachh Bharat Abhiyan.
- The formulation does not require a license, making it ideal for small-scale manufacturing.

V. CONCLUSION

The developed white phenyl formulation proves to be a cost-effective, eco-friendly, and efficient disinfectant, meeting both hygiene and sustainability requirements. The research successfully achieved a stable emulsion with long shelf life,

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strong cleaning action, and microbial resistance. The optimized formulation, using pine oil and Sulfonated castor oil, ensures effective dirt and grease removal while providing a pleasant fragrance and non-toxic composition, making it safe for households, hospitals, and public spaces.

One of the key advantages of this formulation is its affordability, with a production cost of ₹15-20 per liter, significantly lower than commercial alternatives priced at ₹50 per liter. This makes high-quality cleaning solutions accessible to low-income households and rural communities, aligning with the Swachh Bharat Abhiyan initiative for improved sanitation. Additionally, the product's biodegradable nature reduces its environmental impact, promoting sustainable cleaning solutions.

The research also demonstrates that white phenyl can be produced without a manufacturing license, making it an ideal opportunity for small-scale entrepreneurs and local manufacturers. Its versatile application across multiple surfaces, such as tiles, wood, and marble, enhances its usability in both domestic and commercial settings.

With increasing demand for safe and eco-friendly cleaning solutions, this project provides a scalable production process that can be adopted for industrial manufacturing. The findings contribute to the development of green cleaning technologies and can be expanded further to improve formulations for other disinfectants and hygiene products, ensuring better health standards and economic growth.

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This project has been a valuable learning experience, and I sincerely hope that the findings contribute to the advancement of affordable and eco-friendly disinfectant solutions.

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