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Green Synthesis of Aspirin Using Plant Extracts as Eco-Friendly Catalysts

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Abstract- Green chemistry promotes environmentally sustainable chemical processes by minimizing hazardous substances and waste generation. Aspirin (acetylsalicylic acid), a widely used pharmaceutical drug, is traditionally synthesized using strong acids and non-renewable catalysts, which pose environmental and safety concerns. This study investigates the green synthesis of aspirin using plant extracts such as curry leaves (Murraya koenigii), clove (Syzygium aromaticum), and neem (Azadirachta indica) as natural catalysts. The phytochemicals present in these extracts, including flavonoids, phenols, and alkaloids, facilitate the acetylation reaction under mild conditions. The synthesized aspirin was characterized using UV–Visible spectroscopy, pH measurement, conductivity analysis, viscosity studies, and flame photometry. The results confirmed successful synthesis with satisfactory yield and purity, with clove extract showing the highest efficiency. The study demonstrates that plant-mediated synthesis is a cost-effective, safe, and environmentally benign alternative to conventional aspirin production methods.

Keywords— Green synthesis, Aspirin, Plant extract, Sustainable chemistry, Phytochemicals, Eco-friendly catalysis

I. INTRODUCTION

Aspirin (acetylsalicylic acid) is one of the most widely used drugs due to its analgesic, antipyretic, and anti-inflammatory properties. Conventional synthesis methods involve strong acids and chemical catalysts that are hazardous and environmentally damaging.
Green chemistry offers an alternative approach by utilizing renewable resources and minimizing toxic by-products. Plant extracts are rich in bioactive compounds such as flavonoids, tannins, phenols, and alkaloids, which can act as natural catalysts and reducing agents.

Figure 1: Green Synthesis of Aspirin (Acetylsalicylic Acid)

This study focuses on the synthesis of aspirin using plant extracts and evaluates their effectiveness as eco-friendly catalysts.

II. MATERIALS AND METHODS

1. Materials

- Salicylic acid
- Acetic anhydride
- Plant extracts (clove, curry leaves, neem)
- Distilled water

2. Preparation of Plant Extracts

- Leaves/spices washed and cleaned
- Crushed or powdered
- Boiled in distilled water
- Filtered for use

3. Green Synthesis of Aspirin

- Salicylic acid mixed with acetic anhydride
- Plant extract added as catalyst
- Heated using hot plate (controlled temperature)
- Reaction monitored
- No use of strong mineral acids (eco-friendly approach)

4. Characterization Techniques

- UV–Visible Spectroscopy
- pH Meter
- Conductivity Meter
- Redwood Viscometer
- Flame Photometer

III. RESULTS AND DISCUSSION

1. Formation of Aspirin

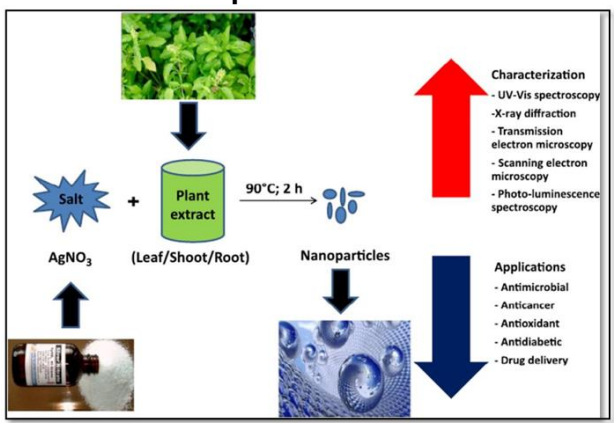

Figure 2: Green synthesis of aspirin using plant extracts

2. Role of Plant Extracts

Plant extracts act as:

- Catalysts
- Stabilizers
- Reaction enhancers

Phytochemicals facilitate acetylation under mild conditions.

3. Yield Comparison

Table 1: Yield of Aspirin Using Different Extracts

Extract	Yield
Clove	Highest
Curry Leaves	Moderate
Neem	Moderate

UV–Visible Analysis

Table 2: Spectroscopic Observations

Sample	Observation
Aspirin	Characteristic peak observed

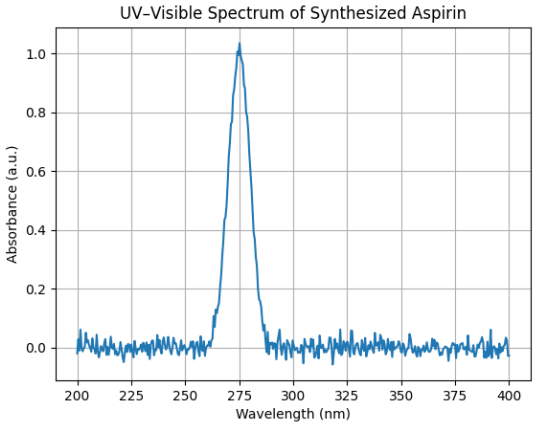

Figure 3: UV–Visible spectrum of synthesized aspirin

Physicochemical Analysis

Table 3: pH and Conductivity

Parameter	Observation
pH	Stable
Conductivity	Slight variation

Viscosity Studies

Table 4: Viscosity Observations

Sample	Viscosity
Reaction mixture	Moderate

Flame Photometry

Table 5: Trace Elements Analysis

Element	Observation
Metal ions	Trace presence

Advantages of Green Method

Table 6: Conventional vs Green Synthesis

Parameter	Conventional	Green
Catalyst	Strong acids	Plant extract
Toxicity	High	Low
Cost	High	Low
Environmental impact	Harmful	Eco-friendly

Mechanism of Green Catalysis

- Phytochemicals donate electrons
- Facilitate acetylation
- Stabilize reaction intermediates

IV. CONCLUSION

The study successfully demonstrates the green synthesis of aspirin using plant extracts as eco-friendly catalysts. The method eliminates the need for hazardous chemicals and provides a sustainable alternative to conventional synthesis. Among the extracts studied, clove extract exhibited the highest efficiency. The approach is cost-effective, safe, and suitable for laboratory-scale and potential industrial applications.

REFERENCES

1. Anastas, P.T., Warner, J.C. (1998). Green Chemistry: Theory and Practice.
2. Ahmed, S. et al. (2016). Green synthesis using plant extracts.
3. Iravani, S. (2011). Green nanoparticle synthesis.
4. Rai, M. et al. (2009). Nanotechnology in pharmaceuticals.
5. Sharma, V.K. et al. (2009). Green synthesis applications.
6. Singh, P. et al. (2018). Plant-mediated synthesis.
7. WHO (2017). Sustainable pharmaceutical guidelines.
8. Khandel, P. et al. (2018). Green chemistry advancements.
9. Prabhu, S. (2012). Mechanism of nanoparticles.
10. Dwivedi, A.D. (2010). Neem-based synthesis.
11. Zhang, H. et al. (2016). Nanotechnology applications.
12. APHA (2012). Standard methods.