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# COMPARATIVE IN VITRO ANTIMICROBIAL ACTIVITY OF ALOE VERA (Aloe barbadensis MILLER) AND OCIMUM SANCTUM AGAINST SELECTED BACTERIAL AND FUNGAL PATHOGENS

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## ABSTRACT



*This study compared the in vitro antibacterial and antifungal activity of Aloe vera (Aloe barbadensis Miller) and Ocimum sanctum (Tulsi) leaf extracts prepared using methanol, ethanol and acetone. According to the supplied project report, plant material was collected from the Vadalur–Kurinjipadi area of Cuddalore District, Tamil Nadu. The extracts were tested against six bacterial organisms—Bacillus cereus, B. subtilis, Escherichia coli, Pseudomonas aeruginosa, Salmonella Typhi and Staphylococcus aureus—and five fungal organisms—Aspergillus flavus, A. niger, A. fumigatus, Candida albicans and Penicillium species—using a disc-diffusion method. Inhibition zones were reported in millimetres at an extract concentration of 10 mg/mL. In the reported data, methanol extracts generally produced larger zones than ethanol and acetone extracts. The largest reported antibacterial zone was 23.00 mm for methanolic Aloe vera extract against E. coli; the largest reported antifungal zone was 16.80 mm for methanolic Aloe vera extract against A. flavus. Methanolic Ocimum sanctum extract produced zones of 20.00 mm against E. coli and 7.50 mm against A. flavus. These findings suggest preliminary in vitro antimicrobial activity under the study conditions.*

**KEYWORDS:** *Aloe vera; Ocimum sanctum; Tulsi; antimicrobial activity; disc diffusion; medicinal plants; bacterial pathogens; fungal pathogens.*

## 1. INTRODUCTION

Medicinal plants have long been used in traditional health practices and remain a subject of scientific investigation as possible sources of biologically active compounds. Aloe vera is a succulent plant whose leaf gel has been studied for a range of biological properties. Ocimum sanctum, commonly called Tulsi or holy basil, is an aromatic herb used in traditional Indian medicine. The antimicrobial activity of plant extracts can vary according to plant species, plant part, extraction solvent, preparation conditions and the organism being tested.

The project report that forms the basis of this paper evaluates methanol, ethanol and acetone extracts of Aloe vera and Ocimum sanctum against selected bacteria and fungi. It reports that

methanolic extracts showed the greatest inhibition overall, particularly against Escherichia coli and Aspergillus flavus.

## 2. AIM AND OBJECTIVES

**Aim:** To compare the in vitro antimicrobial activity of Aloe vera and Ocimum sanctum leaf extracts against selected bacterial and fungal organisms.

- To prepare methanol, ethanol and acetone extracts from Aloe vera and Ocimum sanctum leaves.
- To evaluate antibacterial activity against six selected bacterial organisms using the disc-diffusion method.
- To evaluate antifungal activity against five selected fungal organisms.
- To compare the inhibition zones produced by the three solvent extracts for each plant.

## 3. MATERIALS AND METHODS

### 3.1 Collection of plant samples

The project report states that Aloe vera and Ocimum sanctum (Tulsi) leaves were collected from Vadalur–Kurinjipadi, Cuddalore District, Tamil Nadu, India. The report does not specify the collection date, plant authentication procedure, voucher specimen number or exact collection coordinates.

### 3.2 Test microorganisms

The bacterial organisms listed in the source are Bacillus cereus, Bacillus subtilis, Escherichia coli, Pseudomonas aeruginosa, Salmonella Typhi and Staphylococcus aureus. The fungal organisms are Aspergillus flavus, Aspergillus niger, Aspergillus fumigatus, Candida albicans and Penicillium species. The report states that reference strains were obtained from the Department of Microbiology, Aries Arts and Science College, Karunkuzhi, Vadalur, Cuddalore District, Tamil Nadu. Strain accession numbers are not provided.

### 3.3 Preparation of plant extracts

For Aloe vera, fresh leaf gel was oven-dried at 80 °C for 48 hours and powdered. Twenty grams of powder was soaked separately in 200 mL of methanol, ethanol or acetone for 24 hours. The mixtures were filtered through Whatman No. 1 filter paper, and the filtrates were evaporated to dryness. The dried extracts were powdered and dissolved in distilled water. For Tulsi, fresh leaves were washed with distilled water, air-dried at a reported temperature of 37–40 °C for two weeks and ground to a uniform powder. Twenty grams of leaf powder was extracted separately with 200 mL of each solvent, then filtered and dried. The dried extracts were redissolved in distilled water.

### 3.4 Disc-diffusion assay

The project describes paper discs of 6 mm diameter prepared from Whatman No. 1 filter paper. Nutrient agar was used for bacterial testing and potato dextrose agar for fungal testing. Bacterial lawns were prepared using sterile cotton swabs, and fungal inocula were spread on the corresponding plates. Extract discs and control discs were placed on the inoculated agar. The report states that bacterial plates were incubated at 27 °C for 24 hours and fungal plates at 24 °C for 72 hours. Zones of inhibition were measured in millimetres, and each test was reportedly performed in triplicate. The report does not provide detailed inoculum standardization, extract loading volume, positive-control identity or replicate-level measurements.

### 3.5 Data presentation

The tables below reproduce the reported inhibition-zone values. The concentration is stated in the source report as 10 mg/mL. Values are presented descriptively.

## 4. RESULTS

The source report records inhibition against the listed bacterial and fungal test organisms for the plant extracts. For both plants, methanol generally produced the largest inhibition zones, followed by ethanol and acetone. The strongest reported responses were against E. coli among bacteria and A. flavus among fungi.

**Table 1. Antibacterial activity of Aloe vera leaf extracts**

| Test organism | Methanol | Ethanol | Acetone |
|---|---|---|---|
| Bacillus cereus | 17.00 | 15.00 | 9.33 |
| Bacillus subtilis | 20.00 | 17.12 | 14.32 |
| Escherichia coli | 23.00 | 20.13 | 18.13 |
| Pseudomonas aeruginosa | 14.21 | 10.12 | 8.32 |
| Salmonella Typhi | 18.01 | 14.23 | 10.12 |
| Staphylococcus aureus | 12.20 | 8.32 | 6.01 |

**Values are zones of inhibition (mm); the extract concentration as 10 mg/mL.**

**Table 2. Antifungal activity of Aloe vera leaf extracts**

| Test organism | Methanol | Ethanol | Acetone |
|---|---|---|---|
| Aspergillus flavus | 16.80 | 10.20 | 6.20 |
| Aspergillus niger | 12.50 | 8.10 | 4.50 |
| Aspergillus fumigatus | 9.50 | 7.30 | 4.20 |
| Candida albicans | 4.00 | 2.00 | 1.00 |
| Penicillium species | 3.00 | 1.00 | 1.00 |

**Values are zones of inhibition (mm); the extract concentration as 10 mg/mL.**

**Table 3. Antibacterial activity of Ocimum sanctum leaf extracts**

| Test organism | Methanol | Ethanol | Acetone |
|---|---|---|---|
| Bacillus cereus | 14.00 | 12.00 | 6.33 |
| Bacillus subtilis | 17.00 | 14.12 | 11.31 |
| Escherichia coli | 20.00 | 17.12 | 15.13 |
| Pseudomonas aeruginosa | 11.22 | 7.13 | 5.13 |
| Salmonella Typhi | 15.01 | 11.21 | 7.31 |
| Staphylococcus aureus | 9.03 | 5.31 | 3.01 |

**Values are zones of inhibition (mm); the extract concentration as 10 mg/mL.**

**Table 4. Antifungal activity of Ocimum sanctum leaf extracts**

| Test organism | Methanol | Ethanol | Acetone |
|---|---|---|---|
| Aspergillus flavus | 7.50 | 4.20 | 2.20 |
| Aspergillus niger | 6.20 | 4.40 | 2.30 |
| Aspergillus fumigatus | 5.50 | 3.70 | 2.00 |
| Candida albicans | 4.00 | 3.01 | 1.80 |
| Penicillium species | 3.00 | 2.10 | 1.00 |

**Values are zones of inhibition (mm); the extract concentration as 10 mg/mL.**

## 4.1 Plates Figures

**Fig. 1 Antibacterial activity of different extracts of *aloe vera* against *E.coli***

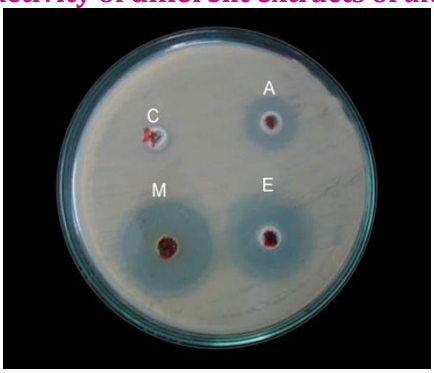
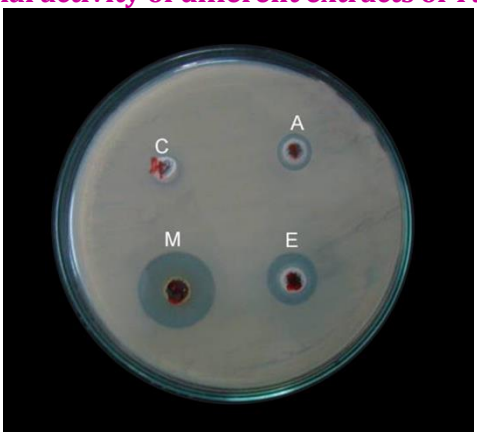



**Fig. 2 Antibacterial activity of different extracts of *Tulsi* against *E.coli***




**C- Control, M-Methanol extract, E-Ethanol extract, A-Acetone extract.**

**Fig. 3 Antifungal activity of different extracts of *aloe vera* against *A.flavus***

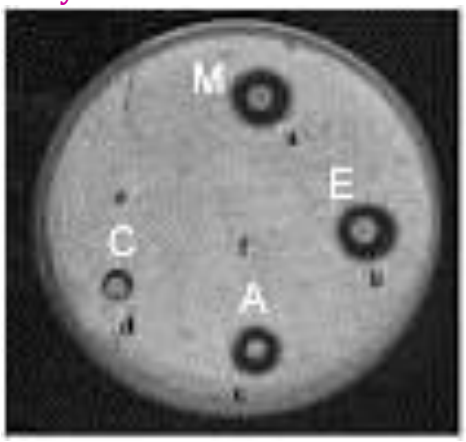
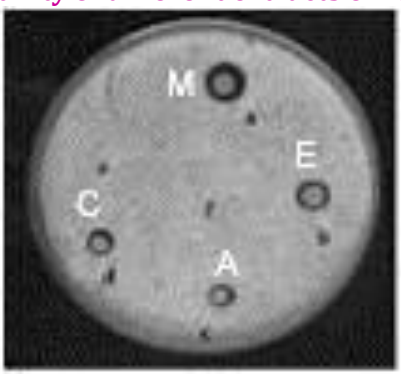


**Fig. 4 Antifungal activity of different extracts of *Tulsi* against *A.flavus***




**C- Control, M-Methanol extract, E-Ethanol extract, A-Acetone extract.**

***Aloe vera* (*Aloe barbadensis miller*)**



***Tulsi* (*Ocimun sanctum*)**



## 5. DISCUSSION

The reported results indicate that extraction solvent influenced the apparent antimicrobial activity. Methanolic extracts produced the largest inhibition zones in the tables for both plants, while ethanol and acetone extracts generally produced smaller zones. This pattern may reflect differences in the compounds extracted by each solvent, although the present project did not chemically characterize the extracts, so the responsible compounds cannot be identified from these data.

Aloe vera showed its largest reported antibacterial zone against E. coli (23.00 mm with methanol) and its largest antifungal zone against A. flavus (16.80 mm with methanol). Ocimum sanctum showed its largest reported antibacterial zone against E. coli (20.00 mm with methanol) and its largest antifungal zone against A. flavus (7.50 mm with methanol). These are descriptive comparisons of the values reported in the source document. Differences in inhibition zones alone do not demonstrate clinical effectiveness, and they cannot be compared reliably with standard antibiotics without appropriate positive controls and a validated assay protocol.

Several reporting limitations should be addressed in future work: provide the positive and negative control results; report the mean and standard deviation from each replicate; specify the strain identifiers, inoculum density, extract volume per disc and solvent-removal procedure; and perform appropriate statistical comparisons. Minimum inhibitory concentration (MIC), minimum bactericidal/fungicidal concentration (MBC/MFC), phytochemical profiling and toxicity testing would provide additional evidence. Work with pathogenic microorganisms should be performed only in an appropriately equipped laboratory by trained personnel using institutional biosafety procedures.

## 6. CONCLUSION

Based on the report, leaf extracts of Aloe vera and Ocimum sanctum showed in vitro antibacterial and antifungal activity against the selected organisms when assessed by disc diffusion. Methanol extracts generally produced the largest inhibition zones, with the highest reported values for Aloe vera against E. coli (23.00 mm) and A. flavus (16.80 mm). For Ocimum sanctum, the corresponding largest values were 20.00 mm against E. coli and 7.50 mm against A. flavus. These findings support further controlled laboratory investigation of the extracts.

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