Abstract—Antibacterial activity of Plumeria alba (Frangipani) petals methanolic extracts were evaluated against Escherichia coli, Proteus vulgaris, Staphylococcus aureus, Klebsiella pneumoniae, Pseudomonas aeruginosa, Staphylococcus saprophyticus, Enterococcus faecalis and Serratia marcescens by using disk diffusion method. Concentration extracts (80 %) showed the highest inhibition zone towards Escherichia coli (14.3 mm). Frangipani extract also showed high antibacterial activity against Staphylococcus saprophyticus, Proteus vulgaris and Serratia marcescens, but not more than the zones of the positive control used. Comparison between two broad spectrum antibiotics to frangipani extracts showed that the 80 % concentration extracts produce the same zone of inhibition as Streptomycin. Frangipani extracts showed no bacterial activity towards Klebsiella pneumoniae, Pseudomonas aeruginosa and Enterococcus faecalis. There are differences in the sensitivity of different bacteria to frangipani extracts, suggesting that frangipani’s potency varies between these bacteria. The present results indicate that frangipani showed significant antibacterial activity especially to Escherichia coli.

Keywords—Frangipani, Plumeria alba, anti microbial, Escherichia coli

I. INTRODUCTION

White frangipani (Plumeria alba) are from the family of Apocynaceae. The flower of the plant is white with yellow centers. Frangipani is well-known for its intensely fragrant and spiral-shaped blooms [1].

The plant is mainly grown for its ornamental and fragrant flowers. Methanolic extract of this flower has showed antimicrobial activity against Bacillus anthracis and Pseudomonas aeruginosa [2]. Species of Plumeria may also include P. rubra, P. acutifolia, P. obtusa, P. obtusifolia, P. alba, P. bicolor, P. tricolour and P. jamesoni. The bioactive compounds prepared from P. rubra having molluscidical, cytotoxic and anti-bacterial activities. The plant is reported as medicinal which contains arumrinacetae, mixture of amyrins, ß-sitosterol, scopotetin, the iriddoids isoplumericin, plumieride, plumieride coumerate and plumieride coumerate glucoside [9]. Bioactive richness of these active constituents was present in the plant. The active ingredients in plants are produced as secondary metabolites, which may not only be developmental stage-specific but also organ and tissue specific [3]. The flower petals which provide physical protection to the reproductive components can be expected to synthesize potent bioactive compounds. Interestingly the symptoms of most plant disease of bacterial or fungal origin have been reported mostly on the leaves, stem, roots, and seldom on petals.

Study shows that the floral petals of many angiosperm plant species contain antibiotic substances. The study open up the area for further detailed characterisation of higher plants, using a wide spectrum of biological screen including plant, as well as animal and pathogenic bacteria. The rapidity of this screening procedure by direct testing of the petals may allow large-scale screening to identify the petals of specific plant species as sources of new antibiotics, drugs or agrochemical [25].

Extracts of the flowers of Plumeria have also been used as fragrances in cosmetics. The present inventor has discovered that extracts from different parts of Plumeria also have therapeutic properties and can be used in the prevention or treatment of skin cancers, fungal infections, and viral infections, various skin defects, anti filarial and other afflictions [35].

Different part of the plant was believed, have been useful in variety of diseases. Namely the diseases of Malaria, Leprosy, Rheumatism and abdominal tumors. However, little study have been done to determine the antibacterial property of this species of frangipani. The development of bacterial resistance against synthetic antimicrobial agents encourages an alternative insight on another source of bacterial infection treatment.

II. MATERIALS AND METHODS

The frangipani flowers were collected fresh in Malaysia. The frangipani was identified as Plumeria alba species by comparing with the standard description of the species. The study was done to determine frangipani petals ability in inhibiting bacteria, mainly which is involved in urinary tract infection or which act as human pathogens.

Plumeria alba petals were air-dried for 3 weeks at room temperature. The air-dried samples were ground to a mesh size of 1mm. A 67.5 g sample of the powdered materials was soaked in 300 ml of a mixture of methanol and water (4:1) for 96 hr. These were filtered and concentrated to a small volume to remove the entire methanol using rotary evaporator at 400rpm/50°C. 25 ml of gummy extraction were obtained upon evaporation. The gummy extract was kept in the fridge at 8°C for further studies.

Prior swabbing on the agar plate the bacteria was standardized to McFarland standards. A 0.5 McFarland standard is prepared by mixing 0.05 ml of 1.175% barium chloride dihydrate (BaCl₂•2H₂O), with 9.95 mL of 1% sulfuric acid (H₂SO₄). A 0.5 McFarland standard is comparable to a bacterial suspension of 10⁶ cfu/ml.

Pure frangipani extract obtained was subjected into serial dilution. The gummy extract is diluted into serial 80%, 60%, 40% and 20% concentration using sterile distilled water. The antibiotic positive control of this test was Gentamicin and...
Streptomycin. Sterile disc diffused with each extracts was impregnated and placed firmly on the inoculated bacteria lawn and subjected to incubation for 24 hours at 37°C. The dishes are taken out for visual analysis of inhibition diameter, upon incubation.

### III. RESULTS AND DISCUSSION

Data collected was compared with a positive control and the standard inhibition diameter measurement was done. Eight species of bacteria commonly related to urinary tract infection, were screened. Observation showed an intermediate capacity zone in anti microbial activity of the extract towards *Staphylococcus saprophyticus*, *Proteus vulgaris* and *Serratia marcescens* (Table 4-9), having zones less than the positive control. High concentrations of the extract produce an inhibitory zone towards the *Escherichia coli* resembling the antibiotic, Streptomycin. Gentamicin however gives a smaller zone difference of 10 mm towards *Escherichia coli*. No zone was formed towards lawn of *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa* and *Enterococcus faecalis*.

The antibacterial inhibition of *Escherichia coli* were shown in Table 2 and Table 3, with the average measurement of minimum inhibition excluding other inhibition data which is completely negative. Fig. 1 and Figure 2 summarise the mean inhibitory zones of the bacteria tested with the extracts, using both chosen antibiotics, respectively.

#### TABLE I

<table>
<thead>
<tr>
<th>Measurement Value (mm)</th>
<th>Result</th>
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<tbody>
<tr>
<td>5mm and below</td>
<td>Resistant</td>
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<tr>
<td>5 to 11mm</td>
<td>Intermediate</td>
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<td>12mm and above</td>
<td>Sensitive</td>
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#### Table II

<table>
<thead>
<tr>
<th>Petri Dishes</th>
<th>Gentamicin</th>
<th>Extract (80%)</th>
<th>Extract (60%)</th>
<th>Extract (40%)</th>
<th>Extract (20%)</th>
<th>Methanol 80%</th>
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</table>

Table II: Gentamicin recorded the highest reading of 24mm and the lowest of 22mm. 80% extract recorded the highest reading of 19mm and the lowest of 9mm. Meanwhile in 60% extract, the highest reading is 13mm and the lowest is 9mm. 40% extract scores the highest reading of 13mm and the lowest is 8mm. 20% extract shows the highest of 8mm and the lowest of 6mm. 80% methanol posted negative result. The average of each are as follows; Gentamicin- 23mm (sensitive), 80% extract- 14.33mm (sensitive), 60% extract – 11.33mm (intermediate), 40% extract- 10.33mm (intermediate), 20% extract- 7.33mm (intermediate). 80% methanol posted negative result.

#### TABLE III

<table>
<thead>
<tr>
<th>Petri Dishes</th>
<th>Streptomycin</th>
<th>Extract (80%)</th>
<th>Extract (60%)</th>
<th>Extract (40%)</th>
<th>Extract (20%)</th>
<th>Methanol 80%</th>
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</table>

Table III shows the result obtained from *Escherichia coli* to compare with extracts and Streptomycin. Streptomycin recorded the highest reading of 14mm and the lowest of 13mm. 30% extract recorded the highest reading of 14mm and the lowest of 13mm. Meanwhile in 60% extract, the highest reading is 12mm and the lowest is 10mm. 40% extract scores the highest of 11mm and the lowest of 10mm. 20% extracts shows the flat reading of 8mm. 80% methanol posted negative result. The average of each are as follows; Streptomycin- 13.33mm (sensitive), 80% extract- 13.33mm (sensitive), 60% extract – 11.33mm (intermediate), 40% extract- 10.33mm (intermediate), 20% extract- 8mm (intermediate), 80% methanol posted negative result.

#### TABLE IV

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<th>Petri Dishes</th>
<th>Gentamicin</th>
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Table IV shows the result obtained from *Staphylococcus saprophyticus* to compare with extract and Gentamicin. The highest reading still comes from the antibiotic gentamicin, 22mm (sensitive). Next goes to 80% extract in which the reading is 13mm (sensitive). The reading gradually decrease as the concentration decrease as shown for 60% extract, 40% extract and 20% extract recorded 10.67mm (intermediate), 10mm (intermediate) and 8.67mm (intermediate) respectively.

#### TABLE V

<table>
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<tr>
<th>Petri Dishes</th>
<th>Streptomycin</th>
<th>Extract (80%)</th>
<th>Extract (60%)</th>
<th>Extract (40%)</th>
<th>Extract (20%)</th>
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Table V shows the result obtained from *Staphylococcus saprophyticus* to compare with extract and Streptomycin. The streptomycin scores the highest reading of 19.67mm (sensitive). While the 80% extract and 60% extract scores 10.33mm (intermediate) and 8.33mm (intermediate) respectively. Negative result posted by 40% extract, 20 % extract and 80% methanol. The negative result of 40% extract and 20% extract were deviated from those in the comparison with gentamicin.
Table VI shows the result obtained from *Proteus vulgaris* to compare with extracts and Gentamicin. Gentamicin scores 20mm (sensitive) while the 80% extract scores 12mm (sensitive). The rest of the concentration show gradually decrease in which 60% extract, 40% extract and 20% extract recorded 10.33mm (intermediate), 8.67mm (intermediate) and 8.33mm (intermediate) respectively.

Table VII reveals the result obtained from *Proteus vulgaris* to compare with extracts and Streptomycin. Streptomycin records a high 20 mm and low 12mm readings. Meanwhile 80% extract manages a maximum of 13mm and minimum of 12mm. 60% shows the highest of 12mm and the lowest of 11mm. 40% extract records the high reading of 12mm and low reading of 9mm. on the other hand the 20% extract shows the highest reading of 10mm and the lowest of 8mm. In average, streptomycin come out the highest with 15mm (sensitive), 80% extract 12.33mm (sensitive), 11.33mm (intermediate),10.33mm (intermediate) and 20% extract, 9mm(intermediate). 80% methanol remains negative result as it serves as a negative control.

Table VIII shows the result obtained from *Serratia marcescens* to compare with the extracts and Gentamicin. Gentamicin shows the highest average with 18.67mm (sensitive) while the extract shows a gradually decrease of reading as the concentration decrease. 80% extract scores the average of 10mm (intermediate), 60% average records 8.33mm (intermediate), 40% and 20% extract shows a low reading with 7mm (intermediate) and 6mm (intermediate) respectively. 80% methanol posted negative result.

Table IX shows the result obtained from *Serratia marcescens* to compare with extract and Streptomycin. In average Streptomycin comes out with 17.33mm (sensitive). 80% extract records 11mm (intermediate) while 60% and 40% extract scores the same readings with 9.67mm (intermediate). 20% extracts records 7.67mm (intermediate). 80% methanol serves as negative control.
IV. CONCLUSION

*Plumeria alba* appears to have significant antimicrobial capacity resembling a broad spectrum antibiotic against the common uro-gastro pathogenic *Escherichia coli*, one of the common bacteria with pathogenic strains and are relatively resistant towards synthetic drugs. This aromatic plant can be a potential source of evolving newer anti microbial compound and as a non toxic antibiotic producer agent. The extracts of frangipani have a potential as a natural anti toxic antibiotic producer especially against *Escherichia coli*.

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