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# Effect of antistaphylococcal activity of various essential oils against STX pigment producing *Staphylococcus aureus.*

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**ABSTRACT**

In the background of managing staphylococcal infections, health departments are facing a slow down to curb the antibiotic menace. STX pigment promotes resistance to reactive oxygen species and host neutrophil-based killing and is a hallmark phenotype in virulence and is absent in the mutant or less virulent counterpart. Hence the aim of this study was to study the antibacterial effects of essential oils (EOs) against STX producing Staphylococcus aureus isolates from various clinical samples. Comparative activities of seven different essential oils were recorded. Thyme EOwas found to be most effective against most of the *S.aureus* isolates. All the *S.aureus* isolates (n=25) exhibit sensitivity to all the essential oils, however clove oil and thyme oil showed excellent antibacterial activity. The use of essential oils may prevent the development of infections and will minimize antibiotic use, prevent development of resistance as well as promote healing.

**Key words:** Antibiotic resistance, Essential oils, STX producing *S.aureus*

## INTRODUCTION

*Staphylococcus aureus* has a virulence factor which produces an array of diseases in humans. Antibiotics are fight against these virulent factor hence it is exact tools to human. The golden color characteristic *S.aureus* strains are producing a virulence factor Staphyloxanthin (STX)-a carotenoid pigment which gives pathogen a golden colour. STX are antioxidants in nature and the biosynthetic pathways leading to its synthesis have been known. The carotenoid pigment has the ability to douse the singlet oxygen and helps the microbe to survive killing with reactive singlet oxygen used by the host immune system (*Krinsky,* 1993) the golden pigment is responsible for neutrophil killing and promotes virulence through its antioxidant activity. The production of pigment increased pathogenesis and impairing neutrophil killing due to associated with harsh environmental conditions. Essential Oil (EO) which excreted from plant extract has been used for therapeutic purposes.

In recent years, much research has been devoted to investigating such plant extracts. EO contains main constituent that is terpenoids which are highly complex. Terpenoids have been found to show antimicrobial activity against *S. aureus* and other bacteria. Increasing in popularity as consumers seek to utilize more "natural" means to stay healthy and treat disease by use of essential oils which promote health and wellness. Consumers are inhaling these oils through the use of in-home diffusers and applying the oils cutaneously to treat a variety of ailments from anxiety to wounds. Several studies have indicated the effectiveness of essential oils against a wide variety of microbial agents.

Plant derived essential oils having numerous studies about discovery of promising novel antimicrobial candidates. In previous studies, the antimicrobial activities of other EOs have also been investigated, and their actions against various pathogens, including clinical Methicillin resistance *S. aureus* (MRSA) isolates, have been demonstrated (Cox *et al.,* 1998). Also, research data indicate that antimicrobial activity was present in many essential oils.

## METHODOLOGY

**Antimicrobial agents and chemicals:**
In the present work numerous commercial chemicals and media were purchases from indicating manufacturer, Media like Nutrient agar, Nutrient broth, Muller Hinton agar, Baired parkar Agar, Manitol Salt Agar from Himedia Company Mumbai, India. Essential oils like Thyme oil, Clove Oil and Lemon Oil (LR grade) from Burgoyn Urbidges & Co, India. Whereas Eucalyptus oil, Sesame oil, Castor oil and Mustard oil purchased from medical shop at Gadchiroli, Maharashtra India.

**Tested Bacterial Strain:**
Test bacterial strain i.e., *S. aureus* was isolated from various clinical sample collected from hospital & pathological laboratories of Gadchiroli, Maharashtra. These samples inoculated into tryptose soya broth and then culture sample transfer to the Baired parkar agar and Manitol salt agar to get the colonies of *S. aureus.* These colonies transfer over nutrient agar media & incubate for 24 hr it get the golden, orange, cream & white color colonies. 25 (n=25) isolates were taken for antibacterial activity against essential oils. All isolates were identified by standard protocol.

**Agar diffusion susceptibility testing:**
All *Staphylococcus aureus* isolates (n=25) were individually tested against above 7 essential oils by using Kirby Bauer disc diffusion method and record the values of inhibition zone. Lawn of *S. aureus* culture was swabbed onto Muller Hinton Agar plates. Filter paper discs soaked in different EO was placed on inoculated plates and incubated for 24 hrs. Values of diemeter of inhibition zones were recorded.

## RESULT AND DISCUSSION

As evident from table no. 1, all the seven essential oils were effective against the *S. aureus* which was a produces a virulent factor that causes diseases to human beings. Among 7 EO, Thyme & Clove oil was showing the highest zone of inhibition it means that Thyme & Clove oil was highly effective against virulent factor of *Staphylococcal aureus.* Thyme & Clove oil was showing the 20mm inhibitory zone against C2 isolates and 16mm inhibitory zone against C3 isolates respectively. Then Mustard oil and Castrol oil were showing resistance against these isolates and Lemon oil, Eucalyptus oil & sesame oil were showing little effect against these isolates.

In previous reports antimicrobial properties of EOs and their components have been reviewed extensively (Burt 2004). However, only a few studies have reported the mechanism of antibacterial action of EOs in great detail (Cox et al. 1998, Cox et al. 2000, Fisher and Phillips 2006). It is concluded that recent efforts have targeted virulence factors rather than Essential gene functions (Hung *et al.,* 2005). STX of *S.aureus* is a virulence factor for the organism (Song *et al.,* 2009). The golden-colored pigment is a typical secondary metabolite that is not essential for growth an reproduction of the pathogen (Liu *et al.,* 2005) but might aid invasiveness in vivo (Pelz *et al.,* 2005). The STX (VF) producing organism was isolated from clinical sample & treated with various EO for antistaphylococcal purposes.

In present work it was concluded that all EO (Thyme oil, Clove oil, Lemon oil, Eucalyptus oil, Sesame oil, Castor oil & Mustered Oil) which extracted from plant were effective against the STX virulent factor producing *Staphylococcal aureus*. Thyme oil was highly effective against *S.aureus* as compared to clove oil , mustered oil and castrol oil. Sesame oil, eucalyptus & lemon oil were not effective against STX producing *S.aureus.*

**Table No.1 Antistaphylococcal activity of various essential oils against STX virulent factor of *S.aureus***

| Sr. no. | Sample No. | Clinical Sample | Clove Oil | Thyme Oil | Lemon Oil | Eucalyptus oil | Sesame oil | Mustered Oil | Castrol oil |
|---|---|---|---|---|---|---|---|---|---|
| 1 | O1 | Pus | 10mm | 15mm | 9mm | 10mm | 4mm | 10mm | 11mm |
| 2 | O2 | Pus | 12mm | 16mm | 8mm | 9mm | 3mm | 9mm | 10mm |
| 3 | O3 | Pus | 9mm | 8mm | 7mm | 7mm | 4mm | 7mm | 8mm |
| 4 | O4 | Pus | 13mm | 10mm | 5mm | 6mm | 4mm | 8mm | 7mm |
| 5 | O5 | Pus | 11mm | 12mm | 6mm | 9mm | 5mm | 10mm | 10mm |
| 6 | O6 | Urine | 6mm | 8mm | 4mm | 5mm | 2mm | 6mm | 11mm |
| 7 | O7 | Urine | 8mm | 10mm | 5mm | 8mm | 3mm | 9mm | 12mm |
| 8 | O8 | Urine | 10mm | 13mm | 7mm | 10mm | 5mm | 8mm | 6mm |
| 9 | O9 | Urine | 7mm | 12mm | 5mm | 7mm | 3mm | 10mm | 9mm |
| 10 | W1 | Pus | 10mm | 12mm | 8mm | 9mm | 4mm | 12mm | 13mm |
| 11 | W2 | Pus | 9mm | 15mm | 7mm | 10mm | 3mm | 8mm | 10mm |
| 12 | W3 | Pus | 10mm | 13mm | 6mm | 11mm | 5mm | 9mm | 11mm |
| 13 | W4 | Pus | 13mm | 12mm | 10mm | 12mm | 6mm | 11mm | 12mm |
| 14 | W5 | Pus | 11mm | 14mm | 7mm | 10mm | 3mm | 12mm | 8mm |
| 15 | C1 | Urine | 2mm | 9mm | 6mm | 8mm | 2mm | 6mm | 5mm |
| 16 | C2 | Pus | 10mm | 20mm | 6mm | 12mm | 3mm | 13mm | 10mm |
| 17 | C3 | Pus | 16mm | 15mm | 5mm | 13mm | 8mm | 12mm | 11mm |
| 18 | C4 | Urine | 15mm | 9mm | 8mm | 11mm | 3mm | 10mm | 9mm |
| 19 | C5 | Urine | 13mm | 16mm | 8mm | 13mm | 5mm | 9mm | 6mm |
| 20 | Y1 | Urine | 9mm | 6mm | 4mm | 6mm | 4mm | 5mm | 7mm |
| 21 | Y2 | Urine | 10mm | 7mm | 3mm | 5mm | 3mm | 9mm | 12mm |
| 22 | Y3 | Urine | 7mm | 10mm | 7mm | 5mm | 2mm | 4mm | 10mm |
| 23 | Y4 | Urine | 8mm | 12mm | 6mm | 10mm | 3mm | 9mm | 11mm |
| 24 | Y5 | Urine | 9mm | 10mm | 4mm | 7mm | 4mm | 8mm | 6mm |
| 25 | Y6 | Pus | 10mm | 9mm | 6mm | 6mm | 3mm | 7mm | 7mm |

*Note: O – Orange color pigment, W- White color Pigment, C- Cream color Pigment,Y- Yellow Color Pigment*

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