# Antibacterial Activity of Ethanolic Extracts of *Curcuma mangga*. Val Against *Staphylococcus aureus*

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**Abstract.** Temu mangga (*Curcuma mangga*) is a powerful medicinal plants as antioxidants because it contains curcuminoids. The constituents of bioactive chemical and antibacterial activity from temu mangga had not been widely researched and other scientific information is still limited. This study aimed to examine the antibacterial activity of the plants *Curcuma mangga* for pathogenic bacteria *Staphylococcus aureus* and describes the phytochemical analysis. Antibacterial research conducted by the diffusion method of ethanol extracts against pathogenic bacteria, and qualitatively tested for the presence of chemical constituents. The results showed antibacterial activity against *Staphylococcus aureus*. The diameter of the largest barriers to *S. aureus* (30.5 mm) in 8% of ethanol extracts similar to Amoxicillin 30 µg/ml. Minimum Inhibitory Concentration was 2% of ethanolic extracts. Phytochemical analysis of the results of the ethanol extract of *Curcuma mangga* showed varying bioactive compounds consisting of flavonoids, saponins, quinones and steroids were the most prominent. The research results prove that the *C. mangga* is a good source of antibacterial against *S. aureus.*

**Keywords** : *Antibacterial*, *Curcuma mangga*, *Ethanolic Extracts*, *Staphylococcus aureus*

## 1 Introduction

*Curcuma mangga* Val. is a member of the Zingiberaceae family that grows in Java, Indonesia. The plant has the potential to produce new drugs that are beneficial to humans. Many approaches to search for the principle of the biological activity of this plant. Medicinal plants are a rich source of antimicrobial various. Kinds of medicinal plants used in medicine extract has properties that vary were given by Elizabeth in [3]. Curcuma mangga as raw material of medicine there is collected in small quantities and immediately sold in the market, there are also gathered in large number for the materials for the

herbal industry, in accordance with the opinion of Uniyal *et.al* in [12]. The increasing number of failures in the treatment shown due to the many microorganisms that are resistant to antibiotics then the search for medicinal plants that have strong antimicrobial need to do it, in accordance with the opinion of Renisheya *et.al* in [9]. In developing countries synthetic drugs are expensive also inadequate for the treatment of diseases and many have side effects. Drug discovery using microbial strains that have been done seem to be ineffective because of resistance of pathogenic bacteria. Therefore interest in search of medicinal plants spread in Indonesia the greater because the safe, no ill effects and more reliable than the synthetic drugs, according to Akinjogunla *et.al* in [2]. In Indonesia some medicinal plants have been used since ancient times to cure certain diseases. Rhizome efficacious as upset stomach, chest pain, fever and general weakness. Based on the research results Renisheya *et.al* in [9] the results of hexane and ethyl acetate fraction of Curcuma mangga producing seven compounds, namely (*E*)-labda-8(17),12-dien-15,16-dial (**1**), (*E*)-15,16-bisnor-labda-8(17),11-dien-13-on (**2**), zerumin A (**3**), β-sitosterol, curcumin, demethoxycurcumin and bis-demethoxycurcumin. Compounds 1 and 3 show a very strong cytotoxic effect against cancer cells while compound 2 showed no anti-proliferative activity on cancer cells. According to Abas *et.al* in [1] compounds from *C. mangga* showed strong cytotoxic activity against a human tumor cells, such as human leukemia (HL-60), breast cancer (MCF-7) and liver cancer (HepG2). The present study is aimed to examine the antibacterial activity of the plants *Curcuma mangga* against the bacterial pathogens *Staphylococcus aureus* and describes the phytochemical analysis.

## 2 Methods

The water and dust level were agree with Regulation of Ministry of health Republic of Indonesia (1985). The powder was extracted via Soxhlet extraction using ethanolic 96% for 8 h, the resulting filtrate was evaporated using a *rotary evaporator* at 5 to 6 rpm and at 68$^{o}$C temperatur. Finally extract is dried using a *freeze dryer* and store in a sealed container. Stock cultures of *S. aureus* grown in nutrient broth at 30$^{0}$C for 3x24 h and if it grows stored at 4$^{0}$C. Antibacterial testing was performed using disc-diffusion methods against *Staphylococcus aureus*. Nutrient agar mixed with the inocula in plates. Steril discs with a diameter of 6 mm was filled with 20 µl ethanolic extracts of Curcuma mangga concentration of 5%, 6%, 7%, 8%, 9% from 5 g of dry extracts and combined with sterile media and test organism in a petri dish. Subsequently incubated at 37$^{0}$C for 24 h. The antibacterial activity is determined from the magnitude of the inhibition zone. And the Minimum Inhibitory Concentration is determined from the smallest concentration which can inhibit the bacteria. All sampling is conducted four replications. Positive

and negative controls are also determined inhibitory power. DMSO 2% is used as a negative control to determine its effect on test organisms. Amoxicillin 30 µg/ml is used as a positive control to compare the effects of *Curcuma mangga* against the test organisms. Qualitative test conducted to identify the content of flavonoids, saponins, tannins, quinone, alkaloids, and steroid-triterpenoid were carried out for powder by the method described previously in accordance with the Harbone in [5].

## 3 Results

Ethanolic extracts of five different concentration of *Curcuma mangga* were examined for the antibacterial activity against *Staphylococcus aureus* (from Biopharmaca Research Center Bogor Agricultural University). The results of measuring the diameter of inhibitory areas are listed in Table 1.

**Table 1**. Data inhibition area diameter antibacterial activity of ethanol extracts of *Curcuma mangga*

| Repetition | Inhibition area diameter (mm) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 5% | 6% | 7% | 8% | 9% | A* | (-) |
| 1 | 22 | 25 | 27 | 30 | 26 | 30 | 0 |
| 2 | 23 | 24 | 28 | 28 | 27 | 31 | 0 |
| 3 | 27 | 26 | 28 | 34 | 25 | 30 | 0 |
| 4 | 18 | 25 | 27 | 30 | 27 | 28 | 0 |
| Mean | 22.5 | 25 | 27.5 | 30.5 | 26.25 | 29.75 | 0 |

Note : A* : Amoxicillin 30 µg/ml
(-) : DMSO 2%

Antibacterial activity of ethanol extracts of Curcuma mangga all concentrations against *Staphylococcus aureus* showed varying width barriers. Width diameter is 30.5 mm maximum inhibition to 8% ethanolic extracts showed the same activity with Amoxicillin 30 µg/ml against *Staphylococcus aureus.*
Phytochemical analysis results of powder and ethanolic extract of *Curcuma mangga* indicate the active compound varies, especially prominent are flavonoids, saponins, Quinone and steroid. Phytochemical analysis has been summarized in the Table 2.

**Table 2**. Phytochemical analysis of powder and ethanolic extract of *Curcuma mangga*

| Bioactive components | Sample | |
|---|---|---|
| | powder | extract |
| Flavonoids | ++ | ++ |
| Saponins | +++ | +++ |
| Tannins | - | - |
| Quinone | +++ | +++ |

| | | |
|---|---|---|
| Alkaloids | - | - |
| Steroids | + | + |
| Triterpenoid | - | - |

Note: + prominent
-no chemical constituents

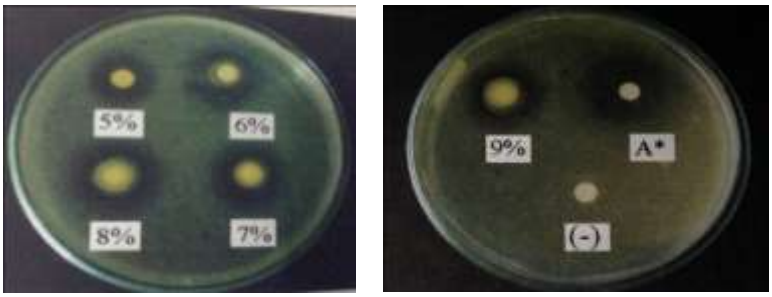


**Figure 1.** Diameter of inhibition zone antibacterial activity of ethanolic extracts of *Curcuma mangga* on *Staphylococcus aureus*
Note: A* : Amoxicillin 30 µg/ml
(-) : DMSO 2%

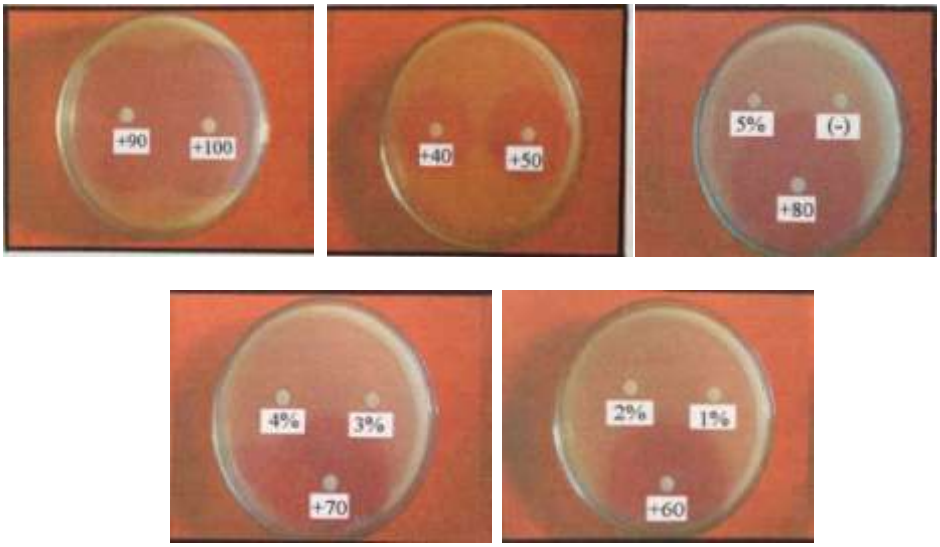


**Figure 2.** Minimum Inhibitory Concentration is 2% of ethanolic extracts
Note: (-) : DMSO 2%

## 4 Discussion

Based on these result the ethanolic extracts of roots of *C. mangga* inhibits the activity of the bacteria *S. aureus* , thus in plant *C. mangga* contain bioactive compounds that cause damage to the bacterial growth. All concentrations of ethanol extract of *C. mangga* studied could indicate barriers against *S. aureus.* According to Palombo and Semple in [7] that when ethanol, hexane and methanol is used as a solvent to extract the plant, mostly from the extraction may indicate an inhibitory effect on gram- positive and gram-negative. According Renisheya *et.al* in [9] the *in vitro* efficacy of the ethanol extract of *C. mangga* as an antibacterial can be seen by the size of the width of the barriers. It is also stressed that *C. mangga* can be used in the treatment of food-borne illness and mild superficial skin infections caused by *S. aureus*. Whereas caryophyllene oxide (18.71%) and caryophyllene (12.69%) were the major compounds in *C. mangga* oil. The essential oils displayed varying degrees of antimicrobial activity against all tested microorganisms. *C. mangga* oil had the highest and most broad-spectrum activity by inhibiting all microorganisms tested, *C. neoformans* has the lowest minimum inhibitory concentration against microorganisms and minimum fungicidal concentration value of 0.1 ul / ml. *C. aeruginosa* oil showed mild antimicrobial activity, whereas *Z. cassumunar* had very low or weak activity against the tested microorganisms according to Sri Nurestri *et. al* in [11]. The ethanol extract of *Curcuma mangga* contain bioactive compounds and which obviously are flavonoids, saponins, quinone and steroids. Flavonoids are known as antioxidants according Parekh and Chandren in [8], which is very important in heart health and prevent cancer. Additionally useful as antihistamines, antimicroba, improve memory and tranquility. Flavonoids are plant secondary metabolites. Secreted by plant roots and helps the bacteria Rhizobia in holding a symbiotic relationship with legumes such as peas, soybeans and others. Rhizobia which live in the soil can feel flavonoids and triggers the secretion of Nod factors, which ultimately perceived by the host plant and can cause deformation of the hair roots and some cellular responses such as fluctuation of ions and the formation of root nodules. Some flavonoids have inhibitory activity against organisms according to Zamora-Ros et. al in [14], according Galeotti et. al in [4] flavonoids can inhibit e.g.*Fusarium oxysporum* that causes pain to the plant.

Saponins are phytosterol compounds that occur naturally in some plants according to Xu *et. al* in [13]. Saponins have the power antimicrobial, antifungal, anti-inflammatory and stimulates the immune system. Saponins contained in some foods so it's easy to add these compounds to the diet naturally. Saponins are compounds that are dissolved in fat (think soap, we use soap to wash off greasy hands). This very property on the cellular level is makes

it possible to reduce cholesterol. The cell walls of microorganisms consist of fatty chain molecules and saponins may have the ability to rupture these walls which, indicates gives rise to anti microbial & anti fungal characteristics. If Saponins from *Quillaja saponaria* is injected in vitro or into the bloodstream of experimented animal; it will cause a damage of red blood cell. Not all saponins are reacted equally. Some of them indicate anti-inflammatory and stimulate immune system as well as antimicrobial towards fungi and bacteria. Saponins are being commercially promoted as dietary supplements and nutriceuticals according to Skene and Philip in [10]. According to Akinjogunla *et. al* in [2] Saponin can rise permeability of the cell membrane so that it occurs cell haemolisis. Saponin has an antibacterial activity that contains of a cluster of polar (sugar) and non-polar (Terpenoids) so it can decrease the surface tension of cell wall and intervere microbial cell permeability. Most of saponins can be easily dissolve in water, and are toxic for fish according to Jonathan *et. al* in [6]. Quinones and their derivatives are intermediate products in the production of dyes. They are also used as fungicides, insecticides, and tanning agents. 2-Methyl-1,4-naphthoquinone is a vitamin of the vitamin K group. Quinones, it is a chemical term used to describe a molecule which contains a benzene ring with two double bonded oxygen atoms attached. These are common in biological systems, and any molecule which contains a structure like this can be termed a 'quinone'. They do different things in different places depending on their structures. A number of quinone pigments have been isolated from plants and animals. Steroids are types of organic compounds containing the composition of the four ring cycloalkanes are joined to each other. steroid function depends on the type of steroid, but generally build muscle and reduce inflammation. Steroids are molecules that mimic the effects of the body's natural hormones. There are a number of different varieties of steroid that helps build muscle to steroid that helps reduce inflammation. The function of steroids largely depends on the type of steroid being used, as well as the symptoms being treated by using a particular substance. A healthy person has a vast number of varying steroids moving around the body at all times. All natural steroids are fatty molecules. Some are signaling molecules, which tell one part of the body to do something at particular times, such as the female sex hormone steroids that control menstruation and female fertility. The immune system also uses steroids, which in this case are called adrenocorticosteroids, to regulate inflammation in response to injury and infection. Some adrenocorticosteroids are regulators of metabolism, and help move glucose and other nutrients around the body. Testosterone, a male steroid hormone, promotes the development of male genitalia and body hair. Although steroids are natural molecules, steroids are most commonly used in the treatment and bodybuilding steroid that form artificial body. The function of the steroid in bodybuilding is to develop muscle mass. steroid is a form of testosterone that mimics the body's natural

testosterone. Effects of steroids are very different. Steroid is a compound of plant and animal fats.

## 5 Conclusions

The results showed that the ethanol extract of *Curcuma mangga* can inhibit the growth of bacteria or have antibacterial activity against *S. aureus*. Ethanol extract of *Curcuma mangga* contain bioactive compounds flavonoids, saponins, quinone and steroids.

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