

WOUND HEALING BIOACTIVITY OF *Curcuma Longa Linn*

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ABSTRACT

Traditional people of Sumatera Utara, Indonesia, mostly used *Curcuma Longa Linn* as a wound medicine. This research aims to see the wound healing bioactivity of *Curcuma Longa Linn*. Identify *Curcuma Longa Linn* content with the phytochemical screening; the displayed results contain alkaloid, terpenoid/steroid, phenolic, and saponin. FTIR analysis indicated the presence of secondary metabolite. The presence of alkaloids relieved due to the NH stretching peaks at 1579.56 cm⁻¹, terpenoid due to the CH group peak at 2926.58 cm⁻¹, 2106.17 cm⁻¹, and reinforced with peaks at 971.15 cm⁻¹ and 871.49 cm⁻¹. O-H stretching peaks at 3316.33 cm⁻¹, 1515.34 cm⁻¹, 971.15 cm⁻¹ were indicated polyphenols. Antibacterial test using *Escherichia coli*, *Pseudomonas aeruginosa* and *Staphylococcus aureus* the result of Antibacterial test shown the secondary metabolite of *Curcuma Longa Linn* has high antibacterial activity. This compound play a role in increasing collagen synthesis early, which can function to restore wound tissue structure and support faster wound healing.

Keywords: Wound Healing Bioactivity, *Curcuma Longa Linn*, Phytochemical Screening, FTIR Analysis, Antibacterial Activity.

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INTRODUCTION

Wounds are a type of skin disease that can easily happen to anyone, whether minor or serious injuries, such as punctures, sharp cuts, or surgical injuries¹, the impact of hard objects, heat shocks, or animal bites. The wound on the skin is the occurrence of damage to the skin tissue and skin tissue². The process of wound healing occurs in 4 phases (Table-1), i.e.:

Table-1: The Phases of Wound Healing³

Phase		Mechanism
First	Hemostasis	Vasoconstriction
		Platelet aggregation
		Leucocyte migration
Second	Inflammatory	Neutrophil release
		Macrophages
		Phagocytosis
		Removal of microbes
Third	Proliferation	Collagen synthesis
		Fibroblast proliferation
		Angiogenesis
		Granulation
Fourth	Maturation	Epithelialization
		ECM remodeling
		Tensile strength
		Scar formation

Traditional people in Sumatera Utara Indonesia used plants, especially *Curcuma longa Linn* as wound healing. Research on *Curcuma longa Linn* as a medicine for various diseases has been widely carried out⁴, like diabetes⁵, anti-inflammation anti cancer^{6,7}, antioxidant, anti-microbial, anti-Alzheimer.⁸ *Curcuma longa Linn* contains curcumin, a phenolic compound as a main content⁴. In addition, *Curcuma*

longa Linn also contains saponin and triterpenoid.⁹ This research aims to see the bioactivity wound healing of *Curcuma Longa Linn* from Sumatera Utara Indonesia.

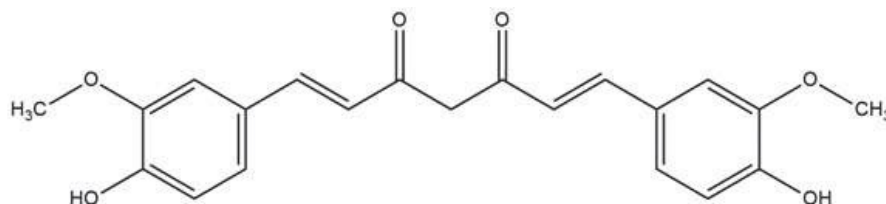


Fig.-1: Curcumin Structure⁹

EXPERIMENTAL

Material and Methods

Curcuma Longa Linn sample was cleaned, thinly sliced, dried and mashed into powder. The sample methanol extract was prepared using the maceration method about 24 hours. Extract were collected, than carried out phytochemical screening tests, FTIR test and anti-bacterial test.

Phytochemical Screening Test

Phytochemical screening test aims to identify the chemical compound contained. Alkaloid identification is made by Wagner, Mayer, and Dragendorff methods,^{10,11} To identify Flavonoid using ethyl acetate, Terpenoid/steroid test using Ce (IV) sulfate, phenolic identification using Iron (III) chloride, and Saponin identification using hot water.^{12,13}

FTIR Analysis

The FTIR spectra of *Curcuma Longa Linn* extract were scanned using a 2000 FTIR spectrophotometer (PerkinElmer; Waltham, MA, U.S.A.), which was inserted into the instrument, added with KBr IR content of 950 mg and crushed in a mortar until homogeneous. FTIR spectra were scanned in the middle infrared region of 4000-400 cm^{-1} with a resolution of 4 cm^{-1} and the number of scans was 32.^{14,15}

Antibacterial Activity

The antibacterial activity of *Curcuma Longa Linn* extract was tested by agar diffusion method. Pre-sterilization using alcohol 70%. The bacteria used in this antibacterial test are Escherichia coli, Pseudomonas aeruginosa and Staphylococcus aureus⁴. Amoxycillin was used as control, each inoculum was applied into an agar nutrient medium by using a cotton bud. Then the sample incubated at 35±2°C for 24 hours and the clear zone was measured.^{4,16,17}

RESULTS AND DISCUSSION

Phytochemical Screening Test

Results of phytochemical screening test can be seen in Table-2 and Figure-1.

Table-2: *Curcuma Longa Linn* Phytochemical Screening

Secondary metabolite	Reagent	Result	Evidence
Alkaloid	Mayer	+	Yellow deposits ¹⁸
	Bouchardat	+	Reddish brown deposits ¹⁸
	Dragendorff/ Wagner	+	Brownish red deposits ¹⁸
Flavonoid	Acetic Acid, FeCl ₃	-	No red purple solution ¹⁸
Phenolic	FeCl ₃	+	Blackish blue solution ^{18,19}
Saponin	Aquadest	+	A lot of froth ¹⁸
Terpenoid /Steroid	Ce(SO ₄) ₂	+	red color ^{17,19}

Table-2 shows that *Curcuma Longa Linn* contains alkaloid, and contains a lot of phenolic, saponin and terpenoid.⁹ Alkaloid, Phenolic, Saponin and Terpenoid are the various of phytochemical compound that

had therapeutic value at wound healing process.^{20,21} The previous research have proven that these secondary metabolites act as antimicrobial, antioxidant which accelerates wound healing and skin regeneration.^{22,23}

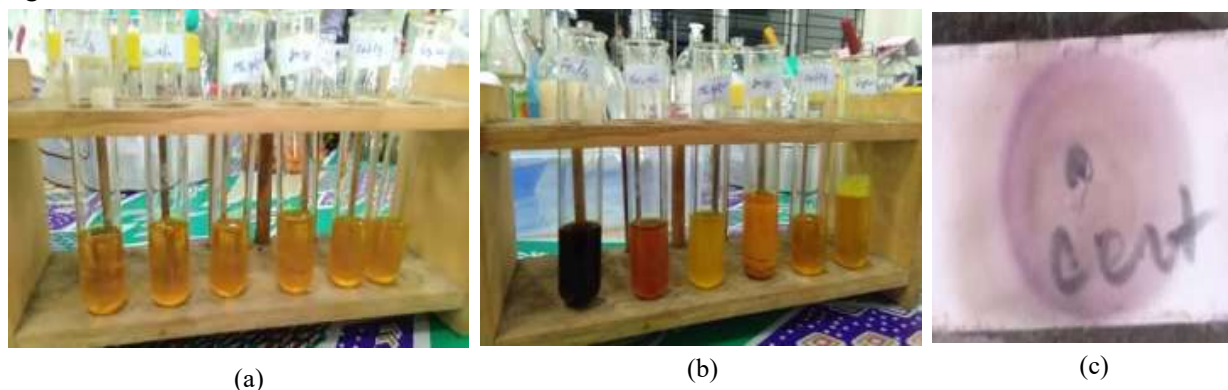


Fig.-2: Phytochemical Screening of *Curcuma Longa Linn* (a) before (b) after (c) terpenoid test

The presence of these secondary metabolites in *Curcuma Longa Linn* is also proven by analysis FTIR. Figure 2 is the analysis FTIR result of *Curcuma Longa Linn* and the peak value is represented in table 3.

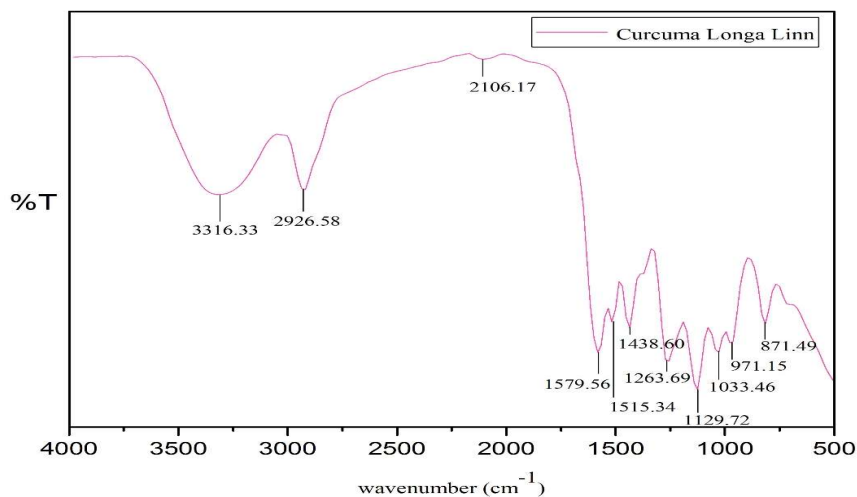


Fig.-3: FTIR Analysis of *Curcuma Longa Linn*

Table-3: FTIR Analysis of *Curcuma Longa Linn*^{24,25,26}

Peak Value (cm ⁻¹)	Functional Group	Vibration
871.49	C-H	Rocking
971.15	C-H	Rocking
1033.46	C-O	Stretching
1129.72	C-O	Stretching
1263.69	C-O	Stretching
1438.60	CH ₂	Bending
1515.34	C=C	Aromatic stretching
1579.56	N-H	Bending
2106.17	-CH ₂	Asymmetric stretching
2926.58	CH ₃	Asymmetric stretching
3316.33	O-H	Stretching

The presence of alkaloids relieved due to the NH stretching peaks at 1579.56 cm⁻¹, terpenoid due to the CH group peaks at 2926.58 cm⁻¹, 2106.17 cm⁻¹, and reinforced with peaks at 971.15 cm⁻¹ and 871.49 cm⁻¹. O-H stretching peaks at 3316.33 cm⁻¹, 1515.34 cm⁻¹, 971.15 cm⁻¹ were indicate polyphenols²⁷.

This study also proves that *Curcuma Longa Linn* plays a role in wound healing with antibacterial tests. Figure-3 shows *Curcuma Longa Linn* antibacterial activity and Table-4 describes the diameter of the clear zone of *Curcuma Longa Linn*.⁴

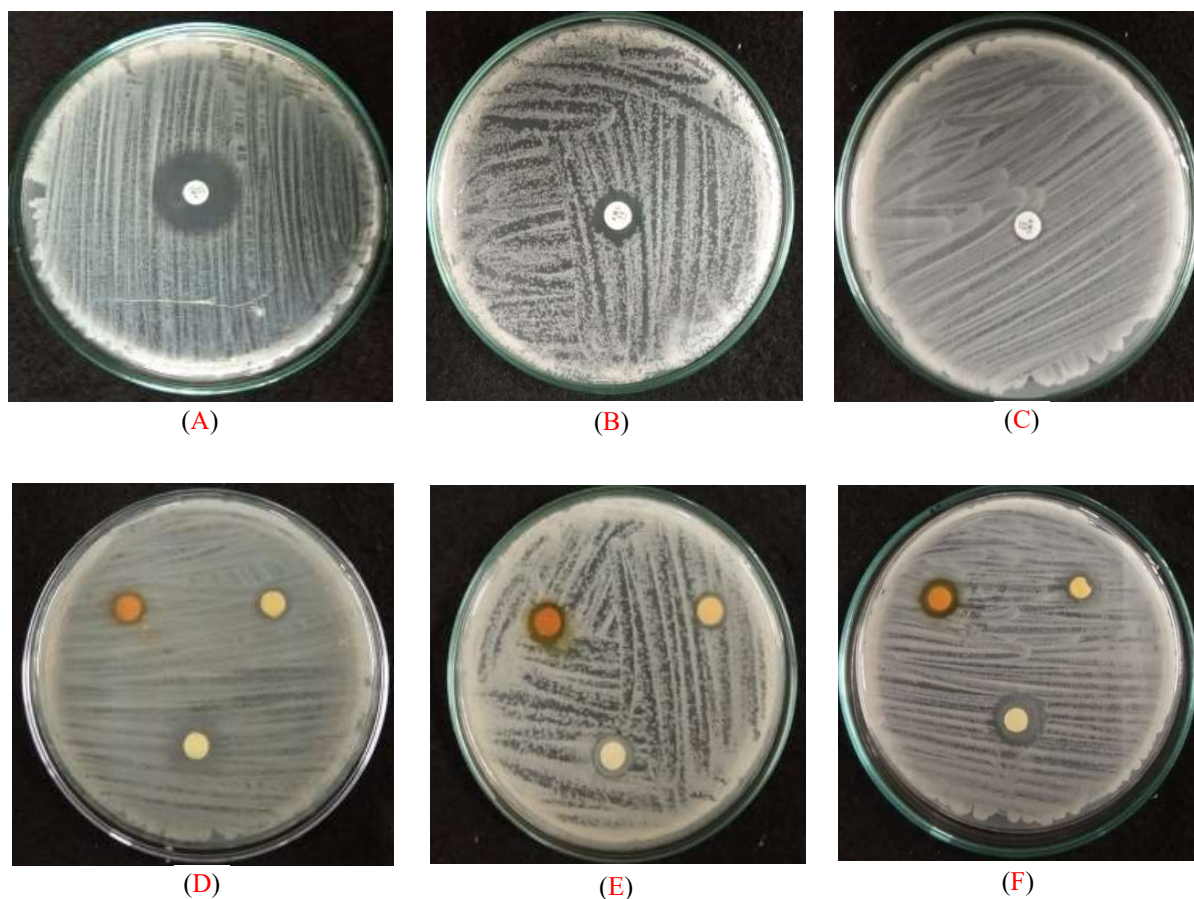


Fig.-4: Antibacterial Activity; (A) amoxicillin - E.coli, (B) amoxicillin - P. Aeruginosa, (C) amoxicillin - S. Aureus, (D) *Curcuma Longa Linn* - E.coli, (E) *Curcuma Longa Linn* - P. Aeruginosa, (F) *Curcuma Longa Linn* - S. Aureus

Table-4: Describes Diameter of the Clear Zone of *Curcuma Longa Linn*⁴

Concentration	E. coli	P. Aeruginosa	S. Aureus
10 ppm	7.61 + 0.15	8.22 + 0.12	7.58 + 0.11
100 ppm	7.83 + 0.11	8.70 + 0.14	8.74 + 0.09
1000 ppm	9.08 + 0.18	10.37 + 0.18	10.43 + 0.11
Amoxicillin	20.28 + 0.04	12.16 + 0.08	7.53 + 0.04

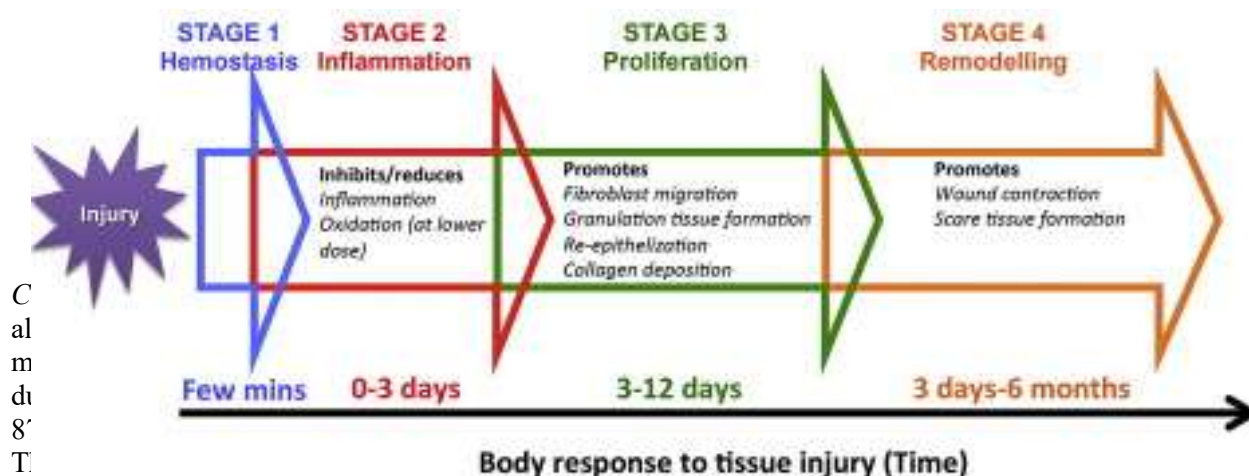
The bacteria used in this test are bacteria that play a role with the wound, i.e. Escherichia coli, Pseudomonas aeruginosa and Staphylococcus aureus. These bacteria are the main cause of open wound infection. Other than also using Amoxicillin as a positive control. Amoxicillin is a lactam antibiotic that works against Gram positive and Gram negative microorganisms; its bactericidal action can be used to treat bacterial infections caused by microorganisms by inhibiting the biosynthesis and repair of bacterial mucopeptide walls.²⁸ This study proves that *Curcuma Longa Linn* has good antibacterial activity.

Concentration of the sample was in 3 variation, i.e. 10 ppm, 100 ppm and 1000 ppm. This is intended to see if there is an effect of concentration on the anti-bacterial ability. The result showed that at 10 ppm, *Curcuma Longa Linn* had anti-bacterial properties in a moderate category of bacteria Escherichia coli, Pseudomonas aeruginosa and Staphylococcus aureus. The addition of concentration can increase the level

of anti-bacterial *Curcuma Longa Linn*. It can be seen the addition of the clear zone at the 100 ppm sample. High category of *Curcuma Longa Linn*'s anti-bacterial was seen at 1000 ppm.

This research succeeded in proving that *Curcuma Longa Linn* contains the wound healing bioactivity. Alkaloids and terpenoids as astringents and anti-microbes are effective for helping the process of reepithelization of injured tissue by increasing the maturity of collagen tissue in the wound area and increasing the weight of dry granulation tissue and the production of hydroxyproline enzymes. Phenolic compounds play a role in increasing collagen synthesis early, which can function to restore wound tissue structure and support faster-wound healing.

Phenolic compound found in *Curcuma Longa Linn* is *curcumin*²⁹. Curcumin has a high antibacterial activity. On the wound healing process, Curcumin works on the inflammation stage, proliferation stage and remodeling.



metabolite compound play a role in increasing collagen synthesis early, which can function to restore wound tissue structure and support faster wound healing.

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