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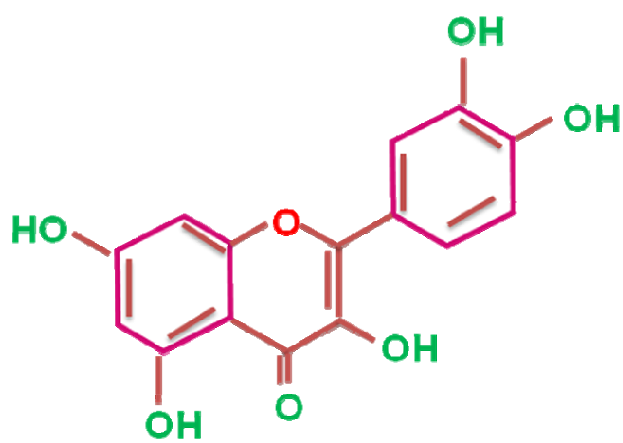
Isolation and Structural Identification of Medicinal Quercetin Compound from Stem Bark of *Lannea coromandelica* (Nabe)



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နဘဲခေါက်မှ ဆေးဘက်ဝင် Quercetin ဒြပ်ပေါင်းကို Structure အားဖြင့်ခွဲထုတ်ခြင်း

သီတာချို၊ သုတေသနလက်ထောက်-၂
ဒေါက်တာငွေးငွေးလွင်၊ ပါမောက္ခ

စာတမ်းအကျဉ်း

flavonoid ဒြပ်ပေါင်းပါဝင်နေခြင်းကြောင့် နဘဲခေါက်သည် အသုံးဝင်ဆုံး အစိတ်အပိုင်းဖြစ်ပါသည်။ သဘာဝအတိုင်းတွေ့ရှိရသည့် flavonoid ဒြပ်ပေါင်း တစ်မျိုးဖြစ်သော quercetin သည် နဘဲခေါက်တွင် ပမာဏအများဆုံးပါဝင်ပါသည်။ နဘဲပင်၏ အစိတ်အပိုင်း အသီးသီးကို တိုင်းရင်းဆေးအဖြစ် ကမ္ဘာတစ်ဝှမ်းတွင် သုံးစွဲနေပါသည်။ သို့သော် နဘဲပင်မှ ဆေးဘက်ဝင်သော အသုံးချမှု မြန်မာနိုင်ငံတွင် လူသိအလွန် နည်းနေပါသည်။ သို့ပါ၍ ယင်းအပင်၏ ဆေးဘက်ဝင်သော အသုံးချမှုများကို ပြည်သူလူထုသိရှိစေရန် ရည်ရွယ်၍ နဘဲခေါက်တွင်ပါဝင်သော ဇီဝအကျိုးပြု အော်ဂဲနစ်ဒြပ်ပေါင်းကို စူးစမ်းလေ့လာခဲ့ပါသည်။ ဤသုတေသနပြုချက်တွင် နမူနာကို စမ်းသပ်စစ်ဆေးရန်အတွက် အပင်တွင် ပါဝင်သော ဒြပ်ပေါင်းများ စစ်ဆေးစမ်းသပ်ခြင်း (phytochemical test)ကို ပဏာမပြုလုပ်ခဲ့ပါသည်။ စစ်ဆေးမှုရလဒ်များမှ flavonoid ဒြပ်ပေါင်းသည် ပမာဏအများအပြားပါဝင်ပြီး ယင်းနောက် glycoside, Phenolic compound? Steroid, terpene, Tannin နှင့် ဆက်စပ်ပစ္စည်းများ အသီးသီး ပါဝင်ပါသည်။ ဖျော်ရည်အမျိုးမျိုးကို အသုံးပြု၍စမ်းသပ်သော်လည်း alkaloids ပါဝင်မှု ပမာဏသည် အလွန့်အလွန့် နည်းပါးကြောင်း တွေ့ရှိခဲ့ရပါသည်။ ထုတ်နုတ်ပစ္စည်းကြမ်း (crude extract)၏ အဏုဇီဝပိုးမွှားဆန့်ကျင်နိုင်သတÅကိုလည်း စမ်းသပ်ခဲ့ပါသည်။ Phytochemical survey မှ နဘဲပင်အခေါက်တွင် အမည်သိပြီး quercetin ဒြပ်ပေါင်း ခွဲခြားခြင်းကို ဦးတည် ညွှန်ပြနေသကဲ့သို့ column နှင့် thin layer chromatography နည်းပညာအားဖြင့်လည်း ယင်းဒြပ်ပေါင်းကို ခွဲထုတ်ခဲ့ပါသည်။ သီးခြားခွဲထုတ်ခဲ့သော အော်ဂဲနစ်ဒြပ်ပေါင်း၏ Structure သည် quercetin ဒြပ်ပေါင်း၏ Structure အမှန်တကယ်ဖြစ်ကြောင်းကို အပင်တွင်ပါဝင်သော ဒြပ်ပေါင်းများ စစ်ဆေးစမ်းသပ်ချက် ရလဒ်အားဖြင့်လည်းကောင်း၊ ဒြပ်ပေါင်း၏ FT-IR spectrum တွင် တွေ့ရှိရသော functional group များကို literature တွင်တွေ့ရှိရသော quercetin ဒြပ်ပေါင်း၏ functional group များနှင့် နှိုင်းယှဉ်ခြင်းအားဖြင့်လည်းကောင်း၊ တိုင်းတာရရှိသော နဘဲခေါက် extract ၏ အရည်ပျော်မှတ်တန်ဖိုး (melting point value) ကို literature တွင်တွေ့ရရှိသော quercetin \ melting point value နှင့် နှိုင်းယှဉ်ခြင်းအားဖြင့်လည်းကောင်း အတည်ပြု ထားပါသည်။

Isolation and Structural Identification of Medicinal Quercetin Compound from Stem Bark of *Lannea coromandelica* (Nabe)

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Abstract

The bark of Nabe tree (*Lannea coromandelica (Houtt.)Merr.,*) is the most useful part because of its constituent, flavonoid. Quercetin ,a natural flavonoid that is found high level in the stem bark of Nabe. All the parts of this plant are widely used as traditional medicines all over the world. In Myanmar, medicinal uses of Nabe tree is lesser known. Thus, with the objective of the promotion of its medicinal uses, the active organic component in the stem bark of Nabe is intended to be investigated. In this study, Preliminary phytochemical tests were carried out for qualitative examination of the sample. The results revealed the presence of flavanoid in high concentration, followed by glycoside, phenolic compound, steroid, terpene, tannin and their derivatives respectively. Alkaloid was absent in all the solvent systems used. The anti-microbial activity of the crude extract was also determined. Phytochemical survey of the stem bark of Nabe led to the isolation of a known compound quercetin, which was identified by using column and thin layer chromatography. The structure of the isolated compound was confirmed with phytochemical examination, the comparison of functional groups from FT-IR spectrum of isolated compound with functional groups of the structure of quercetin compound from the literature. Moreover, the observed melting point of the extract of Nabe bark has been compared with the literature melting point value of quercetin.

Keyworks: phytochemical, qualitative examination, flavanoids, chromatography, melting point

Contents

Isolation and Structural Identification of Medicinal Quercetin Compound from Stem Bark of *Lannea coromandelica* (Nabe)

1. Introduction

Myanmar is rich in genetic resources of medicinal plants. *Lannea coromandelica* (Houtt.) Merr., (Nabe in Myanmar) is one of Anacardiaceae family. It is an indigenous medicinal plant. It is a medium to large sized deciduous tree. The various parts of this plant exhibit significant pharmacological properties. Its barks, leaves and gums have been used as traditional medicines all over the world.

Some of the important bioactive compounds found in the stem bark of *Lannea.coromandelica* are flavonoid, glycoside, phenolic compound, steroid, terpene, tannin and their derivatives. The principal component of this plant is flavonoid. Flavonoid, natural compounds are widely used for the treatment of human disease therapy and prevention. Flavonoid become popular because of their many health promoting effects and also show various interesting biological activities. They are implicated in UV tolerance and can directly scavenge active oxygen species. Thus, they act as light screen and antioxidants. Moreover, flavonoids can treat as vasodilators, enzyme-inhibitors, precursors of toxic substances, and pigments. (Harborne et al. 1975, Mc clure, 1986). In addition, recent research suggests that flavonoids may be useful in the prevention and treatment of many health conditions.

The bark of Nabe (*Lanna coromandelica*)is the most useful part because of its constituent, flavonoid . Quercetin, a natural flavonoid that is found high level in the stem bark of Nabe. The bark is acrid, sweet, astringent, and thermogenic, stomachic, and anodyne and is useful to cure bruises, ulcers, impetigo, inflammation, heart diseases, arthritis, gout, sprains, diarrhoea, dysentery, tooth ache, body ache, dyspepsia, general debility, leprosy and other skin diseases. It is also used in the treatment of coma caused by narcotics. Moreover, the aqueous extract of the bark being used as an abortive. The medicinal values of the plant are due to the presence of small doses of active compounds which produces physiological actions in the human and animal body (Zaidi, 1998).

In Myanmar, it is distributed in Yangon, Mandalay, Bago, Tantinthayi, Kayin, Rakhine and Shan States. The plant is used for various purposes such as, planking, boxes, carts, staircase components, house building and agricultural implements, etc. But, medicinal uses of Nabe tree are lesser known in Myanmar. Thus, with the objectives of the promotion of its medicinal uses, the active organic components which possess pharmacological properties in the stem bark of Nabe (*Lannea coromandelica*) is intended to be investigated.

2. Literature Review

2.1 Botanical Description of *Lannea coromandelica*

Family	:	Anacardiaceae
Botanical name	:	*Lannea coromandelica* (Houtt.) Merr.
Local name	:	Nabe
English name	:	Odina wodier Raxb
Flowering period	:	February to March
Fruiting period	:	End of April
Propagation	:	By seeds and vegetative method

Description of plant : A medium sized to large tree 12-28 m in height with grayish rough bark, exfoliating in this irregular flakes; leaves imparipinnately compound, crowded at the ends of branches, leaflets membranous, 7-9 oblong-ovate, green above, brown beneath, base acute or rounded, often oblique, main nerves 6-8 pairs: flowers small, yellowish or purplish, the male racemes compound, the female simple: fruits reniform, compressed, 1-seeded red drupes.

Fig (2.1) Nabe tree

Fig (2.2) Nabe bark

2.2 Phytochemical constituents of *Lannea coromandelica* (Nabe)

Phytochemical constituents of Nabe found in the literature are mentioned below.

Table2.2.1 - Phytochemical constituents of *Lannea coromandelica.*

Part	Chemicals	Extraction
Barks	-dl-epicatechin, (+) leucocyanidin, quercetin, rutin, -β -sitosterol, leucoanthocyanidin and two unidentified crystalline phenolic compounds	Acetone extract -
Stem bark	-Phloba-tannins, rutin, leucocyanidin, quercetin, hydroxyl- anthraquinones -β- sitosterol , physcion, physcion anthranol B, tannin(20-53%), quercetin, -Hydroxyanthraquinone	Methanolic extract Petroleum extract -
Heartwood	-β-sitosterol , leucocyanidin -Lanosterol - dl-epicatechin , (+) leucocyanidin; lanosterol	Ether, acetone extract Hexane extract -
Fruits	-Terpenes, alkaloids	-
Flowers	- ellagic acid and quercetin-3- arabinoside - physcion ,physcion anthranol B , quercetin - 3-arabinoside, ellagic acid	Alcohol extract -
Leaves	-ellalgic acid,quercetin, isoquercetin and morin, leucocyanidin , leucodelphiniden (trace) -β-sitosterol, ellagic acid, quercitin and quercetin-3-α-arabinoside, rutin - physicion and physcion anthranol B	- Methanolic extract - -
Root	-Long chain ester cluytyl ferulate	Hexane extraction
Gum	L-arabinose, D -galactose and D -galactouronic acid, aldobiuronic acid, glucuronic acid, rhaminose, Uronic anhydride.	-

2.3 Medicinal Uses of *Lannea coromandelica*

The medicinal uses of all parts of the plant, *Lannea coromandelica* are summarized as follow.

Table 2.3.1 - The medicinal uses of *Lannea coromandelica*

Parts	Uses
Bark (Decoction)	arthritis, inflammation, diarrhoea, dysentery, tooth ache, Cuts, wounds, bruise, ulcers, as a stimulant for gout, dyspepsia, general debility, as a wash for old and obstinate ulcers, leprous ulcers, impetigo, astringent gargle, emetic, coma, elephantiasis
Powdered Bark (paste with nim oil)	As a dressing for old and obstinate ulcers and other skin diseases
Aqueous Bark Extract	As an abortive, soaps, lotion and shampoos, gels, body milk, face lotions, creams, sprays
Green Branches	As an emetic
Fresh Bark	Sore eyes
Leaves	As a poultice for rheumatism, elephantiasis, inflammation, bruises, body ache, arthritis, physical pain
Gum	asthma, cordial for lacting women, gargle, liniment and wash for eruptions on the skin

2.4 Flavonoid

Flavonoids are most commonly known for their antioxidant activity. They are also commonly referred to as bioflavonoids. Flavonoids are a group of polyphenolic phytochemicals that include flavones, isoflavones, flavanones, flavans, chalcones and etc. Flavonoids are ubiquitous in plants and recognized as the pigments responsible for the color of leaves, especially in autumn. They are low molecular weight organic compounds composed of three-ring structure with various substitutions.

Flavonoids are built upon a $C_6 – C_3$- C_6 flavone skeleton in which the three-carbon bridge between the phenyl groups is commonly cyclized with oxygen. Several classes are differentiated according to the degree of unsaturation and degree of oxidation of the three-carbon segment. Within the various classes, further differentiation is possible based on the number and nature of substituent groups attached to the rings. More than 5000 different flavonoids are known with a variety of functions.

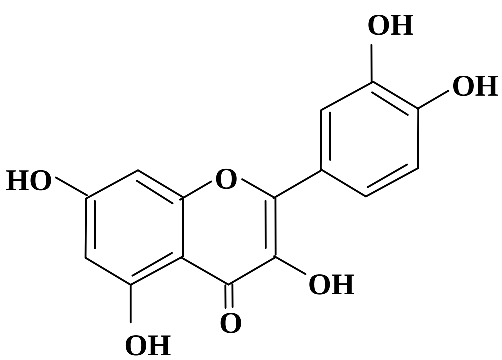
2.4.1 Biological Activities and Health Effects of Flavonoids

Flavonoids have important effects in plant biochemistry and physiology, acting as antioxidants, enzyme inhibitors and precursors of toxic substances, pigments and light screens. In addition, these compounds are involved in photosensitization and energy transfer, the action of plant growth hormones and growth regulators, the control of respiration and sex determination as well as defense against infection.

Flavonoids have long been recognized to possess antioxidant, anti-inflammatory, anti-allergic, antithrombotic, antitumor, antibacterial, antiviral, anti-carcinogenic, hepato-protective, and uv tolerance activities, effects on capillarity, and cholesterol-lowering ability. They are typical phenolic compounds and, therefore, act as potent metal chelators and free redical scavengers. They are powerful chain-breaking antioxidants. Other advantages effects of flavonoids, such as important antioxidant activity in the diet have been shown to boost immunity, help with the maintenance, and proper functioning of blood vessels and slowing the growth of cancer.

2.4.2 Quercetin

Quercetin is one of the sub-classes of flavonoids and more specifically a flavonol. Quercetin prevents free radicals from oxidizing the low density lipoproteins (LDL). It possesses anti-inflammatory, anti-histamine and anti-platelet action. Also inhibit both tumor promoters and human cancer cells. The presence of oxy and hydroxyl groups as well as double bonds in specific positions make them strong antioxidants. The molecular structure of quercetin is as follow-



Mol. formula: $C_{15}H_{10}O_7$
Mol. wt 302.25
C 59.61 % , H 3.34 % , O 37.06 %

Dehydrate : UV max 258,375 nm
Crystal mp 123-125° ; UV max 249, 343 nm

3. Materials and Methods

3.1 Sample Collection

The fresh barks of *Lannea coromandelica* were collected from the FRI campus, Yezin. They were cleaned firstly, then chopped into tiny pieces, air dried in shade at room temperature for one month and powdered.

3.2 Determination of Anti-microbial Activities

Three portions of powered samples were placed in three small bottles. Each of them were percolated with ethanol, pet-ether and distilled water, respectively and sent to DCPT (Development Center for Pharmaceutical Technology), Insein, Yangon to determine the anti-microbial activities on six organisms, *Bacillus subtilis*, *Staphylococcus aureus*, *Bacillus pumalis*, *Pseudomonas aeruginosa*, *Candida albicans* and *E-Coli*.

3.3 Phytochemical Screening of the stem bark of *Lannea coromandelica*

To known phytochemials of the crude extract of the stem bark of *Lannea coromandelica,* the following phyto-tests were carried out.

1. Test for flavonoid
2. Test for Alkaloid
3. Test For Steroid
4. Test For Phenolic Compound
5. Test For Terpene
6. Test For Glycoside
7. Test For Tannin
8. Test For Carbohydrate

3.4 Extraction

3.4.1 Extraction of Phytochemical from the stem bark of *Lannea coromandelica*

Powdered sample (500g) was extracted with 95% ethanol (500ml) at room temperature for two months. During percolation, the crude mixture was frequently shaken to achieve the maximum extraction. The extract was filtered through Whatman number - 1 filter paper. The combined ethanolic extract was evaporated. The ethanol extract was then re-extracted with ethylacetate and concentrated.

3.5. Isolation

3.5.1 Separation of crude extract by TLC

The concentrated crude sample was applied to the marked origin on a TLC plate by using a capillary tube. The plate was placed in a chamber saturated with mobile solvent (n-hexane: ethyl acetate = 4:1v/v). Before it reaches the upper edges of the plate, it was removed from the chamber, dried and then located with Iodine vapor. Some spots were observed as in figure (3.1). Therefore, it was separated by using column chromatography.

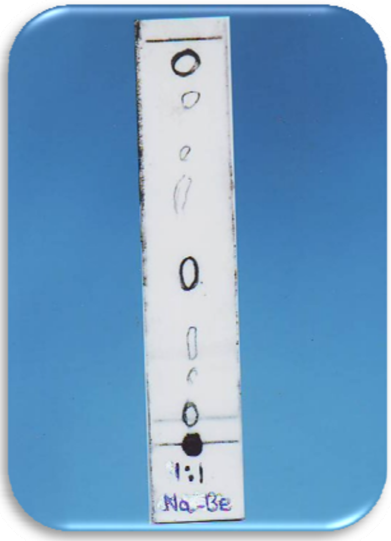


Fig (3.1) Thin layer chromatogram of crude extract

3.5.2 Separation of crude extract by column chromatography

Column size	►	(1.5 x40) cm
Adsorbent	►	Silica gel, 30g
Flow rate	►	$0.45cm^3$/ min
Eluting solvent	►	various ratio system (increasing polarity)

	n-Hexane	:	Ethyl Acetate	
(A)	only			$40cm^3$
(B)	19	:	1	$40cm^3$
(C)	9	:	1	$40cm^3$
(D)	4	:	1	$80cm^3$
(E)	7	:	3	$70cm^3$
(F)	3	:	2	$60cm^3$
(G)	1	:	1	$60cm^3$
(H)	2	:	3	$40cm^3$
(I)	3	:	7	$30cm^3$
(J)	1	:	3	$20cm^3$
(K)	1	:	4	$40cm^3$
(L)	-		only	$50cm^3$

Solvent system for TLC = n-hex : EtoAc (in various ratio)

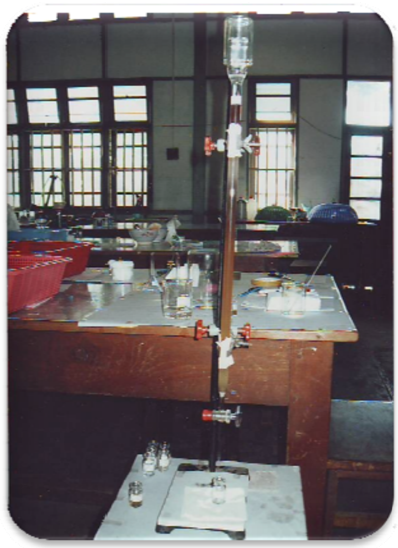


Figure (3.2) Column chromatographic separation of *Lannea coromandelica*

3.5.3 Procedure for Column Chromatographic Separation

The crude extract of stem bark of Nabe was separated by wet column chromatography. The column was vertically clamped and a small amount of n-hexane was poured into it. A small piece of cotton wool was inserted and tamped at the bottom of the column to prevent the packing material from falling down. Then the gel slurry prepared by mixing 30g of gel and 100ml of n-hexane was introduced into the column. The external wall of the column was tapped with a small rubber tube to affect the removal of the air bubbles. The height of the adsorbent was about 17 cm. Care must be taken not to dry the adsorbent while the experiment was carried out.

When the solvent level in the column had just reached to the adsorbent, the tap was closed and the concentrated solution of the crude sample prepared by dissolving (2.16g) of crude in minimum volume of n-hexane was introduced to the column along the wall by using micropipette. Finally, about 3g of pure sand was added on the solute to obtain a sand layer of about 0.5cm thickness.

The eluting n-hexane was poured into the column; the tap was opened and then adjusted the flow rate. As the layer began to separate and move down the column, a small and dried bottle was placed under the tap of column to collect the eluents.

About 3ml of each fraction was collected in small bottle by using eluting solvents simultaneously. (129) fractions were collected. Then each fraction was checked by TLC using n-hexane: ethylacetate in various ratios. The fractions that showed the same R_f values were combined. Six combined fractions were obtained. The combined fractions were checked by TLC. The following solvent systems were used.

(1) n-hexane : EtOAc (4:1, v/v) (2) n-hexane : EtOAc (1:1, v/v)

Visualizing agent = Iodine and UV lamp

Fig (3.3) Thin layer chromatogram of some fractions

According to the TLC checking, the combined fraction (II) shows one spot on TLC plate.

Fig (3.4) Thin layer chromatogram of pure fraction

3.5.4 Re-crystallization of Sample

The combined fraction II was evaporated and the residues were dissolved in a solvent mixture containing n-hexane and ethylacetate (4:1 v/v).After it was stored in the refrigerator for over night, the colorless crystals were appeared. These crystals were then re-crystallized. The needle shaped colorless crystals obtained from fraction (II) was labeled as TDC-1.

3.5.5 Melting Point Determination

The melting point of the isolated compound, TDC-1 was determined by capillary tube method. A little amount of sample was inserted into a capillary tube of 3 cm in length. Then it was attached to the thermometer by using a small rubber ring. It was inserted into a round-bottomed flask containing liquid paraffin. The thermometer was supported by a cork. When the flask was gently heated, the compound in the capillary tube melted and the melting point observed was recorded and the result was shown in Table (4.3).

3.5.6 FT-IR Spectroscopic Determination

The FT-IR Spectrum of the isolated compound, TDC-1 was measured at the Department of Chemistry, University of Mandalay.

3.5.7 Phytochemical Test on the Isolated Compound

The phytochemical screening on the isolated compound, TDC-1 was carried out and the result was tabulated in Table (4.2.2).

4. Results and Discussion

4.1 Antimicrobial Activities Examination of the stem bark of *Lannea coromandelica*

The study of antimicrobial activities was performed by agar well diffusion method. The results were shown in table (4.1.1).

Table (4.1.1) Antimicrobial activities of the stem bark of L*annea coromandelica*

No.	Solvent extracted	I	II	III	IV	V	VI
1.	Distilled water	++	++	++	++	++	++
2.	EtOH	+++	++	++	+++	++	+++
3.	Pet-ether	+	++	++	++	-	+

Agar Well – 7mm

7mm – 11mm (+)

12mm – 16mm (++)

17mm above (+++)

Organisms:

I = *Bacillus subtilis*

II = *Staphylococcus aureus*

III = *Bacillus pumilus*

IV = *Pseudomonas aeruginosa*

V = *Candida albicans*

VI = *E-Coli*

According to this table, the distilled water extract gave medium activity on all six organisms. EtOH extract responded high activity on three organisms, such as *Bacillus subtis, Pseudomonas aeruginosa* and *E-Coli.* This extract responded medium activity on *Staphylococcus aureus, Bacillus pumilus Candida albicans*. Pet-ether extract gave medium activity on *Staphylococcus aureus, Bacillus pumilus, Pseudomonas aeruginosa* and low activity on *Bacillus subtilis* and *E-Coli.* Pet-ether extract gave no responded on *Candida albicans*.

4.2 Phytochemical Examination

Table-4.2.1 Results of Phytochemical Examination of the stem bark of Nabe

No.	Test	Extract	Test Reagent	Observation	Result
1.	Flavonoid	95%EtOH	Conc HCl + Mg turnings	Pink Colour	+
2.	Phenolic compound	Distilled water	1% $K_3Fe(CN)_6$ solution and 1% $FeCl_3$ sol	Bluish black colour	+
3.	Steroid	95%EtOH	Acetic anhydride $+H_2SO_4$	Green color	+
4.	Terpene	95% EtOH	$(CH_3CO)_2O + CHCl_3 + H_2SO_4$	Reddish brown color	+
5.	Tannin	Distilled water	2% NaCl + 1% $FeCl_3$	Yellowish brown ppt	+
6.	Glycoside	Distilled water	10% NaOH sol	Yellow ppt	+
7.	Polyphenol		1% $FeCl_3[K_3Fe(CN)_6]$	Greenish blue color	+
8.	Alkaloid	1% HCl	Wagner's reagent	No brown ppt	-

According to the above data, the crude extract of the stem bark of Nabe gave positive test for flavonoid, pnenolic compound, steroid, terpene, tannin and glycoside respectively. After the compound, TDC-1 has been isolated, the phytochemical test was carried out and the result was shown in Table (4.2.2) and Fig. (4.1). This indicate that TDC-1 must be flavonoid.

Table (4.2.2) Result of phytochemical tests on the isolated compound

No	Test	Extract	Test Reagent	Observation	Result
1.	TDC-1 Flavonoid)	95%EtOH	Conc HCl + Mg turnings	Pink Colour	+

Fig (4.1)Colour development of flavonoid test on TDC-1

4.3 Melting Point Determination

The observed melting point of the isolated compound TDC-1 was 126˚C. The literature value of quercetin is 123-125 ˚C. Therefore the melting point of TDC-1 is in agreement with the literature values. Hence TDC-1 could be assigned as quercetin.

Table (4.3.1) Melting points of the isolated compound TDC-1

No.	Sample	Form	Melting point ˚C	
			Observed	Literature
1.	TDC-1 (Quercetin)	Crystal	126 ˚C	123-125 ˚C

4.4 Spectroscopic Examination

4.4.1 Identification of Compound TDC-1 by FT-IR Spectroscopic Method

The FT-IR spectrum of compound TDC-1 is shown in Fig (4.2).In this spectrum, the band a t 3342 cm^{-1} indicates the stretching vibration of (-OH) group. The intense band at 1650 cm^{-1} indicates >C=O stretching vibration band of carbonyl group.

The bands which appear at 1604 and 1504 cm^{-1} imply >C=C< stretching vibration of aromatic benzene ring. The sharp band, which appears at 1367 cm^{-1} indicates, (-OH) in plane bending vibration of phenolic group.

The bands which appear at 1272 and 1049 cm^{-1} indicate C-O-C stretching vibration of ether group. In addition, the band at 1195 cm^{-1} is due to the –OH bending vibration of alcohol. =C-H bending vibration of trans alkene observed at 948 cm^{-1}. The band which appears at 825 cm^{-1} indicate the presence of =C-H bending vibration of cis alkene.

Hence, the FT-IR spectrum represents the existence of the following functional groups.

- Phenolic (-OH) group
- Aromatic ring group
- Carbonyl group
- Ether functional group respectively.

In accordance with the above spectral data, nearly all functional groups are identical with the quercetin. Although the FT-IR spectrum of compound TDC-1 could not be identified by that of an authentic quercetin, the functional groups in the isolated compound TDC-1 resemble those of quercetin. Hence, the isolated compound TDC-1 could be assigned as quercetin.

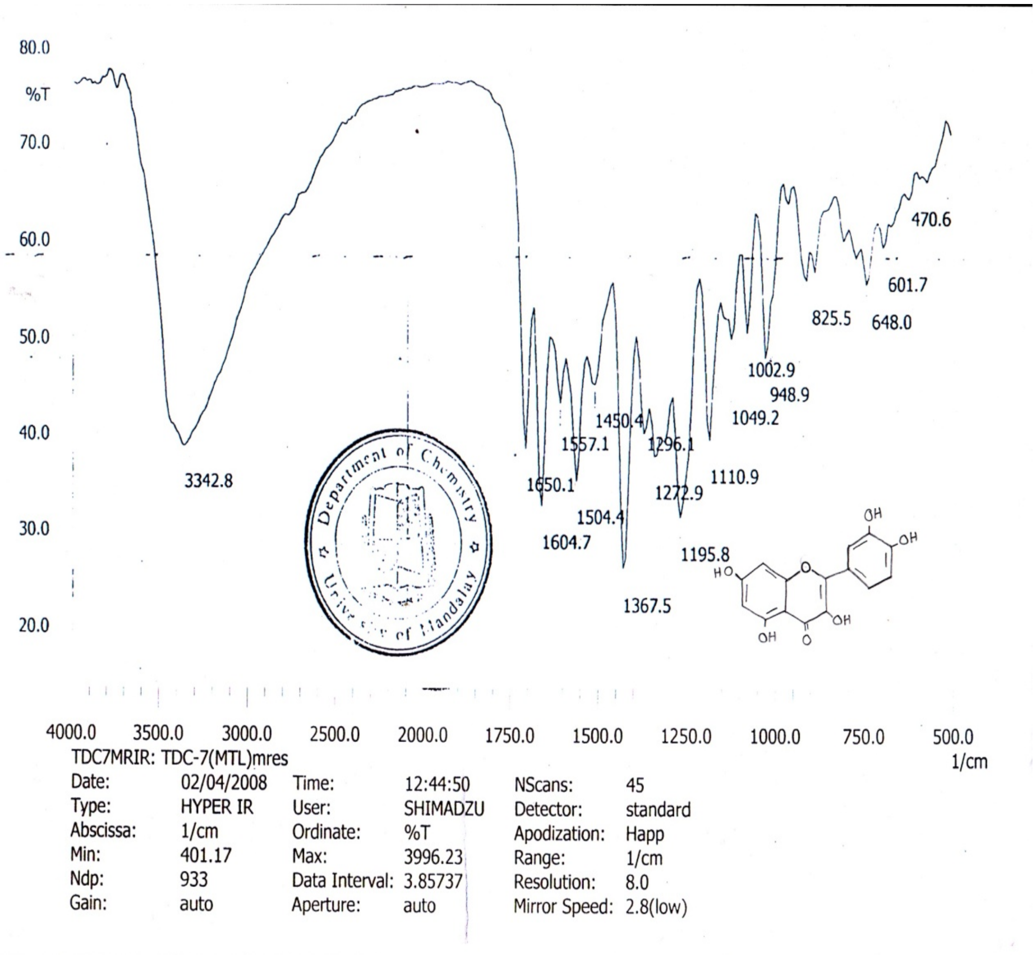


Fig (4.4.1) FT-IR Spectrum of Compound TDC-1

5. Conclusion

From the preliminary phytochemical tests it has been observed that the chemical constituents of the stem bark of *Lannea coromandelica* contain flavonoid, tannin, steroid, terpene, glycoside and phenolic compound. Most of the constituents are very useful as drugs.

In this research work, the preliminary investigations on the stem bark of *Lannea coromandelica* have been done. The antimicrobial activities of the crude extract in various systems have been examined by agar well diffusion method on the selected organisms. Isolation of quercetin compound from EtOH extract of the sample has been made.

Then, the EtOAc extract (crude) of *Lannea coromandelica* was subjected to silica gel column chromatography, followed by TLC purification, and re-crystallization to afford the desired compound. Finally the compound TDC-1 was identified by phytochemical examination, melting point determination and FT- IR spectroscopy.

From the study of the results of phytochemical examination, melting point determination, compound TDC-1 must be quercetin. Although the FT-IR spectrum of compound TDC-1 could not be identified with that of an authentic quercetin, the functional groups in the isolated compound TDC-1 resemble those of quercetin. Hence, the isolated compound TDC-1 could be assigned as quercetin.

Quercetin, a natural flavonoid that is found high level in the stem bark of Nabe. It is a most promising compound for disease prevention and therapy. Quercetin has several pharmacological properties, among which: it has an anti-inflammatory, anti-thrombotic and anti-carcinogenic action, it has an effect on the immunological system and works as an antiviral; it slows down the effect of cataract in patients with diabetes; it also has a gastro-protective and hepatoprotective effect. Moreover, it is used in countless medical applications, mainly in the treatment of blood circulation and capillary problems, including any type of inflammation. In conclusion, Quercetin can also prevent the heart attack, stroke, diabetes, allergic reaction, Alzheimer's desease, arthritis and cancers.

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