www.jmscr.igmpublication.org
Impact Factor 5.244
Index Copernicus Value: 83.27
ISSN (e)-2347-176x ISSN (p) 2455-0450
crossref DOI: https://dx.doi.org/10.18535/jmscr/v4i11.49

IGM Publication
Journal Of Medical Science And Clinical Research
An Official Publication Of IGM Publication

Identification Functional Group on Medicin Plants Using FTIR Spectrometry

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ABSTRACT
Has done research on the analysis of functional groups on medicinal plants for the treatment of malaria and diarrhea treatment using FTIR spectroscopy. Analysis of the functional groups of samples of malaria drugs, namely dried papaya leaves and unripe papaya leaves, and plant samples diarrhea, which guava leaves and dried tea leaves which analyzes the spectrum is adjusted for the correlation table Absorbance IR. Identification of the spectrum of medicinal plants for sampling malaria medications (drugs chloroquine and leaves of papaya) and diarrhea (drug Diapet, guava leaves, and the leaves of the tea) shows that there is a nitro group (N - O), a wavelength of 1550 cm-1, ketone (C = O), a wavelength of 1650 cm-1, hydrogen (OH), the wavelength of 2350 to 2450 cm-1 with a stretching vibration, while the fifth sample of diarrhea medicine containing the nitro group (N - O), aldehyde (C = O) and (C = C) aromatic. Based on the research results, the spectrum of medicinal plant raw papaya has a bonding force is nearly equal to the malaria drugs, while on medicinal plants tea leaves have a bonding group is nearly equal to cure diarrhea.
Keywords: *FTIR, bond cluster, leaf papaya, guava leaves, leaf tea.*

INTRODUCTION

Indonesia is one of the country's mega diversity of medicinal plants in the world. Indonesian tropical forest areas have the highest biodiversity of the 2nd in the world after Brazil. Of the 40,000 species of flora in the world, in Indonesia found as many as 30,000 kinds. 940 types of which are known to have medicinal properties that have been used in folk medicine for generations by various ethnic groups in Indonesia. The amount of the herb cover about 90% of the number of medicinal plants found in the region (Dorly, 2005). Medicinal plants are used by people as a traditional medicine, known as ethnobotany.

This plant contains a natural chemical compounds, called secondary metabolites. One species of medicinal plants are commonly used are papaya (Carica papaya L). Papaya is a fruit that is consumed and including ripe fruit quickly after harvest, grow in moist fertile soil and stagnant water. Fruit, flowers and young leaves can be eaten.

Efficacy of papaya as facilitating digestion, stabilize the body heat, drug ulcers, strengthens the stomach and antiscorbutic. Half-ripe papaya fruit is used as launched breast milk (ASI). Carica papaya provides efficacy as fever, appetite enhancer, launched menstruation and relieve pain

(analgesic), and malaria.Guava leaves also a medicinal plant that is widely used in everyday life. Guava leaves have many benefits and uses as dengue fever, and toothache.

Nutrient content in guava leaves will effectively bind and clean up cholesterol in the blood vessels that faci litate blood circulation anyway. The content of anti-oxidants in fruit leaves is also very effective in preventing premature aging, acne removal and blackheads.In the field of health leaf green tea bag is highly recommended to drink green tea to your diet, this is because green tea has a natural substance that can help you burn fat fast.

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CHEMICAL COMPONENTS

C. Papaya L. chemical constituents is papain contained in papaya latex, which is a compound that can extend pepsin digestibility so that digestion more perfect. Other content that is caricaksatin, violaksantin (Kartasapoetra, 1988). On the leaves, roots and fruits are also karpasida, karpain alkaloids, glucosides karpasida, a proteolytic enzyme papain, papayotin, resins, proteins, fats, organic acids, protease, an enzyme Tenin. Karpasida existing efficacious as anti-worm, karpalna, an acid alkaloid contained in papaya can be used to reduce heart disease, anti-amoebic drug, and the drug laxative urine vitamin. Plants Guava leaves have a sweet taste, neutral and have properties (astringent), anti-diarrhea, anti-inflammatory, to stop bleeding (hemostatic) and as a laxative menstruation. Guava leaves contain tannin, eugenol (essential oils), fatty oils, resins, tanning substances, triterpenoid. The fruit is nutritious antioxidant beta-carotene in addition to amino acids (tryptophan, lysine), calcium, phosphorus, iron, sulfur, vitamin A, vitamin B1, and vitamin C is high. Dermatologist effect guava, among others, to boost immunity, lower cholest-erol, prevent cancer, and protect the body from radiation-free. Tea is rich in chemical ingredients such as caffeine 2-3%, theobromine, theophylline, tannins, Xan tin, adenine, MINTAK volatile, quercetin, naringenin, and natural fluoride. Tannins error epigallocathin contain substances that can prevent cancer and esophageal symbol. Polyphenols, proteins, carbohydrates, caffeine, fiber and pectin contained in tea leaves.

FUNCTIONAL GROUP

Functional group as the main characteristic of an organic compound that basically can be known clearly by grouping these molecules related to each other so it is difficult to discuss a functional group without the other. But simply to say that the functional group is an atom-atom, group of atoms in an organic compound that is arguably the most decisive nature of these substances Although carbon-carbon and carbon-hydrogen bond is common to all organic compounds, but the surprise is that bonds of this magnitude does not play an important role in organic compounds, for

the most part is the presence of other atoms bond in an organic structure that raises the reactivity.

Position in the chemical reactivity of molecules called functional groups. Compounds with the same functional groups tend to undergo a chemical reaction of the same. Because of the similarity in the reactivity between the compounds with the same Functional group it easier to use the general formula for this compound series. Usually a group containing only carbon atoms plus atoms of H, can be used to express other groups. With this technique an alcohol can be expressed as R-OH (Fessenden, 1982).

Absorption of IR radiation is quantization process. Only certain frequencies of IR radiation that will be absorbed by the molecules. Frequency IR radiation that can be absorbed is the frequency corresponding to the frequency range stretching vibration and bending covalent bonds in most molecules. Once absorbed, the frequency of the IR radiation will increase the amplitude of the vibrational movement of the bond in the molecule. However, not all the bonds in the molecule can absorb energy even though the frequency IR radiation is in conformity with the movement of the bond.

Only bonds with a dipole moment that can vibrate when absorbs IR radiation. The greater the change in the dipole moment, then absorption will be more intense (Stuart, 2004).

Where h states Planck constant (6.6242 x 10-27 erg sec) and υ declared constant frequency in Hertz (Hz). The relationship between frequency and wavelength (λ) is expressed as:

$v = c\lambda$

Where c isthe speed of light (3 x 10^{10} cm^{-1} s) and λ is expressed in centimeters. Contrary wavelength (ύ) said the number of waves per cm. So,

$\bar{\upsilon} = 1 / \lambda$

The number of waves (ύ) is proportional to the frequency or energy, because it is part horizontal infrared spectrum is usually expressed as the number of waves (ύ) in cm-1.

Qualitative analysis of FTIR Spectrometer

It is generally useful to classify the whole area into three to four broad areas. One way is to categorize some areas near IR (0.7 to 2.5 μ); fundamental area (2.5 to 5.0 μ); and remote areas (50-500 μ).

The other way is to classify them as the fingerprint region (6.7 to 14 μ). The second area of this classification appears that in the second category all regions is fundamental, and the most widely used (Sastrohmidjojo, 1991).

1. The area hydrogen stretching (3700-2700 cm-1). Peak occurs due to stretching vibration of hydrogen atoms with other atoms. The frequency is much greater so that the interaction can be ignored. Absorption peaks occur in the region 3700-3100 cm-1 due to stretching vibration of O-H or N-H.
2. Regional triple bond (2700-1850 cm-1), the groups absorb limited, such as for the double bond stretching vibration occurs in the area from 2250 to 2225 cm-1 (for -C = N at 2120 cm-1, -C- = N- at 2260 cm-1). The highlight for SH is at 2600-2550 cm-1 for pH at 2240-2350 cm-1 and SiH at 2260 to 2090 cm-1
3. Regions double bonds (1950-1550 cm-1), stretching vibration of the carbonyl group can be characterized here, such as aldehydes, acids, aminol, carbonates, all have peaks at 1700 cm-1.
4. Regional fingerprints are at 1500-1700 cm-1, which is a little different in structure and molecular structure, will lead to the distribution of absorption peak changed. In this area, to ensure an organic compound is by comparing with the comparison.

Research to be done is to identify bonding groups on samples of medicinal plants and medicinal plant. FTIR Spectrometers Used Equipment Type MB 3000.

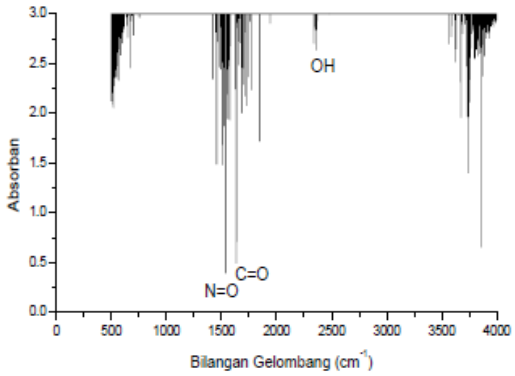
RESEARCH RESULT

MALARIA MEDICINE

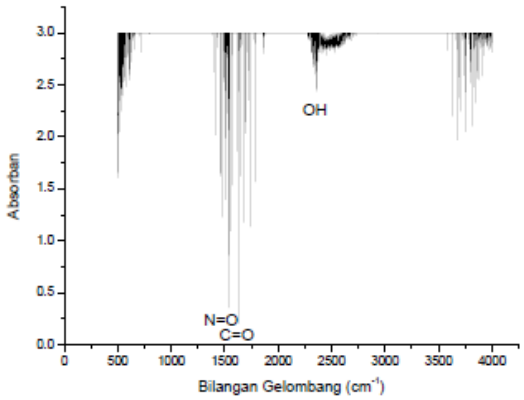
The research process malarial drug samples, namely: Drugs Chloroquine, dried papaya leaves, and the leaves raw papaya we need to smooth the above three samples that are analyzed by an

infrared spectrometer. Having analyzed the results can be seen from the three samples where the difference of the functional groups and the resulting wave numbers.

Chloroquine drug has on the wave number 2350 cm-1, 1650 cm-1 and 1550 cm-1 and bonding OH group, C = O, and the N-O. In the area of 3500-4000 cm-1, was not taken as the correlation table list does not specify the area.

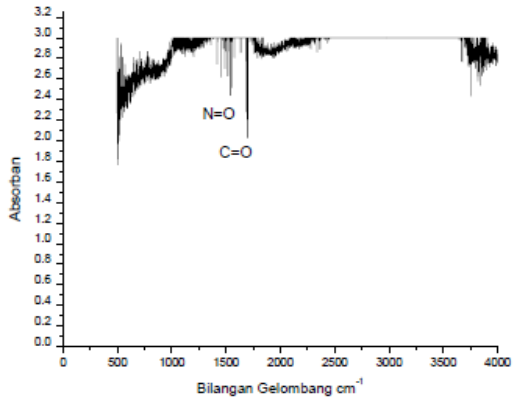


The absorbance spectrum of the drug chloroquine



The absorbance spectrum on Raw Papaya Leaf

Raw papaya leaf at wave number 2450 cm-1, 1650 cm-1, 1500 cm-1 and bonding OH group, C = O, and N-O.



Absorbance spectrum at Papaya Leaf Dry

Dried papaya leaves at wave number 1700 cm-1, 1550 cm-1 and the bonding group C = O and N-O. Of the three samples above malaria drug that has a value approaching wave numbers of drug chloroquine is raw papaya leaf. By this, if we are suffering from diarrhea, raw papaya leaf is solution for traditional medicine because it has the same compound.

Based on the spectrum of the wave, then the data absorbance of the samples from the interpretation of the infrared spectrum using FTIR spectrometer can be seen in Table 1.

Table 1 Data absorbance spectrum of malaria drug

Gugus Fungsi	Senyawa	Bil.Gelombang (cm^{-1})	Absorbansi	Sampel
OH	Hidrogen	2350	3,11	Obat Kloroquin
C=O	Keton	1650	0,5	
N-O	Nitro	1550	0.6	
OH	Hidrogen	2450	2,1	Daun Pepaya
C=O	Keton	1650	0,4	Mentah
N-O	Nitro	1500	0,8	
C=O	Aldehida	1700	2,11	Daun Pepaya
N-O	Nitro	1550	2,35	Kering

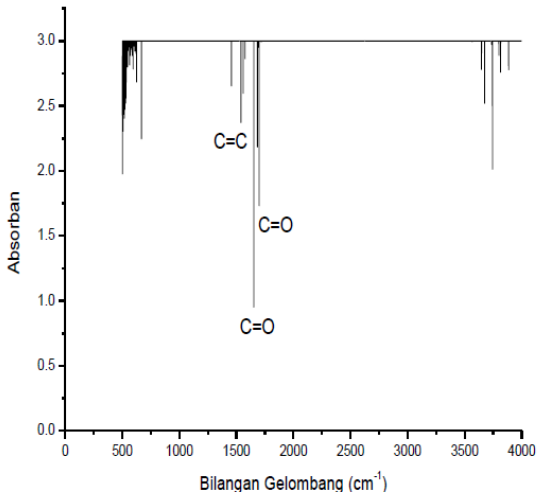
On the third malaria drug samples has peaks due to the stretching vibration of -C = C- and C = N is located at 1690-1600 cm-1, is useful for the identification of olefins. Aromatic ring shows a peak in the region of 1650-1450 cm-1, which with a low degree of substitution (low degree of substitution) showed a peak at 1600,1580,1500, and 1450 cm-1. Stretching vibration of the carbonyl group can be characterized here, such as aldehydes (Dried papaya leaves), which peak at 1700 cm-1.

DRUG DIARRHEA

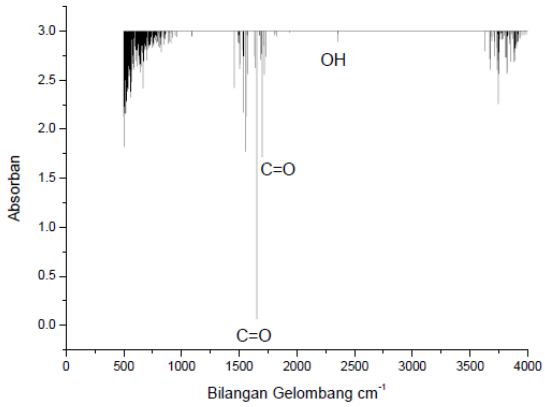
In the research process for the five samples of malaria, it is necessary to do the smoothing on each sample to be examined using an infrared spectrometer. The results were clear where the differences in the results of the wave number, as well as the functional groups of the absorbance of each sample was examined. Despite the apparent difference in wave number and the functional group, the resulting spectra look the same.

Because of the five samples that have properties to cure diarrhea.

In medicine, there are three compounds Diapet i.e. C = C, C = O and OH.

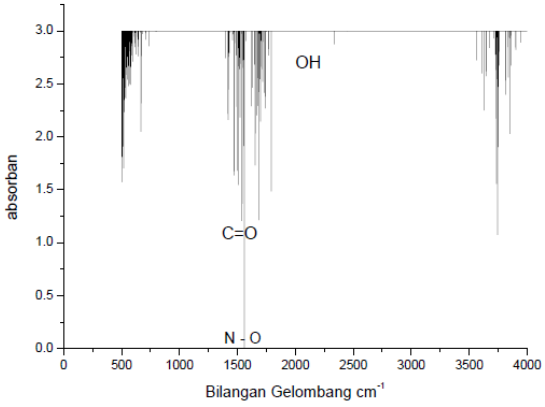


Absorbance spectrum on drug Diapet



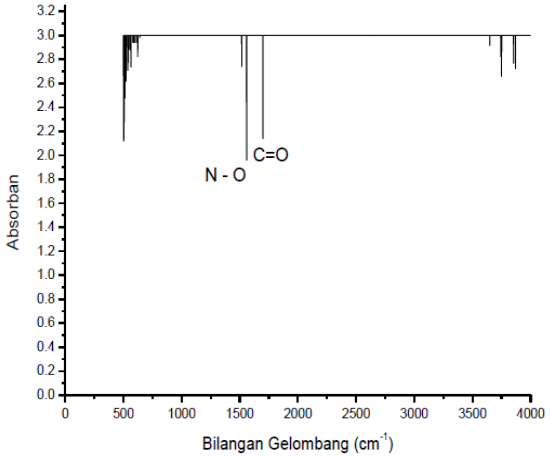
Absorbance spectrum at Guava Leaf Dry

In Figure 4.5, there are three compounds are aldehydes (C = O), ketones (C = O) and hydrogen OH at wave number 2450 cm-1, 1740 cm-1, 1650 cm-1.



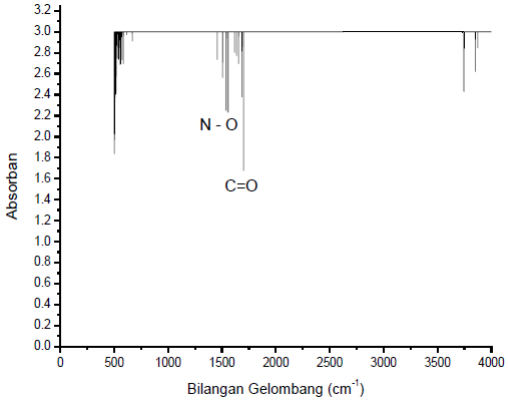
The spectrum at Guava Leaf Raw

Pictured above have compounds are: ketones, nitro and hydrogen with wave number 1550 cm-1, 1650 cm-1 and 2450 cm-1.



Absorption spectrum at regular tea leaves

In the picture above, there are two, namely nitro compounds and aldehydes.



The absorption spectrum of the leaves teabag

Based on the wave spectrum, the data of each sample absorbance of infrared spectrum interpretation results using FTIR spectrometer can be seen in table 2.

Table 2 Data spectral absorbance of Drug Diarrhea

Gugus Fungsi	Senyawa	Bil.Gelombang (cm^{-1})	Absorbansi	Sampel
C=O	Aldehida	1700	1,75	Obat Diapet
C=O	Keton	1650	0,4	
C=C	Aromatik	1450	2,27	
C=O	Aldehida	1750	1,41	Daun Jambu Biji
N-O	Nitro	1550	-0,8	Mentah
OH	Hidrogen	2450	3,5	Daun Jambu Biji
C=O	Aldehida	1740	1,57	Kering
C=O	Keton	1650	0,1	
C=O	Aldehida	1700	2,14	Daun teh Biasa
N-O	Nitro	1550	1,96	
C=O	Aldehida	1700	1,67	Daun Teh Celup
N-O	Nitro	1550	2,24	

From the research data Table 4.2 shows that out of each sample type diarrhea drug has a peak absorbance which each sample produced, has a peak varying with wave numbers produced range of 1550 cm-1, 1650 cm-1 to 1700 cm -1 and 2450 cm-1 containing the functional group C = O, N - O and OH. The compounds contained is nitro, ketones and aldehydes with sharp intensity.

In the fifth Diapet drug samples has peaks due to the stretching vibration of -C = C- and C = N is located at 1690-1600 cm-1, is useful for the identification of olefins. Aromatic ring shows a peak in the region of 1650-1450 cm-1, which with a low degree of substitution (low degree of substitution) showed a peak at 1600,1580,1500, and 1450 cm-1. Stretching vibration of the carbonyl group can be characterized here, such as aldehydes (Leaf tea bag), which peak at 1700 cm-1.Of the five samples diarrhea medication above that have a value approaching wave numbers Diapet drug is dried guava leaves. By this, if we are suffering from diarrhea then the leaves of guava is the solution for traditional medicine because has the same compound.

The infrared spectrum lies in the frequency range 1650 cm-1 to 2450 cm-1, has a functional group N-O, C = O, C = C, OH-type vibration (stretch).

Table 3. Frequency Vibration, Wavelength and Energy Vibration

Ikatan Gugus	Posisi Pita Serapan	Frekuensi υ (*Hz*)	Panjang Gelombang λ (μm)	Energi (Joule)
N-O	1550	$0,40X10^{-4}$	7 μm	$2,652X10^{-20}$
C=O	1650-1700	$0,5X10^{-4}$	6 μm	$3,315\ X10^{-20}$
C=C	1400-1600	$0,4X10^{-4}$	7,5 μm	$2,652X10^{-20}$

Based on table 4.2 NO functional group in the nitro compounds with a range of local wave number 1550 cm-1 with a vibration frequency of 0.40, a wavelength of 7 μm and the vibrational energy absorbed by the molecules that bond with the functional groups of 2,652X10-20 J, hereinafter in group C = O in ketones and aldehydes in the range of wave number 1650 cm-1 to 1700 cm-1 with a vibration frequency of 0.5, 6 μm wavelengths and vibrational energy absorbed by the molecules that bond with the functional groups of 3,315 X10 -20. The functional groups of C = C in compound (Aromatic) with a range of local wave number 1550 cm-1 with a vibration frequency of 0.4, a wavelength of 7.5 μm and the vibrational energy absorbed by the molecules that bond with the functional groups of 2,652X10-20 J.

CONCLUSION

The results of data analysis of FTIR spectrum in malarial drugs (drugs chloroquine and papaya) obtained contained four compounds, namely Nitro (NO) in the range of wave number 1550 cm-1, ketones and aldehydes (C = O) at wave number 1650 cm-1 and 1740 cm-1, and hydrogen (OH) with wave number 2350 cm-1. Of malaria drug samples above that have a value approaching wave numbers of drug chloroquine is raw papaya leaf. By this, if we are suffering from diarrhea, raw papaya leaf is solution for traditional medicine because it has the same compound. In the sample of diarrhea medication (drug Diapet, guava leaves crude, guava leaves dry leaves ordinary tea, leaf tea bags) also has similarities with the functional groups and compounds, namely Nitro (NO), Ketone aldehyde (C = O) aromatic (C = C) and hydrogen (OH), at wave number 1550 cm-1, 1650 cm-1, 1750 cm-1 and 2450 cm-1. Of the five who had diarrhea drug samples and compounds wave numbers approaching Diapet drug is dried guava leaves. The leaves of guava are the solution for traditional medicine for diarrhea.

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