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A UV-Correlation Survey of Some Local Medicinal Plants Use for Treating Malaria to Common Antimalaria Drugs (Quinine, Chloroquine and Halfan)

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Abstract- ***The scientific assessment of traditionally used medicinal herbs has gained increased attention due to the growing resistance of Plasmodium species to existing antimalarial medications. The UV–Visible (UV–Vis) spectral properties of methanolic leaf extracts from five antimalarial medicinal plants Azadirachta indica, Momordica charantia, Spondias mombin, Mangifera indica, and Vernonia amygdalina were compared with those of a few common antimalarial medications, including quinine, chloroquine, and halofantrine Halfan. Methanol was used to extract fresh leaves that had been gathered from the Benin Forest, air dried, and ground into a powder. The extracts and reference medications UV-Vis absorption spectra were recorded and their absorption maxima (λ_max) were examined and contrasted. In the UV spectrum, the plant extracts showed distinctive absorption peaks. Azadirachta indica (325 nm), Momordica charantia (418 nm), Spondias mombin (318 nm), Mangifera indica (345 nm), and Vernonia amygdalina (318 nm) were among the observed λ_max values. Standard medications displayed λ_max values at 319 nm (halofantrine), 418 nm and 346 nm (quinine), and 325 nm and 319 nm (chloroquine). A number of plant extracts showed absorption maxima in wavelength ranges that were equivalent to those of conventional antimalarial medications, indicating the existence of conjugated structures or similar chromophoric systems. The discovered spectrum similarities suggest possible phytochemical characteristics that might call for additional research utilising sophisticated analytical and biological assays, even though UV–Vis spectroscopy cannot give conclusive structural identification. These results lend credence to the ongoing investigation of traditional medicinal herbs as possible sources of bioactive chemicals with antimalarial properties.***

Index Terms- ***UV–Visible spectroscopy, antimalarial plants, phytochemical screening, methanolic extract, spectral comparison, medicinal plants.***

I. INTRODUCTION

Malaria continues to be one of the world's biggest public health issues, especially in sub Saharan Africa, where it is the primary cause of illness and mortality worldwide. The World Health Organization (WHO) estimates that in 2022 there were 249 million cases of malaria and over 600,000 fatalities globally, with over 95% of cases happening in Africa (WHO, 2023). The most severe and deadly types of malaria are brought on by Plasmodium parasites, mainly Plasmodium falciparum.

Malaria control and eradication efforts are seriously threatened by the establishment and spread of resistance to traditional antimalarial medications like chloroquine and, more recently, partial resistance to artemisinin derivatives (Ashley *et al.*, 2014; WHO, 2023). The urgent need for alternative treatment agents and fresh research into plant-based antimalarial drugs is highlighted by drug resistance. In the past, the discovery of antimalarial drugs has been greatly aided by medicinal plants. For instance, quinine was separated from Cinchona bark, while artemisinin was obtained from Artemisia annua (Newman & Cragg, 2020). These achievements highlight the value of ethnomedicine as a source of bioactive substances.

For many people in poor nations, traditional medicine continues to be their main source of healthcare. According to WHO estimates, traditional herbal medicine provides primary healthcare for up to 80% of people in various Asian and African nations (WHO, 2013). Drug discovery and sensible therapeutic application depend on scientific validation of the phytochemical content, safety, and mechanisms of action of medicinal plants, even if many are employed based on empirical and traditional information.

UV-visible (UV-Vis) spectroscopy is a useful analytical method for the initial characterisation of medicinal plant extracts. Because of its ease of use, quick analysis times, affordability, and capacity to reveal details about electronic transitions in organic compounds, UV-Vis spectroscopy is widely employed (Skoog *et al.,* 2018). The method makes it possible to identify distinctive absorption maxima (λ_max) and sheds light on the existence of conjugated systems, chromophores, aromatic rings, and certain functional groups. Flavonoids, phenolics, and alkaloids are among the many bioactive plant metabolites that have conjugated π-electron systems with distinctive UV absorption patterns (Harborne, 1998).

UV-Vis spectroscopy can be used as an initial comparison tool in antimalarial research to evaluate the similarities between established antimalarial medications and plant extracts. For example, because of their aromatic and heterocyclic compositions, quinine and other quinoline based antimalarial drugs show unique absorption bands (Bruneton, 1999). Alkaloids are a significant family of secondary metabolites found in plants. They are heterocyclic molecules that include nitrogen and are well-known for their strong physiological effects. Quinine, morphine, atropine, and papaverine are a few examples; many of them have important pharmacological characteristics (Bruneton, 1999). Primaquine and similar quinoline derivatives are examples of synthetic antimalarial medications that share structural traits that contribute to their UV absorption properties.

Despite its benefits, UV-Vis spectroscopy has drawbacks, such as comparatively low selectivity, overlapping absorption bands, and lesser sensitivity when compared to more sophisticated methods like mass spectrometry (MS) or high performance liquid chromatography (HPLC) (Skoog *et al.,* 2018). However, it offers a convenient and useful initial step for phytochemical screening and comparative spectral analysis in environments with limited resources. Interestingly, there is no research that directly compares the UV-visible spectra of conventional antimalarial medications with those of historically used antimalarial plant extracts. By establishing such correlations, it may be possible to identify spectrum similarities that point to shared chromophoric systems or structural motifs. This information can be used to inform the selection of prospective extracts for additional chemical and biological testing as well as to guide theories regarding active ingredients.

Bioactive phytochemicals like alkaloids, flavonoids, tannins, and terpenoids have been found in a number of medicinal plants that are frequently used in traditional malaria treatment, including Azadirachta indica (neem), Mangifera indica (mango), Momordica charantia (bitter melon), Spondias mombin, and Vernonia amygdalina (bitter leaf) (Saxena *et al.,* 2003; Erasto *et al.,* 2007). Examining the UV-visible spectrum characteristics of these plant extracts and contrasting them with conventional antimalarial medications may offer some initial understanding of their chemical makeup and possible modes of action.

Systematic phytochemical analysis of traditional medicinal plants using easily accessible analytical methods like UV-Vis spectroscopy is a crucial step toward finding new drug leads and bolstering evidence-based integration of herbal medicine into contemporary pharmacotherapy, given the ongoing prevalence of malaria and the increasing problem of antimalarial drug resistance.

Therefore, this study seeks to:

i. Collect and prepare extracts from selected local medicinal plants used to treat malaria in the study area.

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ii. Record their UV-Visible absorption spectra (including identification of characteristic peaks, λ_max, absorbance patterns) under standardized conditions.
iii. Record UV-Visible spectra of standard antimalarial drugs (quinine, chloroquine, halofantrine) under comparable conditions.
iv. Compare the spectral features of the plant extracts with those of the standard drugs to identify possible similarities

Neem, or Azadirachta indica, is a tropical tree native to the Indian subcontinent that is extensively grown in Nigeria and other African countries (Jose *et al.*, 2020). Neem is known as "Nsukwugwu" in Ibo, "Ewe" in Yoruba and Edo, and "Dogon Yaro Darakkan" in Hausa. Its many pharmacological qualities, including its possible antimalarial benefits, have been acknowledged in traditional medicine (Jose *et al.*, 2020). Neem leaves, seeds, and bark are used in Nigerian traditional medicine to cure a variety of illnesses, including malaria. Neem has been used for generations to treat malaria, frequently in the form of extracts, teas, or decoctions.

Azadirachtin, Nimbidin, Nimbin, Quercetin, and triterpenoids are among the bioactive substances found in neem extract (Robeena *et al.*, 2019). These substances support neem's antiviral, antifungal, insecticidal, and antimalarial activities (Farahna *et al.*, 2010). Research shows that neem extracts can stop the growth of malaria parasites, especially Plasmodium falciparum, which causes the most severe kind of malaria in humans (Farahna *et al.*, 2010).Neem's capacity to disrupt protein synthesis and promote apoptosis by interfering with different metabolic pathways in the malaria parasite has been linked to its antimalarial efficacy (Awofeso, 2011). According to some study, neem may increase the effectiveness of traditional antimalarial medications, which could be helpful in creating combination treatments to fight drug-resistant types of malaria (Frederich, 2009).

Some bioactive components of Azadirachta indica

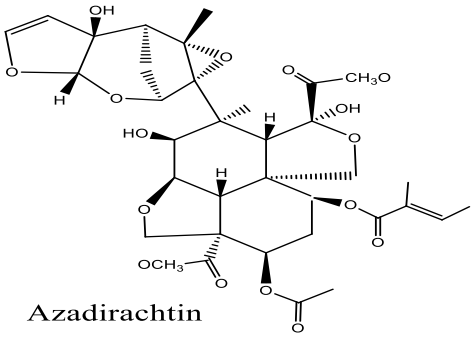

Figure 1. Azadirachtin

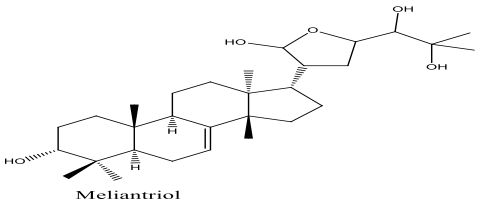

Figure 2. Meliantriol

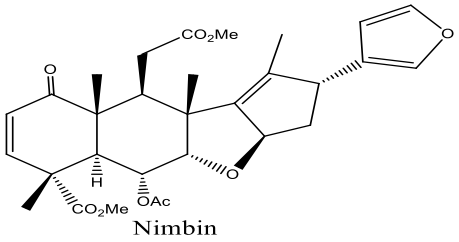

Figure 3. Nimbin

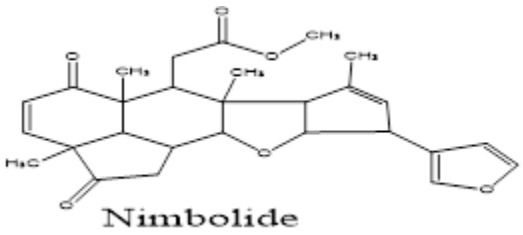

Figure 4. Nimbolide

Mango, or Mangifera indica L., is a tropical fruit tree that originated in South Asia but is now widely grown in tropical and subtropical areas, such as Nigeria and other parts of Africa (Mukherjee, 1997; Morton, 1987). In addition to its economic value as a fruit crop, the mango tree's leaves and bark are widely used in traditional medicine (Shah *et al.*, 2010). Mango leaf and bark preparations have long been used to treat malaria and other feverish disorders in many African societies, including

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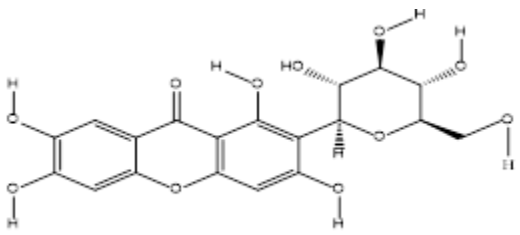
Nigeria (Burkill, 1985; Aiyeloja and Bello, 2006). Infusions, decoctions, or macerations of the leaves or bark are frequently used in preparations; they can be given either by themselves or in conjunction with other medicinal plants (Burkill, 1985).

The plant is called "Ife" in Edo, "igi mango" in Yoruba, "mangoro" in Hausa, and "idi manga" in Igbo, according to several ethnic groups in Nigeria (Burkill, 1985; Aiyeloja and Bello, 2006). The extensive ethnomedical use of M. indica underscores its significance in conventional medical systems and encourages continued research into its phytochemical and pharmacological characteristics.

Flavonoids (such as quercetin and kaempferol), triterpenes (such as lupeol), phenolic compounds, and vitamins (mostly vitamin C) are among the bioactive substances found in mangos that may have therapeutic uses (Ediriweera *et al.,* 2017). These substances support its antibacterial, anti-inflammatory, and antioxidant properties. Research on Mangifera indica's antimalarial qualities has shown encouraging findings: Mango leaf and bark extracts have been found in numerous studies to have strong anti-plasmodial efficacy against Plasmodium falciparum, the parasite that causes human malaria (Edet *et al.,* 2023).

These extracts have the ability to stop the parasite from growing and multiplying. The reduction of parasitic enzyme activity and disruption of the malaria parasite's metabolic pathways are thought to be responsible for the antimalarial effects (Edet *et al.,* 2023). According to some study, combining mango extracts with other antimalarial medications may improve treatment effectiveness and aid in the fight against drug-resistant malaria strains (WHO 2013).

Some bioactive components of Mangifera indica



Mangiferin

Figure 5. Mangiferin

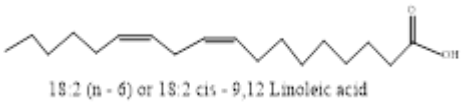
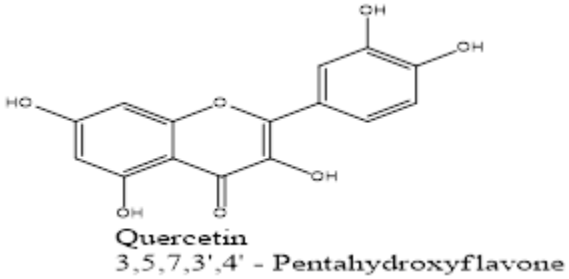
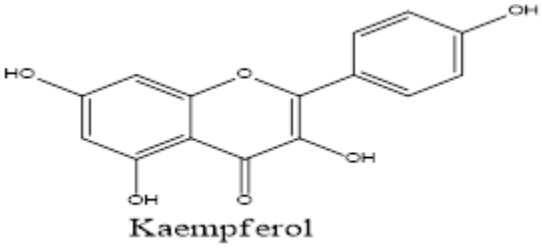


Figure 6. Linileic acid



Quercetin
3,5,7,3',4' - Pentahydroxyflavone

Figure 7. Pentahydroxyflavone



Kaempferol

Figure 8 Kaempferol

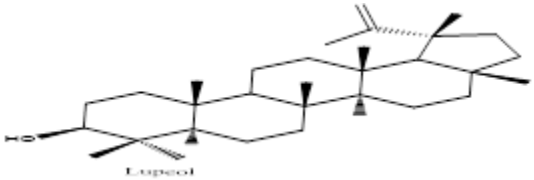


Figure 9. Lupeol

Momordica charantia, a tropical and subtropical vine of the Cucurbitaceae family, is also referred to as bitter melon or bitter gourd. It is widely grown and eaten throughout Asia, Africa, and the Americas. Its potential health benefits, including antimalarial qualities, have been acknowledged (Kandangath, 2015). It is known as "Akwukwo odo" in Ibo, "Ewuro" in Yoruba, "Igu" in Edo, and "Akwatin Kankana" in Hausa. Bitter melon has long been used in Nigeria to treat a number of illnesses, including malaria. Indigenous knowledge frequently uses the fruit, leaves, and seeds in a variety of preparations,

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including extracts, decoctions, and teas. Akaloids, flavonoids, saponins, and triterpenoids are among the bioactive substances found in bitter melon.

Its antimalarial action is thought to be influenced by these substances (Gandhi *et al.,* 2019). Studies have shown that Momordica charantia extracts have anti plasmodial properties against Plasmodium species, the parasites that cause malaria. According to some research, bitter melon's fruits and leaves may prevent these parasites from growing, which could lower the prevalence of malaria (Gandhi *et al.,* 2019). According to in vitro research, bitter melon's methanolic and aqueous extracts have strong antimalarial properties, suggesting that they could be used as a medicinal agent to treat malaria. According to some research, using Momordica charantia in conjunction with other conventional antimalarial herbs may increase its effectiveness and offer a supplementary method of treating malaria (Adebayo *et al;* and Osaro *et al;* 2017).

Some bioactive components of Momordica charantia

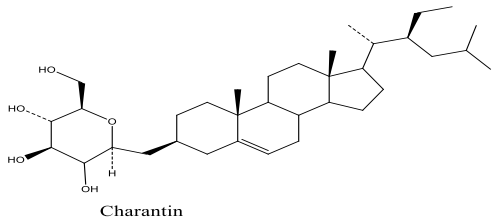

Figure 10. Charantin

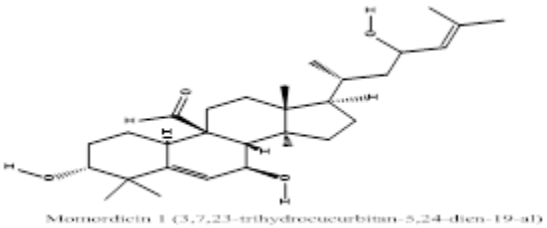

Figure 11. Momordicin

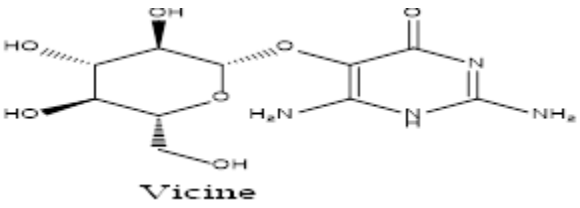

Figure 12. Vicine

Originally from the Americas, Spondias mombin, sometimes called yellow mombin or hog plum, is a tropical fruit tree that is now extensively grown in Nigeria and other African countries. It is known as Itsekiri (akikan), Edo (oghe 'e' ghe), Hausa (tsa 'a' dar), Yoruba (Igbin), and Ibo (Okwu). Traditionally, it has been used for a variety of therapeutic uses, including the treatment of malaria. The leaves bark, and fruit of the Spondias mombin tree are used in traditional Nigerian medicine to cure malaria and other illnesses. Due to their alleged medicinal benefits, preparations frequently consist of infusions, decoctions, and pastes (Ayoka *et al.,* 2005).

The therapeutic qualities of Spondias mombin are attributed to its abundance of bioactive chemicals, which have antibacterial, anti-inflammatory, and antioxidant effects (Ayoka *et al.,* 2005). Studies back up Spondias mombin's antimalarial potential: Research has shown that extracts from Spondias mombin can stop the growth of Plasmodium species, especially Plasmodium falciparum, in experimental settings. According to these investigations (Ayoka *et al.,* 2005; Oedema *et al.,* 2007), there is a promising anti plasmodial impact.

The inhibition of enzymes involved in the malaria parasite's metabolic pathways and the production of reactive oxygen species, which might cause the parasites to undergo apoptosis, may be responsible for the antimalarial impact (Ekor et al., 2015). Combining Spondias mombin with other conventional antimalarial herbs may increase the overall effectiveness against malaria and help fight resistant strains (Adebayo *et al.,* 2018).

Some bioactive components of Spondias mombin

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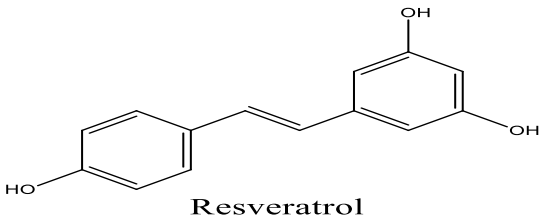

Figure 13. Resveratrol

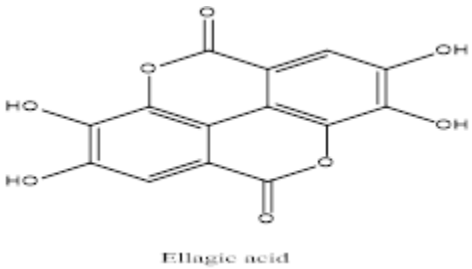

Figure 14. Ellagic acid

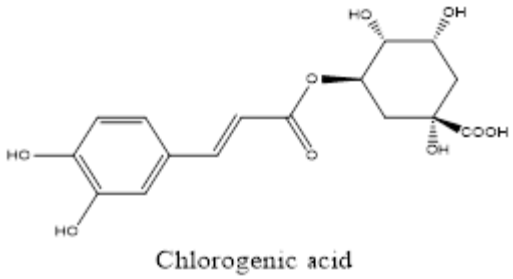

Figure 15. Chlorogenic acid

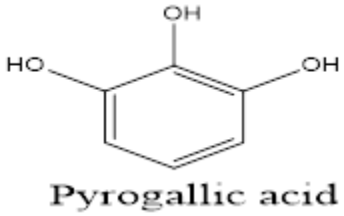

Figure 16. Pyrogallic acid

Vernonia amygdalina, commonly known as bitter leaf, is a shrub native to Africa, notably Nigeria, where it is widely used as a vegetable and a traditional medicinal herb. It is called "Oriwo" in Edo, "Efirin" in Yoruba, "Onogbo" in Igbo, and "Shayi Gawa" in Hausa. It is praised for a number of health advantages, most notably its possible antimalarial qualities. Vernonia amygdalina is frequently used in Nigerian traditional medicine to treat malaria and other illnesses like fever, infections, and digestive issues (Challand *et al.,* 2009).

Usually, the leaves are utilised in extracts, ingested raw, or brewed into teas. Alkaloids, triterpenes, sesquiterpenes, lactones like vernodalin, and saponins are among the bioactive substances found in it. These substances are well known for their antibacterial, anti inflammatory, and antioxidant qualities (Challand *et al.,* 2009). Vernonia amygdalina has been shown to have antimalarial properties. Leaf extracts have been demonstrated in numerous studies to have strong anti plasmodial properties against Plasmodium species, especially Plasmodium falciparum. The effectiveness of both methanol and aqueous extracts has been evaluated (Challand *et al.,* 2009). It is believed that Vernonia amygdalina inhibits the metabolic processes of the malaria parasite and induces oxidative stress, which causes the parasites to die (Challand *et al.,* 2009 and Horton, 1988). According to some research, using bitter leaf in conjunction with traditional antimalarial medications may boost their efficacy and reduce drug resistance (Horton, 1988).

Some bioactive components of Vernonia amygdalina

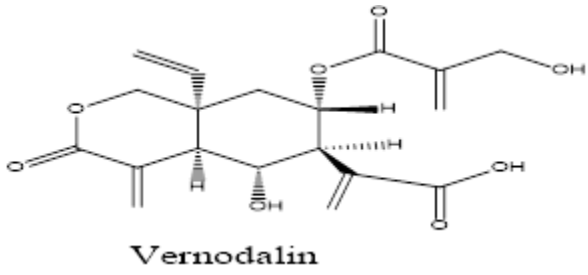

Figure 17. Vernodalin

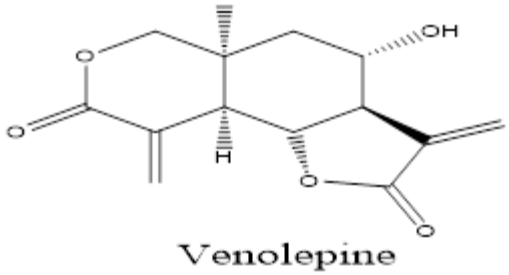

Figure 18. Venolepine

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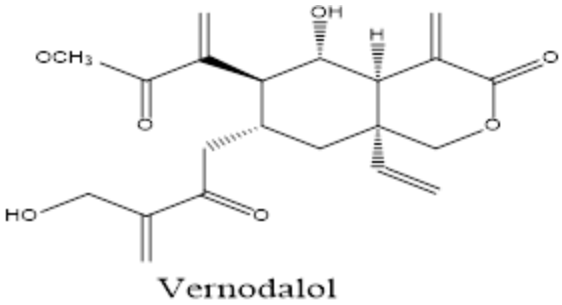

Figure 19. Vernodalol

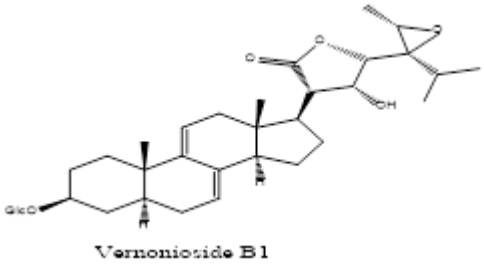

Figure 20. Vernonioside B1

Halfan: Halofantrine is a component of this trademark, which is produced by GlaxoSmithKline Pharmaceutical. Halfan is a phenanthrene methanol antimalarial that has a high level of effectiveness against the asexual erythrocytic stage of malaria parasites. Each tablet contains 250 mg of Halofantrine solution 2% w/v. According to Michael *et al.* (2012), it has no discernible effect on the gametocyte or exoerythrocytic stages of malaria parasites. According to Michael *et al.* (2012), it is recommended for the treatment of acute malaria brought on by a single or mixed infection of Plasmodium falciparum or Plasmodium vivax. Most patients treated with Halfan had P. falciparum infections in regions where quinine, chloroquine, or multidrug resistant strains are prevalent. Although a crystallographic investigation revealed that halofantrine binds to haematin in vitro, indicating a potential mechanism of action, it is never used to prevent malaria and its mode of action is unknown (Telgt *et al.,* 2005). Additionally, it has been demonstrated that halofantrine binds to plasmepsin, an enzyme specific to malarial parasites that breaks down haemoglobin. The structure of halofantrine

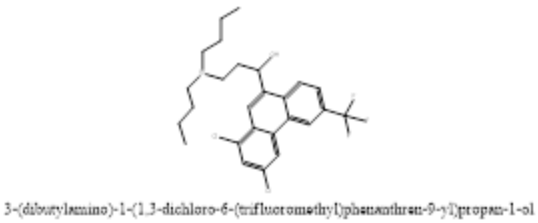

Figure 21. Halofanthrin

Unwanted Effects: Halfan is usually well tolerated. Following halofantrine treatment, side effects such as nausea, diarrhoea, skin rash and prurities, headache, gastrointestinal disturbances, a brief increase in liver enzymes, and cough have been documented (Telgt *et al.,*2005).

Chloroquine, a 4-aminoquinoline, is a very strong blood schizonticidal medication that works against the erythrocytic forms of all four plasmodial species if the patient is susceptible to it. However, it has no effect on gametocytes, hypnozoites, or sporozoites (Telgt *et al.,* 2005). Its intricate and poorly understood method of action (Telgt *et al.,* 2005). This weak base accumulates 1000 times more in the parasite lysosome than would be expected based on the weak base effect. Chloroquine is claimed to break the parasite's RNA and intercalate in its DNA. It also prevents the parasite from digesting haemoglobin, which lowers the supply of amino acids required for parasite life (Telgt *et al.,* 2005). Additional research suggests that chloroquine binds highly to hemosoin, a component of the malarial pigment that remains after haemoglobin is proteolyzed. The parasite is poisoned by this combination (Telgt *et al.,* 2005).

II. STRUCTURE OF CHLOROQUINE

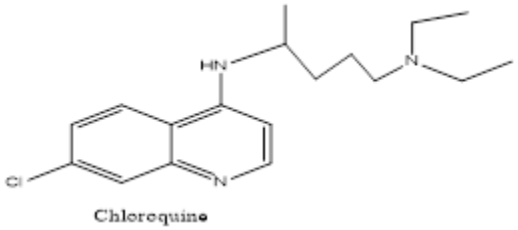

Figure 22. Chloroquine

adverse consequences. This includes headache, urticarial symptoms, nausea and vomiting, and dizziness and blurred vision. Retinopathies are caused by high dosages. When excessive dosages of

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chloroquine are administered intravenously, it can result in deadly dysrhythmias and hypotension (Telgt *etal.*,2005).

QUININE: A member of the quinoline-methanol group. The cinchona plant is the source of this alkaloid. It is a blood schizonticidal medication that works against all four species of Plasmodium's erythrocyte forms. Gametocytes, P. falciparium, and exo-erythrocytic forms are unaffected. It is unclear how it works as an antimalarial drug (Telgt *et al.*, 2005). However, it is known to bind to a component of the malaria pigment hemozine and intercalate in the DNA, just as chloroquine (Telgt *et al.*, 2005).

STRUCTURE OF QUININE

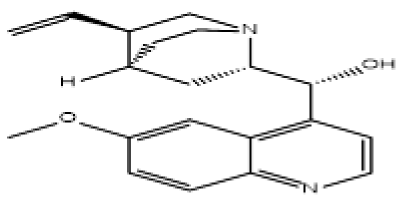

Figure 23. Quinine

Unwanted effects of quinine include nausea and vomiting when taken orally and irritation of the stomach macosa. When the plasma concentration surpasses 30 to 60 μ mol 1c, symptoms such headache, nausea, dizziness, tinnitus, and blurred vision may occur. Hypotension, cardiac arrhythmias, and serious CNS disorders like delirium and coma can all be brought on by high quinine plasma levels. When treating malaria, quinine has been demonstrated to increase pancreatic insulin secretion, which can result in hypersensitivity reactions, blood dyscrasias, and clinically severe hypoglycemia (White *et al.*, 1983; White, 1985; Xiong *et al.*, 2025). According to WHO malaria treatment guidelines, quinine's insulinotropic action is a known pharmacological feature (WHO, 2023).

III. SAMPLING

Healthy leaf samples of the necessary plants were gathered from the forest where they were found for the sampling technique. A sufficient number of leaf samples were collected. Good, healthy leaves are typically used for sampling, but withered, dried, spotted, and disease-infested leaves are typically left out. Azadirachta indica, Mangifera indica, Spondias mombin, Momordica charantia, and Vernonia amygdalins were the plants sampled. Following the collection of the different leaf samples, 200g of each was weighed.

IV. DRYING

For one to two weeks, the weighed (200g) leaf samples from the different plants were exposed to heat from the sun in order to properly dry them off. After that, they were weighed again, and the percentage (%) moisture content was calculated using these weights, as indicated in the table below.

Table 1: Moisture Content of Plant Samples

Leave Sample	Crudesample weight (g)	Driedsample weight (g)	Moisture content lost (%)
Mangifera Indica	200.00	128.12	35.95
Azadirachta Indica	200.00	30.30	84.85
Spondias Mombin	200.00	32.33	83.84
Mormodica Charantia	200.00	32.33	83.84
Vernonia Amygdaline	200.00	42.38	78.81

$$\% \text{ moisture content} = \frac{weight\ of\ dry\ sample}{weight\ of\ crude\ sample} \times 100$$

…………………………......................1

EXTRACTION

Using 300 millilitres of methanol as the extracting solvent, 60 grams of each blended leaf sample were extracted for eight hours in a Soxhlet extractor. After that, the extract was filtered and concentrated in a water bath kept between 35 and 400 degrees Celsius using a rotary evaporator. Using a tong spoon, the

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concentrated extracts were taken out of the round-bottom flask.

PREPARATION OF STANDARD SOLUTION OF LEAVES SAMPLES FOR UV-SCANNING SPECTROSCOPY.

Eight separate specimen glass crucibles were filled with around 0.05g of each leaf extract, which was then dissolved in 50ml of methanol in a measuring cylinder (100ml). Ten millilitres of each of these solutions were pipetted into separate 100 millilitre measuring cylinders until the 50 millilitre mark was reached. This provides each leaf extract's known concentration in parts per million. The manufacture of a known concentration for each 25 mg of the various antimalarial medications was done using the same technique.

UV – SPECTROSCOPY ANALYSIS DETERMINATION

A Helios UV – Visible spectrophotometer V. 4.20 of serial no: 080933 was used for the samples scanning analysis. This is equipped with a lamp change of 325nm.

PROCEDURE: - small volume of each sample solutions was poured into the sample tube and replaced inside the UV – Spectrophotometer. The wavelength was placed at a range of 190 – 1100nm as shown by the spectra. The sample solution was scanned for about 9 - 22m. the corresponding spectral graphs and the wavelength of maximum absorption was taken for the leave samples and the antimalarial drugs.

RESULTS AND DISCUSSION

From the spectrum obtained chloroquine absorps at ƛmax of 325nm and 1090nm. From the obtained spectra, there are eight peaks at the UV – region (UV-Visible region 200 – 400nm) and two peaks at the far region (400 – 1100nm). In the UV region the peaks were seen at 1,2,3,4,5,6,7,8 and their corresponding wavelength are ƛmax 254nm, 214nm, 333nm, 343nm, 325nm, 340nm, 347nm and absorbance (ABS) are 0.32A, 0.017A, 0.253A, 0.135A, 0.15A, 0.11A. in the visible region, the peaks are at 9, 10 and this corresponds to ƛmax of 1094nm and 1090nm and absorbance of -0.01A, -0.01A.

The spectrum for quinine indicates that it absorbs at 418nm and 1066nm. There are four peaks with corresponding wavelength of maximum absorbance ƛmax at 204nm, 315nm, 268nm, 346nm and absorbance of 0.01A ,– 0.01A, 0.02A ,– 0.02A and there were six peaks in the visible region with ƛmax 418nm, 466nm, 524nm, 978nm, 988nm, 1066nm; absorbance -0.01A, -0.01A, -0.01A, 0.01A, 0.000, -0.01A, 0.000 respectively.

Halfan absorbs at ƛmax 319nm and 1062nm, eight peaks were seen in the UV – region and two peaks in the visible region. In the UV – region absorption were at ƛmax 199nm, 223nm, 263nm, 280nm, 219nm, 250nm, 270nm, 319nm with absorbance 0.035nm, 0.019A, 0.017A, 0.024A, 0.021A, -0.01A, -0.01a and at the visible region ƛmax 426nm, 1062nm with absorbance of -0.01A and -0.01A respectively.

Momordica charantia was seen to have two peaks in the UV – region with ƛmax 208nm and 327nm and their corresponding absorbance was 0.009A and 0.01A respectively. There were six peaks in the visible region corresponding to ƛmax 418nm, 1025nm, 1066nm, 1069nm, 1074nm, 1076nm, 1051nm, 1094nm.

Azadirachta indica have two peaks in the UV – region with ƛmax 215nm, 325nm and corresponding absorbance of 0.016A, -0.01A and eight (8) peaks in the visible region with ƛmax 535nm, 914nm, 1061nm, 1066nm, 1078nm, 1080nm, 1087nm, 1094nm with absorbance at 0.002A, 0.000, -0.01A, 0.004A, -0.01A, 0.05A, -0.01A, 0.008A.

Mangifera indica has nine (8) peaks in the UV – region with ƛmax of 193nm, 197nm, 199nm, 212nm, 224nm, 315nm, 345nm, 346nm and in the visible region a peak at 1090nm respectively.

Vernonia amygdalina has six peaks in the UV – region with ƛmax 214nm, 211nm, 241nm, 251nm, 256nm, 262nm with absorbance of 0.055A, 0.026A, -0.01A, 0.006A, -0.01A, 0.010A.

This data obtained from the spectra of the leave samples and antimalarial drugs can be tabulated by comparing the wavelength and absorbance of the leave samples with those of the antimalarial drugs.

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Table 2: COMPARING THE WAVELENHGT AND ABSORBANCE OF ANTIMALARIAL DRUGS TO LEAVE EXTRACT

S/N	DRUG	SAMPLES	DRUG/LEAVE SAMPLE WAVELENGHT
1.	Chloroquine	Momordica charantia	325/327, 1074/1074 204/208, 1090/1091
	Quinine	Momordica charantia	1074/1074, 418/418, 1062/1066, 204/208
	Halfan	Momordica charantia	
2.	Chloroquine	Spondias mombin	204/208, 1074/1076 1090/1091
	Quinine	Spondias mombin	204/208, 315/318, 1066/1064 319/318, 223/232, 1062/1064
	Halfan	Spondias mombin	
3.	Chloroquine	Azadirachta indica	216/215, 325/325, 1074/1078, 1090/1087 1066/1066
	Quinine	Azadirachta indica	
	Halfan	Azadirachta indica	1062/1061, 1062/1066, 319/325
4	Chloroquine	Mangifera indica	341/345, 216/214, 216/212, 1090/1090 346/345
	Quinine	Mangifera indica	
	Halfan	Mangifera indica	223/226, 199/197, 370/376
5.	Chloroquine	Vernonia Amygdalina	204/208, 216/211, 1074/1076, 1090/1097, 1090/1091 204/208, 268/262, 315/328, 315/325, 1066/1064
	Quinine	Vernonia Amygdalina	319/328, 199/194, 263/262, 252/256, 250/256, 250/257, 1062/1061
	Halfan	Vernonia Amygdalina	

From the table it is observed that the wavelength and absorbance of some leaves were of the same concentration with those of the antimalarial drug because of their equivalent in wavelength. From the first column, when Momordica charantia is compared to chloroquine, Quinine and Halfan, it is observed that both the wavelengths of Momordica charantia and Quinine are equivalent at 418nm, indicating that Mormodica charantia has the same effective potency as Quinine and Chloroquine but is completely different from Halfan properties because of their differences in ƛmax 325/327nm; 1062/1066nm. In columns 2 and 5, both Spondias mombin and Vernonia amygdalina has the same wavelengths, comparing these to those of the anti malarial drugs, their wavelengths are only close or equivalent at 319/318 and 1090/1091. Thus both plants show little anti malaria potency as Halfan and Chloroquine. In column 3, it is seen that Azadirachta indica possesses the same or close equivalent wavelengths with those of Chloroquine 216/215, 325/325, Quinine 1066/1066 and Halfan 1062/1061. Thus, this indicates that Azadirachta indica has the same effective potencies with those of Chloroquine, Quinine and Halfan. Hence it is the most effective malaria plant when compared to those of Mangifera indica, Spondias mombin, Amygdalina Vernonia and Momordica charantia. In column 4, Mangifera indica has ƛmax close to those of Chloroquine 343/343, 216/214 and ƛmax equivalent to Chloroquine at 1090/1090; Quinine ƛmax 346/345, and Halfan 199/197. So Mangifera indica has the same effective potencies with Chloroquine and Quinine only.

CONCLUSION

According to the table, Azadirachta indica has the strongest anti-malarial effectiveness of all the plants because it shares the same set of peaks and max with Quinine, Chloroquine, and Halfan. Vernonia amygdalina and Spondias mombin share the same wavelength and absorbance, which makes their properties somewhat similar. However, Vernonia amygdalina and Spondias mombin have different strengths and actions against malaria parasites, with Vernonia amygdalina having the same set of peaks and ~max with Quinine and Halfan and Spondias mombin having the same set of peaks and ~max with Chloroquine and Halfan. Similar to quinine and chloroquine, Mormodica charantia and Mangifera indica have similar effective potencies in action despite having differing wavelengths of absorption. The table below provides a summary of these.

Table 3: Summary of Results

Leave Extracts	Equivalent in Strenght ƛmax	
Momordica charantia	Quinine 1074/1074 1062/1066	Chloroquine 418/418 1090/1091
Mangifera indica	Quinine 346/345	Chloroquine 1090/1090
Spondias mombin	Chloroquine 1090/1091	Halfan 318/319
Vernonia Amygdalina	Quinine 268/262	Halfan 263/262 250/250
Azadirachta indica	Chloroquine Halfan 216/215 1061/1062 319/325	Quinine 1066/1066

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