

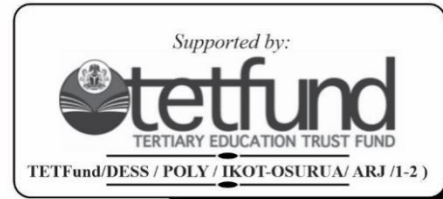
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## EVALUATION OF MACRO AND MICRO ELEMENTS IN *Chromolaena odorata* ROOTS USED IN TREATMENT OF ACUTE MALARIA IN NKO COMMUNITY, OBOT AKARA L.G.A



[www.akwapolyjournal.org](http://www.akwapolyjournal.org)  
P-ISSN: 2536-6733 | E-ISSN: 2616-0773



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### **ABSTRACT**

The evaluation of macro and micro elements in *Chromolaena Odorata* roots was carried out using atomic absorption spectrophotometer (AAS). The results of the analysis were as follows: Calcium (Ca)  $1.33 \pm 80$ , Magnesium (Mg)  $0.05 \pm 0.00$ , Potassium (K)  $4.90 \pm 0.004$ , Sodium (Na)  $0.03 \pm 0.10$ , and Phosphorus (P)  $0.50 \pm 1.20$  while that for the micro elements were also obtained as follows: Iron (Fe) ( $0.11 \pm \text{mg}/100\text{kg}$ ), Copper (Cu) ( $0.020 \pm 0.02 \text{mg}/100\text{kg}$ ) Manganese (Mn) ( $0.54 \pm 0.025 \text{ mg}/100\text{kg}$ ) and Zinc (Zn) ( $0.55 \pm 0.005$ ). The results obtained when duly compared with the recommended dietary allowance standard (RDA) showed that Sodium (Na) had the lowest level ( $0.0310.80$ ) among the analyzed minerals, while Potassium (K) had the highest level ( $4.90 0.004$ ), all the other minerals were however found to be within the recommended dietary allowance standard (RDA). An indication that the root of *Chromolaena odorata* on consumption could serve as a supplement for the mineral elements.

**Keyword:** Evaluation, Elements, Micro&Macro, Treatment *Chromolaena Odorata* Roots.

### **INTRODUCTION**

Minerals are inorganic substances present in all body tissue and fluids, and it is necessary to maintain specific physiochemical processes essential to life. Mineral may be broadly

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classified as macro (major) or micro (trace) elements. The macro-minerals include calcium, phosphorous, sodium, and chlorine, while the micro-elements include Iron, Copper, Cobalt, Potassium, Magnesium, Iodine, Zinc, Manganese, Molybdenum, Fluoride, Chromium, Selenium Sulphur (Eruvbetine, 2003). The macro-minerals are required in amounts greater than 100mg and the micro-minerals in amounts less than 100mg (Murray *et al.*, 2000).

The mineral elements are separate entities from other essential nutrients like proteins, fats, carbohydrates and vitamins. Animal husbandry had demonstrated the need for minerals in the diet (Hegsted *et al.*, 1976). In this country, biological assay methods clarified the significance and importance of mineral elements for human and animal nutrition, and modern analytical techniques led to the detection of trace elements as essential nutrients, and this is still an active area of current research.

Elements availability and its absorption by plants are regarded as the most significant driver of plant growth (Kimani *et al.*, 2001). The availability of mineral elements in plants and animals is very vital for metabolic processes. Microelements are vital to plant growth but only require small amounts. They are also called trace elements because of the tiny amounts found in average soils. Micro elements requirements differ between organisms; for example, humans and other animals require vitamins and dietary minerals, whereas plants require specific minerals.

These microelements include iron (Fe), Zinc (Zn), Copper (Cu), Manganese (Mn), Iodine (I), Cobalt (Co), Chromium (Cr), and Selenium (Se).

Microelements perform a variety of functions in plants. Besides being components of enzymes, certain microelements are involved in activating enzymes and playing a role in oxidation-reduction reactions of plant metabolism.

Some microelements may be toxic when consumed in high amounts. Soil is the main source of microelements for plants except in situations of large atmospheric deposition or from flooding by contaminated water (Parry, 2010).

*Chromolaena odorata* is a species of flowering shrub in the sunflower family, Asteraceae. It is native to North America, from Florida and Texas to America and the Caribbean, "*Chromolaena odorata*." Flora of North America has been introduced to tropical Asia, West Africa, and parts of Australia. Common names include Siam weed, Christmas Bush, Awolowo and common floss flower. It is used as a traditional medicine in Indonesia.

When the young leaves are crushed, the resulting liquid can treat skin wounds. Although it was taxonomically classified under the Eupatorium genus, it is now considered more closely related to other genera in the tribe Eupatorieae (Schmidt *et al.*, 2000).

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*Chromolaena odorata* is considered an invasive weed of field crops in its introduced range and has been reported to be the most problematic invasive species with protected rainforests in Africa (Struhsaker *et al.*, 2005).

It forms dense stands that prevent the establishment of other plant species. It is an aggressive competitor and may have allelopathic effects. It is also a nuisance weed in agricultural land and commercial plantations.

*Chromolaena odorata* is a rapidly growing perennial herb. In open areas, it is a multi-stemmed shrub that can grow to 2.5m (100 inches) tall. The shrub's stems are soft, but the base is woody.

In shady areas, it becomes etiolated and behaves like a creeper, growing on other vegetation. It can then become up to 10m (33 feet) tall. The plant is hairy and glandular and the leaves give off a pungent, aromatic odour when crushed. The leaves are opposite, triangular to elliptical, with serrated edges.

Leaves are 4-10cm long by 1-5cm wide (up to 4x2 inches). Leaf petioles are 1-4cm long. The white to pale pink tubular flowers are in panicles of 10 to 35 flowers that form at the ends of branches. The seeds are achenes and are somewhat hairy.

They are mostly spread by the wind but can also cling to fur, clothes, and machinery, enabling long-distance dispersal. Seed production is about 880,000 to 909,000 per plant. Seeds need light to germinate. The plant can regenerate from the roots. In favorable conditions, they can grow more than 3cm per day (Lalith, 2009).

### **IMPORTANCE OF MACRO MINERALS**

The following is a very brief list of some of the functions of macro and micro minerals in the body. Space does not provide a detailed description of each mineral and its numerous functions throughout the body.

#### **Calcium (Ca)**

The most abundant mineral in the body, 98%, is found in the bones and teeth. Functions in blood clotting, membrane permeability, muscle contraction, nerve function, cardiac regulations, and enzyme activation. Vitamin D is required for active absorption. As dietary Ca intake increases, absorption is reduced. Cereal grains (corn, oats, milo, wheat, barley) are low in Ca.

#### **Phosphorus (P)**

The most deficient mineral throughout the world. Must be supplemented livestock grazing native forages in order to meet requirements. Eighty percent of (P) in the body is found in the bones and teeth. Functions with Ca in bone formation is essential for cell growth, energy utilization, and maintaining acid-base balance, it is a component of DNA, and is required by rumen microbes for optimal growth and activity. The most significant bang for the buck in mineral supplementation is generally associated with providing (P) oil seed meals are an excellent source of P. availability is low.

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### **Potassium (K)**

The third most abundant mineral in the body, potassium is essential for maintaining osmotic and fluid balance. Cereal grains and mature, weathered forages have low (K) content; oilseed meals and green, growing forages are excellent sources.

### **Magnesium (Mg)**

Sixty-five to 70% is found in the skeleton. It functions in carbohydrate and fat metabolism and is a catalyst in over 300 enzyme systems. Like phosphorus, Mg is bitter and is sometimes used to limit the consumption of mineral supplements.

### **Sodium (Na)**

Usually considered with chlorine (Cl). Sodium chloride (NaCl) is salt. Both are critical electrolytes in body fluids. Sodium functions in amino acid and glucose transport and muscle contractions. Chlorine is a component in hydrochloric acid formation and activation of amylase, a starch-digesting enzyme.

## **IMPORTANCE OF MICRO ELEMENTS**

### **Zinc (Zn)**

Zinc is a chemical element with the symbol Zn and atomic number 30. It is the first element of group 12 of the periodic table. This element was discovered by German Chemist Andreas Sigismund Marggraf in 1746 in Germany (Heiserman, 1992). It has an atomic weight of 65.4. Zn is the second metal present in the 4g but before Copper (Cu) (about 0.2g), Zn is required in the synthesis of tryptophan, which in turn is necessary for the formation of indoleacetic acid in plants. (Maretm, *et al.*, 2006), It is also an essential component of several metalloenzymes in plants (various dehydrogenases) and, therefore, is necessary for several functions in plant metabolism. Zinc has a role in KNA and protein synthesis. The enzyme carbonic anhydrase is activated explicitly by zinc (Welch *et al.*, 2004).

### **Iron (Fe)**

Iron is a chemical element with the symbol Fe and atomic number 26 and has been known since the beginning. It is by mass the most common element on Earth, forming much of Earth's outer and inner core. It is the fourth most abundant element after oxygen and aluminum. It is the most abundant element after oxygen, silicon, and aluminum. It has an atomic weight of 55.8. Fe is the most abundant metal in the human body.

Iron is essential in synthesizing and maintaining chlorophyll in plants (Blancquaert *et al.*, 2017). It is part of the protein ferredoxin and is required in nitrate and sulfate reductions (Zevenhovenet *et al.*, 2001); Fe has been strongly associated with protein metabolism. Iron also promotes the enzyme mechanism that operates the respiratory system of cells.

### **Copper (Cu)**

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Copper is a chemical element with symbol Cu and atomic number 29. It is in the top of group 11 of the periodic table above silver and gold. It has an atomic weight of 63.5. Cu is a reddish metal with a face - centered cubic crystalline structure. It reflects red and orange light and absorbs other frequencies in the visible spectrum. It is malleable, ductile, and an excellent conductor of both heat and electricity (Haynes, 2014), (Hammond, 2004). The discovery of copper dates from prehistoric times, where it was known to some of the oldest civilizations on record. Its use history is at least 10,000 years old; a Cu pendant was found in northern Iraq that dates to 8700 BC (Rayner, 2007).

Cu is an essential trace element in plants and animals. It is an essential constituent of several enzymes like cytochrome, amine oxidase, catalase, peroxidase, ascorbic acid oxidase, cytochrome oxidase, plasma monoamine oxidase, etc. Copper is an essential microelement necessary for the growth and formation of bone, formation of myelin sheaths in the nervous system, helps in the incorporation of iron in hemoglobin, assists in the absorption of iron from the gastrointestinal tract and in the transfer of iron from tissues to the plasma (Malhotra, 1998; Murray *et al.*, 2000).

### **Manganese (Mn)**

Manganese is a chemical element with symbol Mn and atomic number 25. Its air atomic weight is 54.9. Manganese is the most abundant element in the Earth's crust, with an average concentration of 0.1%. It is a metal mainly used in alloys, particularly stainless steels. The Swedish chemist Johan Gottlieb Gahn first recognized and isolated it as a separate chemical element in 1774 (Rancke Madsen, 2006).

Manganese is a trace mineral in tiny amounts in the body. It is one of the most important nutrients for human health. Manganese helps the body to form connective tissue, bones, blood-clotting factors, and sex hormones (Palacios, 2006; Fraga, 2005). It also affects fat and carbohydrate metabolism, calcium absorption, and blood sugar regulation (Silva *et al.*, 2013; Henn *et al.*, 2010). In addition, Mn is a key component of enzyme systems, including oxygen handling enzymes. It is a component of the antioxidant SOD, which helps high free radicals (Treiber *et al.*, 2012; Law *et al.*, 1998), in plants; it is also predominant in metabolism of organic acids and activates the reduction of nitrate and hydroxylamine to ammonia. Manganese primarily functions as part of the plant enzyme system, activating several metabolic functions, which are also necessary in Phtoto system II where it participates in photolysis (Wintergerst *et al.*, 2007).

### **Selenium (Se)**

Selenium is a chemical element with the symbol Se and atomic number 34, and it has an atomic weight of 78.97. It was discovered by Swedish Chemist Jons Jacob Berzelius in 1917. It is of the periodic table's group 16, and its properties are intermediate between those of the sulfur and tellurium elements.

Se is an Essential micronutrient for animals and plants. Selenium is a constituent of glutathione peroxidase (Murray *et al.*, 2000). It is a constituent element of the entire defense system that protects the living organism from the harmful action of free Radicals.

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Organic selenium is more thoroughly resorbed and more efficiently metabolized than its organic equivalent, which is poorly resorbed and acts more as a prooxidant provoking glutathione oxidation and oxidative damage to the DNA (Levander, 1983; Schravzer, 2000). Se enhances the overall activity of the  $\alpha$ -ketoglutarate oxidase system, probably by affecting the decarboxylation reaction.

#### **USES OF *Chromolaena odorata***

There are many benefits of *Chromolaena odorata* leaves, the *Chromolaena odorata* leaves is very useful for healing cyst effectively.

*Chromolaena odorata* leaves helps relieve body/back pain etc.

Leave aqueous extract has been used to treat soft-tissue burns or skin infections.

*Chromolaena odorata* also helps to heal wounds. This is due to the drug or plant's antioxidant property, which enhances the conservation of fibroblast and keratinocyte proliferation on those wounds (Vaisakh *et al.*, 2012).

The *Chromolaena odorata* leaves can decrease cholesterol levels and also capable to decrease blood pressure.

In traditional medicine, decoction of the leaf is used as a cough remedy and as an ingredient with lemon grass and guava leaves to treat malaria.

Offor and Okonye's study shows that *Chromolaena odorata* is useful in restoring soil fertility because it provides essential plant growth and protection constituents.

To avoid diseases related to heart, *Chromolaena odorata* leaves have been found helpful in such areas.

*Chromolaena odorata* serves as vertigo medicine and can be cured by drinking *Chromolaena odorata* brewed water.

#### **HEALTH BENEFITS OF CHROMOLAENE ODORATA**

According to traditional and widespread medicinal systems, *Chromolaena odorata* is a highly efficient medicinal herb. This is proved by its pharmacological evaluation performed by the scientific community worldwide.

Mulika Traidej Chomnawang investigated the antimicrobial activity of *Chromolaena odorata* against propionibacterium acnes. Propionibacterium acnes and staphylococcus epidermis have been recognized as pus-forming bacteria triggering inflammation in acne. The disc diffusion method showed that *Chromolaena odorata* had inhibitory solid effects against propionibacterium acnes. The MIC values were (0.039mg/ml) for both bacterial species, and the MBC values were 0.039 and 0.156mg/ml against propionibacterium acnes and Staphylococcus epidermis, respectively.

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A chloroform extract of the leaves of *C. odorata* was found to be effective against 191 strains of plasmodium falciparum in invitro cultures, with a C50 value of 9.5 ug/ml (Runghana, 2003).

Biswal investigated the wound-healing effect of aqueous leaf extracts of *Chromolaena odorata* in rabbits and the antibacterial effect in different bacteria isolates. Complete filling and healing of wounds were observed by the 11th—13th day after daily application of the aqueous leaf extract in experimentally created wounds. Similar findings were also observed with Himax ointment. The decrease in bacterial load varied depending on the type and nature of bacteria when bacterial isolates were subjected to the wet culture inhibition method (Biswal, 1997).

Ling Ring *et al.* found that the volatile oil from *Chromolaena odorata* had significant biological effects on fungi and insects. The result showed that inhibitory: effect of the oil at middle concentration (SOO mg, 1–1) for pyricularia grisea was the strongest, the next was phytophthoranicotianae. The weakest was to lasarium oxysporum. The inhibitory percentage was 61.400, 29.27%, and 14.44%, respectively. The volatile oil from *Chromolaena odorata* had a significant position deterrent effect on the striped flea beene (phyllostreta striolata) and the diamondback moth (plutella xylostella) at dose 10.20ul plant (Ling *et al.*, 2009).

## MATERIALS AND METHODS

### (i) MACRO ELEMENT

*Chromoleana odorata* leaves were obtained from the Botanical Garden of the Akwa Ibom State Polytechnic and brought to the Chemistry Laboratory to be identified by a Botanist, Dr. Dominic Uboh, of the Biological Science Department.

The sample was sun-dried for 7 days and then ground into powdery form using a mortar and pestle.

Digestion of sample for determination of minerals (Wet digestion method) Ig of the powdered sample was weighed into a conical flask containing 10ml of nitric acid (HHNO) and 10ml of hydrochloride acid (HCl). It was boiled on a hot plate until the solution was cleared. The mixture was allowed to cool and then filtered into a 100 cm<sup>3</sup> volumetric flask, made up to mark with deionized water, and then transferred into a plastic sample bottle before the analysis.

Determination of Sodium, Potassium, Calcium, Phosphorus, and Magnesium using a Flame Photometer of 50 ml with distilled water. A set of potassium (K), Calcium (Ca), Magnesium (Mg), Phosphorous (P), and sodium standards were prepared to contain OPPM, 4PPM, and 10PPM of the clement in a solution. The flame photocell with 6ppm and adjusted to 60, the standard solution was tested, their value was recorded, and the selected for each element. The instrument's appropriate filter (photocell) atomizer was dipped into the sample, and the meter reading was taken. The value obtained from the standard was used to plot the calibration curve for the element determined and the

concentration of the sample element determined by extrapolating from the calibration curve.

#### Determination of Magnesium and Phosphorus Using Atomic Absorption Spectrophotometer (AAS)

Magnesium and Phosphorus were determined using the atomic analysis method. The atomic absorption spectrometer 669 instrument was used. The appreciative cathode lamp was fixed for the element, and the sample was introduced to the atomizer. The measured absorbance was plotted against the concentration (ppm) to obtain an iteration curve from which the concentration of the element was obtained.

#### (ii) MICRO ELEMENT

After a thorough identification process, the sample *Chromolaena odorata* was washed in deionized water and allowed to dry. The sample was divided into two portions: one was sundried for three days.

Thereafter, using an electric blender, the sample was ground into a powdery form and kept in a separate, airtight, well-labeled container. The other one was blended wet with the same electric blender and kept in a separate, airtight, well-labeled container. Both were set aside for analysis.

Lg of the sample, both the wet and dried samples, were weighed into a 500ml standard flask with 10ml of nitric acid and 20ml of Hcl solution concentrated. Both were added to each digestion flask and heated using a heating mantle until the solution with brown fumes changed to yellow, showing that digestion was completed. The digest samples were allowed to cold and were diluted with deionized water of 30ml, then filtered, and the volume of the filtered was made up of 100mc' with deionized water; the digest was then stored in the sample bottle for microelement analysis.

Determination of Iron (Fe), Copper (Cu), Zinc (Zn), Selenium (Se), Manganese (Mn)  
This was done using an Atomic Absorption spectrophotometer (A.A.S) (A.O.A.C 2000) as the various concentrations of metals in the four samples were determined.

## RESULTS AND DISCUSSION

### Results

The result of the macro and micro elements present in the root of *Chromolaena odorata*. The results was obtained using atomic absorption spectrophotometer (AAS) and is summarized in the table as shown below:

Table 1: Macro

Elements	Concentration (mg/100g)	RDA
Calcium	1.33 $\pm$ 0.80	0.20 – 0.80
Magnesium	0.50 $\pm$ 0.00	0.12 – 0.18
Potassium	4.90 $\pm$ 0.004	0.50 – 0.80
Sodium	0.03 $\pm$ 0.80	0.09 – 0.18



Phosphorus	$3.50 \pm 1.20$	0.20 – 0.40
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Data are mean  $\pm$  standard deviation of duplication of dry weight basis

**Table 3: Micro**

Elements	Concentration (mg/100g)	RDA
Iron (Fe)	$0.11 \pm 0$	8 mg/day
Copper (Cu)	$0.020 \pm 0.02$	0.9 mg/day
Manganese (Mn)	$0.54 \pm 0.025$	1.8 – 2.3 mg/day
Zinc (Zn)	$0.55 \pm 0.05$	2.2 – 7.5 mg/day

Value are expressed as mean  $\pm$  S.D of duplication determination

## DISCUSSION

The analysis of the macro-element contents of *Chromolaena odorata* roots revealed that the root is rich in minerals. Among the macro-nutrients determined, the concentration of potassium and phosphorus had the highest values of 4.90 and 3.50mg/ 100g, respectively. Calcium was also noted to be high, at 1.33mg/100g. The concentration of Magnesium and Sodium was found to be the lowest, with a value content of 0.50 and 0.03 mg/100g, respectively.

The potassium content of *Chromolaena odorata* roots was  $4.90 \pm 0.004$  mg/100g, which is within the range compared with the recommended dietary allowance standard (RDA). It indicates that *Chromolaena odorata* is a rich source of potassium. This result is lower than the  $84.5 \pm 9.0$  mg/100g value reported by Onojah *et al.* (2018). Among the many functions of potassium in the body are regulation of the heartbeat functions of the muscle (Jorgenson, 2001). An abnormal severe increase or decrease in potassium can profoundly affect the nervous system and increase the chance of irregular heartbeat (Jorgensen, 2001).

The phosphorus content of  $3.50 \pm 1.20$ mg/100g is within the recommended dietary allowance (RDA). This revealed that *Chromolaena odorata* is a rich source of phosphorus. Almost all phosphorus is combined with oxygen, forming phosphate in the body. Phosphate is necessary for the formation of bone and teeth. It is also a building block for several vital substances, including those used by the cell for energy, cell membrane, and DNA.

The calcium content of *Chromolaena odorata* root was  $1.33 \pm 0.80$  mg/100g, which is low compared to the recommended dietary allowance (RDA). This indicates that *Chromolaena odorata* is a rich source of calcium. Calcium is an important component of a healthy diet and one of the essential minerals necessary for life. It plays a vital role in building stronger and healthier cells later in life (Tilak, 2006).

The magnesium content of *Chromolaena odorata* roots was  $0.50 \pm 0.00$  mg/100g. This result is considered low compared with the recommended dietary allowance (RDA), but it indicates that the *Chromolaena odorata* root is a rich source of magnesium.

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Magnesium is an active compound in several enzyme systems and a constituent of bones, teeth, and enzymes (Murray, 2000).

The sodium content of *Chromolaena odorata* was  $0.03 \pm 0.10$  mg/100g. This value is considered low compared to the recommended dietary allowance (RDA). However, *Chromolaena odorata* is a rich source of sodium. This may be due to the species of *Chromolaena odorata* or environmental factors. In addition to its role in ionic exchange and the balance of positive and negative ions in the body fluid and tissue, it also helps in signal transmission and muscle contraction (Welch *et al.*, 2004).

The analysis of the microelement composition of *Chromolaena odorata* roots revealed that the root contained iron (0.1 10mg/100 kg), which is lower than the RDA standard for iron (8 mg/day) (Food and Nutritional Board Institute of Medicine 2001 ). This result revealed that the sample is a rich source of iron. Iron is a significant constituent of hemoglobin and oxygen carrier in the blood.

Copper (Cu) concentration was found to be ( $0.026 \pm 0.02$  mg/100kg), which is lower than the RDA standard for copper 0.9mg/day (Food and Nutritional Board Institute of Medicine, 2001 ). This result revealed that the sample is a rich source of copper. Copper is known to function as co-enzymes for energy metabolism and maintaining blood vessel walls (Malhotra, 1998).

The Manganese (Mn) level of *Chromolaena odorata* was ( $0.54 \pm 0.025$ mg/100kg) which is lower than the RDA standard for Manganese 1.8-2.3mg/day (Food and Nutritional Board Institute of Medicine, 2001). This result revealed that the sample *Chromolaena odorata* is a rich source of Manganese. Manganese is involved in arca formation and metabolism of amino acids and carbohydrates (Zablocka *et al.*, 2012).

The zinc (Zn) concentration of *Chromolaena odorata* was found to be (0.55.05 mg/100kg), which is lower than the RDA standard of zinc (2.2 - 7.5). This result revealed that the plant sample contains zinc. Zinc is a cofactor and constituent of many enzymes like lactose dehydrogenase, alkaline, and phosphatase. Zinc also functions in wound healing and normal fetal development.

## **SUMMARY, CONCLUSION AND RECOMMENDATION**

### **SUMMARY/CONCLUSION**

The analysis results revealed that the root contains an appreciable amount of macro elements. All the values obtained were low compared to Recommended Dietary Allowance (RDA) values. However, *Chromolaena odorata* root is a rich source of minerals like Calcium, Magnesium, Potassium, Sodium and Phosphorus. Also, the results of this analysis showed that microelements such as Copper (Cu), Manganese (Mn), Iron (Fe), and Zinc (Zn) concentrations were within the recommended dietary allowance standard (RDA). Therefore, further research should be conducted on the plant.

### **RECOMMENDATION**

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In view of the research results, I recommend that the pharmaceutical industries use *Chromolaena Odorata* to manufacture suitable drugs for the treatment of malaria. I also recommend that further research be carried out on the plant's leaves and stems to determine its pharmaceutical importance.

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