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Proximate Analysis of Mangrove Leaves of Rhizophora mangle and Laguncularia racemose in the River Nun Estuary Around Akassa, Niger Delta, Nigeria

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Abstract – This research was intended to ascertain the proximate composition in mangrove leaves, *Rhizophora mangle* and *Laguncularia racemose,* of the river Nun estuary around Akassa in the Niger Delta region of Nigeria in October, 2015 because they play the major of primary producers in the estuary. The methods as described by the Association of Official Analytical Chemist (AOAC) was used to evaluate the proximate composition of the mangrove. The results indicated that the leaves mangroves are very nutritious. The results show that the values of % Ash, % Moisture, % Protein, % Fibre, % Dry Matter, and % Nitrogen free extraction were 3.46%, 68.31%, 5.78%, 3.88%, 5.65%, 31.69%, and 81. 23%, respectively, for the leaves of red mangroves (*Rhizophora mangle*) and 3.75%, 63.02%, 4.48%, 4.20%, 5.82%, 36.98%, and 81.75%, respectively, for the leaves of white mangroves (*Laguncularia racemosa*). Based on the results of this research, the mangrove leaves analyzed can be implored as feed ingredient in animals.

Keywords – Proximate, Analysis, Mangrove, Leaves.

I. INTRODUCTION

Mangroves are halophytic, seed bearing, woody aquatic macrophytes that are found in the estuaries. They share common habitat preferences, physiognomy, and functional and structural adaptations [1][2][3]. Most mangroves grow on soils that are muddy, but their growth on sand, peat, and coral rock have been reported. It is assumed that at optimal tidal conditions it is possible for mangroves to flourish far inland, along the upper reaches of coastal estuaries [4].

The Nigerian mangrove vegetation comprises of seven species which belong to three families. The species are *Rhizophora racemosa, R. mangle L.* and *Rhizophora harrisonii L. of* Rhizophoracea family; *Avicennia germinans L.* of Avicenniacea family; and *Launcularia racemosa L., Gaertn f.,* and *Conocarpus erectus L. of* Combrataceae family [5]. The Nigerian mangrove vegetation covers an area of 10, 515km^2 and is the fourth largest in the world with Indonesia being the largest followed by Brazil, Australia, and then Nigeria, respectively [6]. The Niger Delta is home to only five plant species and one introduced family of exotic species representing three endemic families. The species are *Rhizophora racemosa, R. harrisonii* and *R. mangle* species belonging to the Rhizophoraceae family (Red Mangrove); *Avicennia africana* species belonging to the Avicenniaceae family (white mangrove); and *Laguncularia racemosa* species belonging to the Combretaveae family. *Nypa fructicans* is the exotic species belonging to the introduced family of *Arecaceae* (Palmaceae) [3].

Justification of Research

Mangrove is very essential and important to marine organism because the plant is the foundation in a complex estuarine and marine food chain and the detritus food web. Mangrove forest primary productivity is a source of food for benthic crustaceans,

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molluscs, and annelids that consume about 10-40% of plant litter of mangrove origin [7]. Based on the significant role mangroves play in the estuarine food web, therefore, it is imperative to analyze the nutrients that are found in mangrove leaves.

Scope of Study

The leaves of the red and white mangroves were collected from the river Nun estuary and transported to the Chemical Sciences Laboratory, of the Niger Delta University, Nigeria, for analysis. The study used basic laboratory methods in processing the proximate analysis of mangrove.

Aim and Objectives of the Study

The aim of this study is to carry out proximate analysis of mangrove leaves. The objective of the study is:

1. To determine the nutrient composition of mangrove leaves because of the significant role mangroves play as the primary produces of the estuary.

II. Materials And Methods

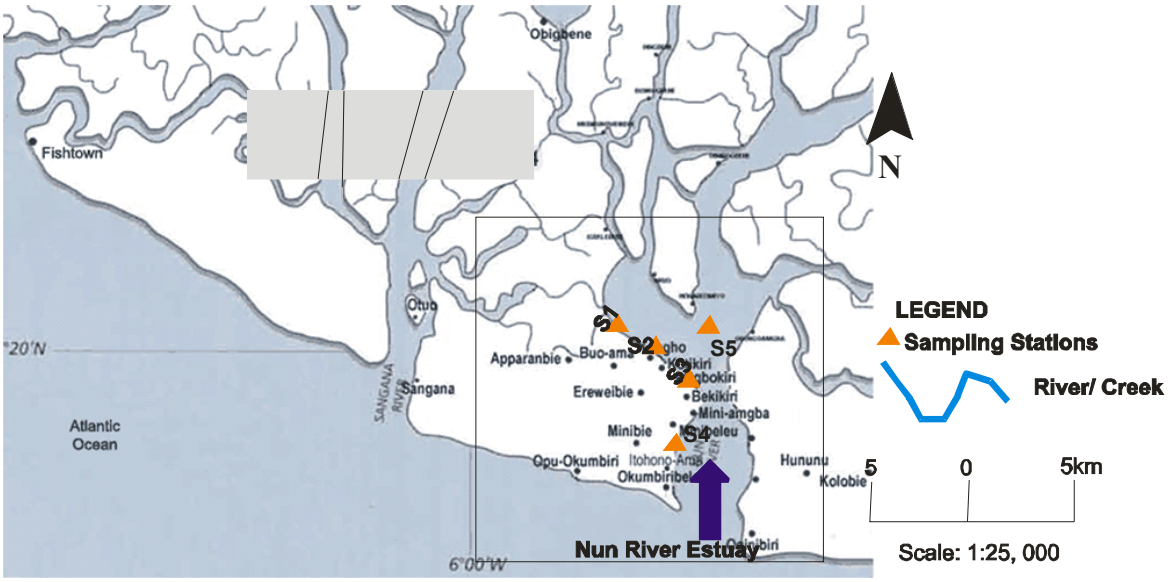
Study Area

The mangrove swamp forest lies in the River Nun Estuary in Bayelsa State, Niger Delta, Nigeria. The seasonally flooded region freshwater swamp forest lies inland from the mangrove forest. The biodiversity of the mangrove forest of the river Nun estuary is rich and wide- ranging.

The Estuary location is latitude of 4^0: 20" and 4^0: 17" N longitude of 6^0: 49" and 4^0:55" E [8]. The rainy season spans from April to November, while the short dry season spans from December to March.

Several creeks, inlets, and canals are interconnected with the Estuary and serve as drainages and navigational routs in the area. Other estuaries are also connected to it through these Channels. The Nun River estuary is bordered to the east by the Brass River estuary and to the west by the Sangana river estuary. It opens up into the Atlantic Ocean at its southern part.

The borders of the Nun River estuary to the east and to the west are the Brass River estuary and the Sangana river estuary respectively. The southern part opens up into the Atlantic Ocean.



http://www.pronatura-nigeria.org/OLD-WEBSITE/adf/akassa.html#amap

Figure 1: Map of Akassa kingdom showing the river Nun estuary

Collection of Samples

The leaves samples red mangroves (*Rhizophora mangle*) and white mangroves (*Laguncularia racemosa*) were collected from the river Nun estuary in Akassa and put in black poly bags and transported to the Chemical Sciences laboratory of the Niger Delta University, Nigeria for analysis. The samples were analyzed in the laboratory following standard methods.

Proximate analysis of Mangrove Leaves

The different methods described by AOAC [9] were used to determine the proximate composition of mangrove leaves.

Moisture

Mangrove leaves moisture content was determined using the oven method.

Ash

Ash content of the mangrove leaves was determined using a muffle furnace ignited at 550^{o}C for 15 hours.

Crude protein

Kjeldahl method was used to determine the crude protein content.

Crude Lipid

Mangrove leaves lipid content was determine using the Soxhlet fat extraction method.

Crude fibre

Crude fibre was determined after boiling 5g defatted sample in refluxing sulphuric acid and sodium hydroxide.

III. Results

The results of the principal component analysis and correlation analysis between the red and white mangrove are shown in Table 1. This revealed that extracts of mangrove plant of the red and white mangrove have a variety of constituents namely, ash, moisture, protein, lipid, fibre, dried matter and nitrogen.

The result clearly indicate that the white mangrove leaves have more ash percentage (3.75%) than the red mangrove leaf (3.46%). The result also illustrated red mangrove has more protein percentage (5.78%) the white (4.48%) and the result also highlight that the white mangrove has higher percentage of dried matter than the red mangrove.

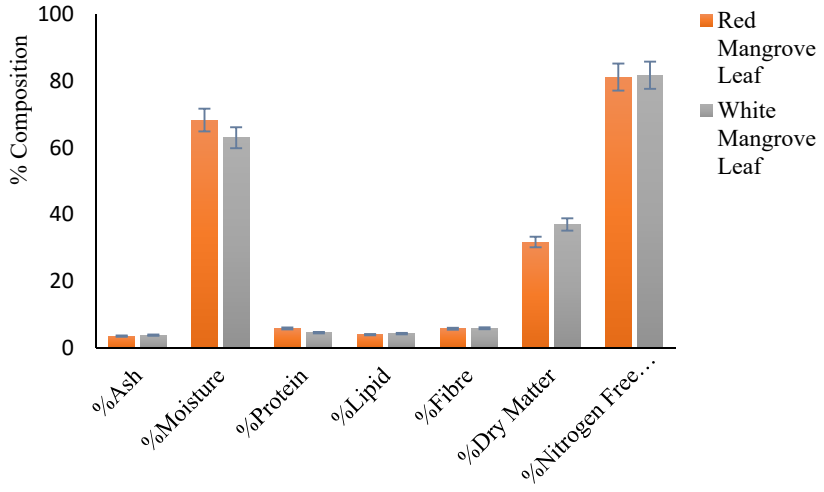


Fig. 2: A chart showing the proximate composition of *Rhizophora mangle and Laguncularia racemose* leaves

IV. Discussion

A study conducted by Sudirman *et. al.,* [10] on proximate composition of large-leafed mangrove (*Bruguiera gymnorrhiza*) fruit, reported that the mangrove fruits had 29.28% carbohydrate, 66.39% moisture, 2.11% protein, 1.07% fat, and 1.15% ash. As revealed in the current study conducted in the river Nun estuary in Nigeria, the values of % Ash, % Moisture, and % Protein were higher in the mangrove leaves than in the fruits when compared to the results obtained by Sudirman *et. al.,* [10]. The ash, moisture, and protein contents were 3.46%, 68.31% and 5.78%, respectively for red mangroves (*Rhizophora mangle*) leaves and 3.75%, 63.02% and 4.48%, respectively for white mangroves (*Laguncularia racemosa*) leaves, while 1.15%, 66.39%, and 2.11%, respectively, were reported for *Bruguiera gymnorrhiza* fruits by Sudirman *et. al.,* [10]. It can be concluded therefore, that the leaves or leaf litter of mangroves are more nutritious than the fruits. Hence, they play more significant roles as primary producers in the detrital food web of the estuaries than the fruits of mangroves.

The protein content in the mangroves leaves in the present study were more than that reported by Das and Paul, [11] for mature leaves of *Bruguiera gymnorrhiza* (5.40%) and *Avicennia officinalis* (4.89%) from Indian Sundarbans. However, the nutrient composition of *Rhizophora mangle* and *Laguncularia racemose* investigated are lower than the composition reported by Ghosh *et al*., [12] for *Avicennia marina, Bruguiera gymnorrhiza, Sonneratia apetala* and *Derris trifoliate* in Indian Sunderban region.

V. Conclusion And Recommendations

Mangroves are very interesting species, considering the role they play in the marine environment and the significant role in food web of the marine eco-system. Mangroves are the major primary producers of the estuarine ecosystem. The results of this research are further proofs that mangrove detritus a really nutritious and serve as good source of food to the benthos and other estuarine organisms. The research work highlights the full potential of mangrove in the marine environment as a viable and nutritious source of food for estuarine organisms. Various classes of chemical constituents such as protein lipid and fibre play a very important role in the growth of marine organisms.

Based on the findings of this research, it is recommended that:

1. The mangroves in the river Nun estuary should be protected from over- exploitation.
2. Intense research should be carried out to delve deeper into this sparsely explored promising area from where more value can be introduced for the benefit of marine dwellers and the world at large.

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