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Physicochemical Characterization of Almond (Terminalia catappa) and Sweet Potato (Ipomoea batatas) Leaves

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Abstract**—*This study investigates the physicochemical properties of almond and sweet potato leaves to evaluate the potential and applicability in the oil and gas industries. Proximate composition, mineral content, phytochemical profile, functional characteristics, and physical attributes were analyzed. The results demonstrate that both leaves are rich in bioactive compounds and essential nutrients, with sweet potato leaves showing higher flavoniods and antioxidant compounds which will help in inhibiting radicals.*

Keywords**—** *Almond leaves, sweet potato leaves, physicochemical properties, inhibiting, Phytochemicals.*

I. Introduction

Leafy vegetables are valuable sources of nutrients and phytochemicals essential for human health which can also be used in the oil and gas industries. Since the leaves are green, biodegradable and are also eco friendly. Almond (*Terminalia catappa)* and sweet potato (Ipomoea batatas) leaves, though are underutilized, possess significant potential in the oil and gas industies. This study aims to characterize the physicochemical properties of these leaves to support their use in the oil and gas industries.

II. Materials and Methods

Fresh almond and sweet potato leaves were collected from nearby farms. Care was taken to ensure the leaves were collected after harvest to avoid damaging the farmer's crops or harvest of premature leaves. The harvested leaves were later air-dried for about two (2) weeks to drastically reduce their moisture content in preparation for grinding. The dried leaves were subsequently ground to increase their surface area for optimal extraction of the extracts.

A ground plant leaves were later separately soaked in 400ml of ethanol and allowed for some time for the ethanol to evaporate. After a number of days, the acetone solvent was successfully evaporated. Thereby leaving behind the solidified extract on which a number of analytical tests were subsequently carried out. The choice of cold extraction was taken against hot extraction to avoid the denaturing of possible active proteineous and amino components. This decision therefore will preserve all components like flavonoids, tannins, alkaloids, and phenolic compounds to ensure the highest possible efficacy can be guaranteed.

Plate 3.1 Freshly harvested (a) almond and sweet potato leaves

Dried plant leaves

III. Results and Discussion

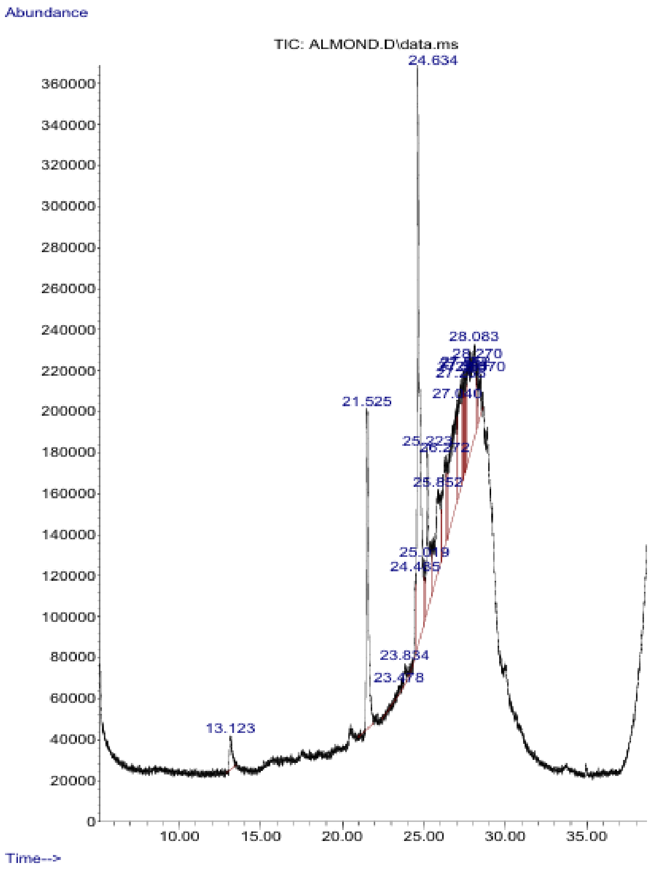

Figure 3.1 a GC-MS spectrum for dried almond (*Terminalia catappa*) leaves

Figure 3.1a shows GC-MS spectrum for dried almond (*Terminalia catappa*) leaves.The phytochemical with highest peak area percentage of 23.9502% was ethyl oleate, which had a retention time of 24.6337. The next phytochemical was oleic acid, which had peak area of 12.5157% and retention time of 27.0402. This was followed by cis-13-octadecenoic acid, with peak area percentage and retention time of 12.4619% and 28.0829respectively. The next highest component was hexadecanoic acid, ethyl ester, which had peak area of 10.9447% and retention time of 21.5255. Then, there were 2-methyl-Z,Z-3,13-octadecadienoland oxacyclotetradecane-2,11-dione, 13-methyl- with peak areas of 7.3715% and 6.1436%, with retention times of 25.8517and 26.2725respectively.

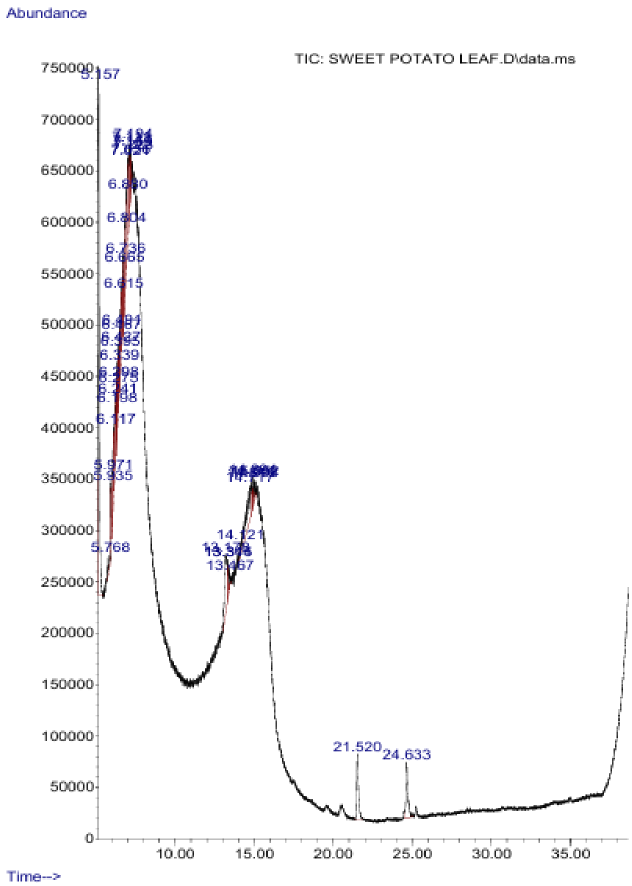

Figure 3.1 b GC-MS spectrum for dried sweet potato (*Ipomoea batatas*) leaves

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Figure 3.1b shows GC-MS spectrum for dried sweet potato (*Ipomoea batatas*) leaves.The phytochemical with highest peak area percentage of 24.2385% was cis,cis-7,10,-hexadecadienal, which had a retention time of 5.1574. The next significant phytochemical was 2-ethylacridine, which had peak area of 6.3186% and retention time of 14.7174. This was followed by cis-9-tetradecenoic acid, propyl ester, with peak area percentage and retention time of 6.1449% and 13.1781respectively. The next highest component was N-methyl-1-adamantaneacetamide, which had peak area of 5.6646% and retention time of 7.0214. Then, there were hexadecanoic acid, ethyl ester;(E)-9-octadecenoic acid ethyl ester and anthracene, 9,10-diethyl-9,10-dihydro-,with peak areas of 4.9894%,4.8696%, and 4.149%, with retention times of 21.5198,24.6328 and 6.8795respectively.

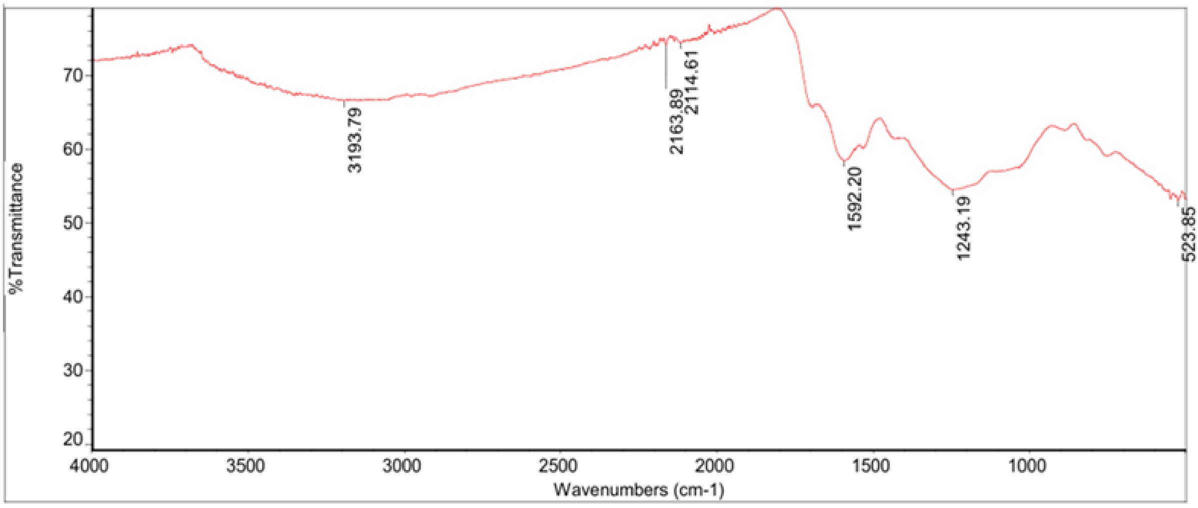

Figure 3.2a FTIR spectrum for dried almond (*Terminalia catappa*) leaves

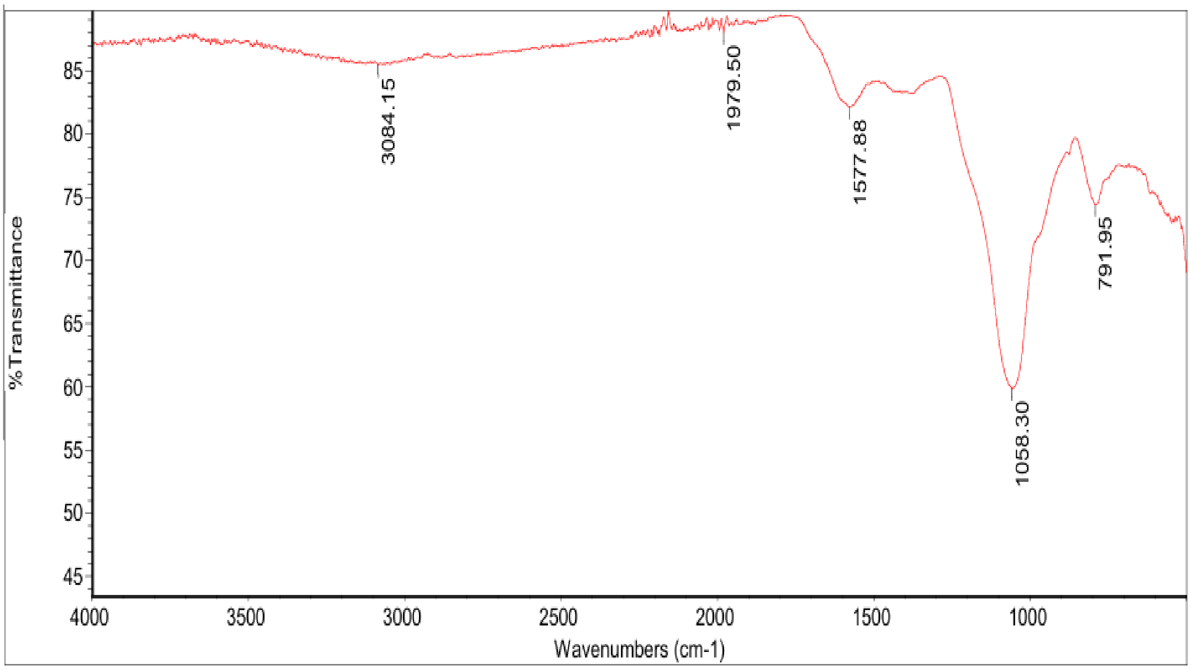

Figure 3.2 b FTIR spectrum for dried sweet potato (*Ipomoea batatas*) leaves

Figure 3.2 a shows FTIR spectrum for dried almond (*Terminalia catappa*) leaves. From the result, four different peaks can be noticed in the functional group section. The peak at a wavenumber of 3193.79 cm^{-1} represents an OH stretching, since it occurred to the right of the 3000 cm^{-1} wavenumber. Compared to an OH stretching associated with an alcohol group, however, the peak is quite wide. This suggests an OH stretching typical of a carboxylic acid group, which is present in carboxylic acids and esters. This explains why ethyl oleate was determined to be the component with the highest concentration in cassava leaf extract. It also explains the presence of other components like cis-13-octadecenoic acid

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and hexadecanoic acid, ethyl ester, also found in dried almond leaves according to GC-MS results reported earlier.

The next two peakswere found at the 2163.89 $cm^{-1}$and 2114.61 cm^{-1} wavenumbers. These peaks represent N=C=S stretching typical of isothiocyanates, which are the hydrolysis products of glucosinolates (a group of secondary plant metabolites). Another peak was also found at the 1592.20 cm^{-1} wavenumber, which is typical of typical double bond functional groups including carbonyl groups (C=O), alkene groups (C=C), and carbonyl-sulphides (C=S). This explains the presence of components like 2-methyl-Z,Z-3,13-octadecadienoland oxacyclotetradecane-2,11-dione, 13-methyl- in dried almond leaves according to the earlier reported GC-MS results. It also confirms the presence of a carboxylic group earlier discussed, which also contains the carbonyl group (C=O) equally found in carboxylic groups (COO-).

Figure 3.2 b shows FTIR spectrum for dried sweet potato (*Ipomoea batatas*) leaves. From the result, three different peaks can be noticed in the functional group section. The peak at a wavenumber of 3084.15 cm^{-1} represents an OH stretching, since it occurred to the right of the 3000 cm^{-1} wavenumber. However, when compared to an OH stretching that belongs to an alcohol group, the peak is very broad. This suggests an OH stretching typical of a carboxylic acid group, which is present in carboxylic acids and esters. This verifies the existence of compounds such as hexadecanoic acid, ethyl ester, and cis-9-tetradecenoic acid, propyl ester in the dried sweet potato leaves. It also explains the presence of other components like (E)-9-octadecenoic acid ethyl ester, also found in dried sweet potato leaves according to GC-MS results reported earlier.

The next peak was found at the 1979.50 cm^{-1} wavenumber. This peak represent N=C=S stretching typical of isothiocyanates, which are the hydrolysis products of glucosinolates (a group of secondary plant metabolites). Another peak was also found at the 1577.88 cm^{-1} wavenumber, which is typical of typical double bond functional groups including carbonyl groups (C=O), alkene groups (C=C), and carbonyl-sulphides (C=S). This explains the presence of components like (E)-9-octadecenoic acid ethyl ester in dried sweet potato leaves according to the earlier reported GC-MS results. It also confirms the presence of a carboxylic group earlier discussed, which also contains the carbonyl group (C=O) equally found in carboxylic groups (COO-).

4. Conclusion The study confirms that almond and sweet potato leaves are nutritionally rich and possess significant functional properties. Sweet potato leaves, in particular, have superior antioxidant and protein contents, supporting their use as a good antioxidant in the oil and gas industry.

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