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# *EXTRACTION AND GC-MS ANALYSIS OF OIL EXTRACTED FROM PINEAPPLE (Ananas comosus) PEELS*

**ORODU, Victor Enearepuadoh and AKPEDI Ivan**

*Department of Chemical Sciences, Faculty of science, Niger Delta University, P.M.B 071, Wilberforce Island, Bayelsa State. Nigeria*

**Keywords:** Chemical composition, extraction, oil, *Ananas comosus.* Agro waste.

**ABSTRACT:** This study determined the chemical compositions of oil extracted from the fruit peels of *Ananas comosus* collected from Amassoma community, Bayelsa state. Oil from the sundried peels was extracted using solvent extraction. The extract was analysed using GC-MS. Seven components were identified in the oil, and limonene was the most abundant (76.34%). The other components identified include palmitic acid (5.38%), n-decanal (0.95%), 1-cyclohexene-1-carboxaldehyde (4.27%), alpha-farnesene (1.26%), trans caryophyllene (0.53%) and myrcene (0.61%).

## 1. INTRODUCTION

Fruits are edible parts of plants that are usually fleshy and important components of a good diet. Fruits are considered to be very nutritious substances and are sources of many essential nutrients including vitamin C, folic acid, potassium etc. Based on the epidemiological studies, it has been shown that consumption of fruits frequently is related with a lower risk of chronic diseases (He *et al,* 2007). Under the recommendation of WHO, a minimum daily intake of 400 g of fruit and vegetables must be observed, based on evidence that higher levels were protective against cardiovascular diseases and some cancers (Feumba *et al.*, 2016). Pineapples (*Ananas comosus*) are edible tropical fruits that are rich in vitamins, enzymes and antioxidants. They are one of the most economically important tropical fruit crops in tropical and subtropical areas. The pineapple is considered an exotic fruit due to its pleasant aroma and flavour, and contains water, carbohydrates, sugars, vitamins A, C and beta-carotene, protein, fat, ash, fibre and antioxidants, namely, flavonoids, in addition to citric and ascorbic acids (Silva *et al*, 2013). In addition to its dietary use, the fruit also possesses medicinal values. They are popularly referred to as the fruit of kings and are the most economically significant plant in the family Bromeliaceae. The five leading pineapple producing countries are Costa Rica, Brazil, Philippines, Thailand and Indonesia (FAO STAT, 2013). Pineapples are consumed or served fresh, cooked, juiced and can be preserved; the fruit is eaten fresh where available and in canned form worldwide (Hossain, 2016). When the pineapple fruits are canned or consumed, the crown, the outer peel and the central core are usually discarded as pineapple waste which accounts for about 50% of the total pineapple fruit weight (Orodu and

Inengite, 2018). By-products of fruits processing industry considered as fruits wastes consist mainly of core, seeds, pomace and peels, contain large amounts of water and are in a wet and easily fermentable form (Feumba *et al.*, 2016). Most fruits after consumption leave a peel which contribute to agro-industrial waste. After consuming the edible part, the fruit peels are separated and dumped into municipal landfills thereby causing serious pollution and disposal (solid-waste management) problems (Pranav *et al*., 2017). If not processed further, these agro wastes produce odour, soil pollution, harbourage for insects and can give rise to serious environmental pollution (Shalini and Gupta, 2010). These immense quantities of lost and wasted food commodities also contribute to immense environmental problems as they decompose in landfills and emit harmful greenhouse gases (Sagar *et al*, 2018). The utilization of agro-industrial waste by conversion into value added products is an innovative solution to the environmental waste problem (Orodu and Inengite, 2018). Instead of aggravating the environmental waste problem, these waste plant parts can be utilised for various purposes including as non-conventional adsorbents, and as substrates for production of various chemical substances. This will serve to eliminate the problem of handling solid wastes, therefore reducing the environmental pollution issue and also provide a cheap source for obtaining some chemical substances. Several studies exist in which chemical composition of different fruit waste parts including seeds, peels, etc. are determined. This research determined the chemical composition of oil extracted from pineapple (*Ananas comosus*) peels in order to find potential application of the oils. Higher production, growth, lack of proper handling methods and infrastructure, have led to huge losses and waste of important food commodities, as well as their components, by-products and residues (Sagar *et al*, 2018). According to Pranav *et al.* (2017), huge quantities of lignocellulosic biomass are produced every year during cultivation, harvesting, processing and consumption of agricultural products and this biomass generated can be utilized for different applications such as a low-cost biosorbent, as feedstock for producing biochemical and biofuels, and as a substrate for production of various enzymes and metabolites. Also, by-products such as fruit wastes (bagasse, peel, and seeds) can also be potential ingredients in food formulations or raw matter for the extraction of bioactive compounds (phenolics, carotenoids, essential oils, and vitamins), minerals, and antimicrobial agents. As the problems generated by natural resource depletion and global warning have motivateded every industry to be green and sustainable, a good option is the utilisation of cellulose wastes (Cassellis *et al.*, 2014). The waste is composed mainly of seed, skin, rind (peels), and pomace, containing good sources of potentially valuable bioactive compounds, such as carotenoids, polyphenols, dietary fibers, vitamins, enzymes, and oils, among others (Sagar *et al*, 2018). These waste materials are of great industrial interest because they are renewable and biodegradable products. Recently, scientist developed high value products from by-products such as cosmetics, medicines and the recovery seems to be economically attractive (Ashoush and Gadallah, 2011). The utilization of fruit peels serves dual purposes which are the generation of wealth from waste and as an efficient solid-waste abatement (Pranav, 2017). More so, using fruit by-products mainly the peels which in some fruits represent almost 30% of the total weight, have slowly gained popularity especially when researchers found that peels possessed better biological influential properties than other parts of the fruit (Moon and Shibamoto, 2009). Recent studies revealed that bio-recovery of valuable by-products like ethanol, enzymes, pharmaceuticals and essential oils from agro-biomass wastes like mango, beniseed, sorrel, pineapple and papaya have been carried out (Adepoju *et al*, 2014). More so, wastes from fruits and vegetable processing are shown to contained valuable molecules (antioxidants, dietary fibers, proteins, natural colorants, aroma compounds, etc.) which can be extracted, purified and valorized in value-added products (Socaci *et al*, 2017). Some peel components such as pectin, flavonoids, carotenoids, limonene and polymethoxy, flavones have known functional properties which are of immense importance. Narjis *et al*, 2009 conducted a study to determine the chemical compounds present in oil extracted from orange peels and the effect of the oil on some pathogens. The peels were found to contains alkaloids, saponins, terpenes, resins, flavonoids, phenols, tannins, and sugars but did not contain coumarins and steroids. In addition to the afore mentioned, sugar, proteins, moisture and ash were also determined and their percentages were 23.8%, 4%, 11.86%, and 5.34% respectively. Olabinjo *et al*. (2017) analysed the physical and chemical composition of sweet orange (citrus sinensis) peels. The result showed sweet orange rinds (peels) as the major waste and contains 45-50% of the total mass of sweet orange fruits. The chemical analysis showed sweet orange rinds to be rich in protein of 7.15% and crude fibre of 12.79% which can be used as ingredients in processed food and these uses will promote sustainable disposal of orange peels. Orodu and Inengite (2018) determined if oil extracted from pineapple peels is edible and/or can be utilized in industries by determining its physicochemical properties. The pineapple peels were collected from different locations in Amassoma, Bayelsa State, sun dried for five days and oven dried for 1hr: 30mins, then ground thoroughly. The sample was dipped inside n-hexane for 72 hours and later placed in a water bath for the evaporation of the solvent. Tests on Free Fatty acid, (FFA), Saponification Values, (SV), Iodine Value(IV), Peroxide Value(PV), and Acid Value were carried out in triplicates and the mean results were obtained; FFA = 2.068 mg/KOH/g, SV = 226.27mg/KOH/g, IV = 37.4355g/100g, PV = 7.666meq/kg, AV = 4.11532mg/KOH/g. The physicochemical parameters determined were compared with the standards set by the Nigerian Industrial Standards (NIS). The results indicated that the oil is fit for human consumption because SV, IV, and PV are within the range stated by the NIS, whereas the excess of FFA and AV are good for industrial purposes and can be utilized. Fiouza *et al* (2015) determined the chemical compositions of macro- and micronutrients in the fruit peels of Citrus medica collected in Pirenópolis, Jandaia and Santo Antonio do Descoberto, Goiás, Brazil, as well as the composition and variability of the essential oils and the chemical composition of the soil. Their results showed high levels of iron, calcium and magnesium in the peels from the three sites. Also, the researchers identified twenty four components in the oil extracted from the peels amongst which limonene was the most abundant (> 85%). No chemical variability was detected in the three oil samples analyzed. Bozkurt *et al*, 2017 collected different fruits of citrus varieties from the local market in Adana/Turkey and extracted the essential oils from the peels using hydro distillation extraction method. The essential oil obtained were analyzed by Gas chromatography–mass spectrometry (GC–MS) and the main components of extracted oils were determined to be α-pinene, sabinene, β-pinen, β-myrcene, d-limonene, linalool, m-cymene and 4-terpineol of which limonene was the major component (66-93%). In another study by Huang *et al*, 2015, the chemical constituents from the leaves of *Ananas comosus* and their biological activities were investigated. The chemical constituents from the air-dried leaves of A. comosus were isolated and purified by the chromatography on silica gel and Sephadex LH-20 columns as well as recrystallization. Their structures were identified on the basis of physiochemical properties and spectroscopic data analyses, and the antibacterial activity and artemia lethal activity of the compounds were determined. The results identified eight compounds and these were tricin-4′-O-[10″-O-(8″-hydroxyl) feruloyl-(9‴-O-p-coumaroyl) glyceryl] ether (1), 2, 4-dichlorobenzoic acid (2), tricin (3), chrysoeriol (4), 1-O-p-coumaroylglycerol (5), 1-O-feruloylglycerol (6), 1-O-feruloyl-3-O-p-coumaroyl-glycerol (7), and 1, 3-O-diferuloylglycerol (8). Compound 1 exhibited as well inhibitory activities as positive control Ciprofloxacin (CPFX) against Staphylococcus aureus and Escherichia coli.

## 2. MATERIALS AND METHODS

## 2.1 MATERIALS/REAGENTS: Water bath, Oven, Test vials, Extraction bottle, Electrical weighing balance, Measuring cylinder, Beakers, n-hexane

## 2.2 PREPARATION OF FRUIT PEELS

Pineapples were procured from a local market in Amassoma, Bayelsa state. The fruits were washed and allowed to dry at room temperature and the peels were removed using sharp knife.

**Fig 1: Pineapple peels**

## 2.3 EXTRACTION OF OIL AND LABORATORY ANALYSIS

The cold extraction technique was applied for the extraction of the oils. The peels were sun dried for 3 days and then oven dried for 24 hours at 80°C. They were then ground to powder and soaked in n-hexane for 3 days. Finally, the mixture was decanted and the oil was obtained after evaporation in a water bath to remove the excess solvent from the oil. The chemical composition of the oil obtained were analysed using GC-MS.

## 3. RESULTS AND DISCUSSION

**Table 3.1: Composition of Oil from Pineapple Peels**

| S/N | Components Name | Percent Composition |
|---|---|---|
| 1. | Palmitic acid | 5.38% |
| 2. | Limonene | 76.34% |
| 3. | n-decanal | 0.95% |
| 4. | 1-cyclohexane-1-caboxaldehyde | 4.27% |

| | | |
|---|---|---|
| 5. | Alpha-farnesene | 1.26% |
| 6. | Trans carophyllene | 0.53 |
| 7. | Myrcene | 0.61% |

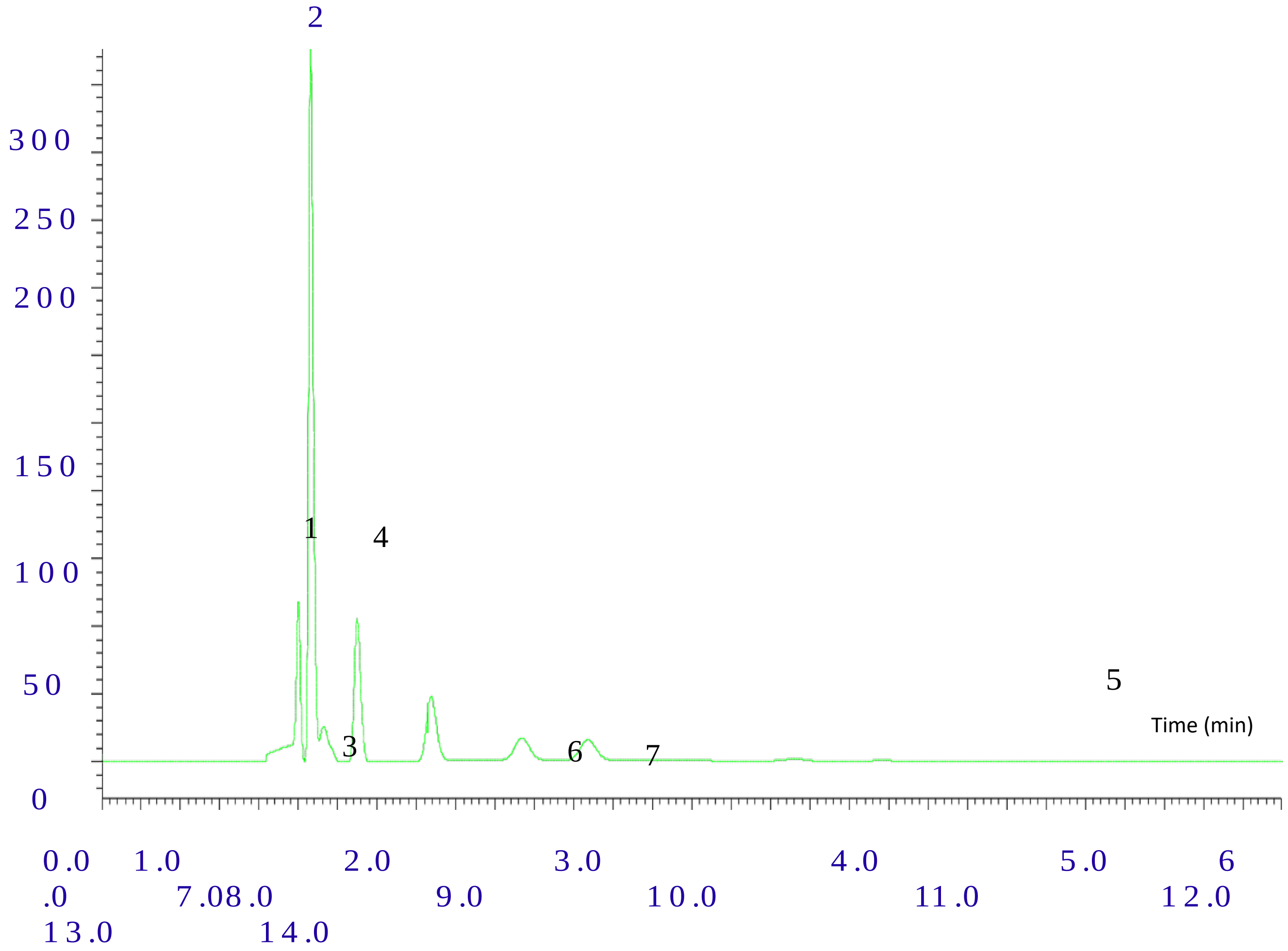


Fig 2: chromatogram of oil extracted from pineapple peels

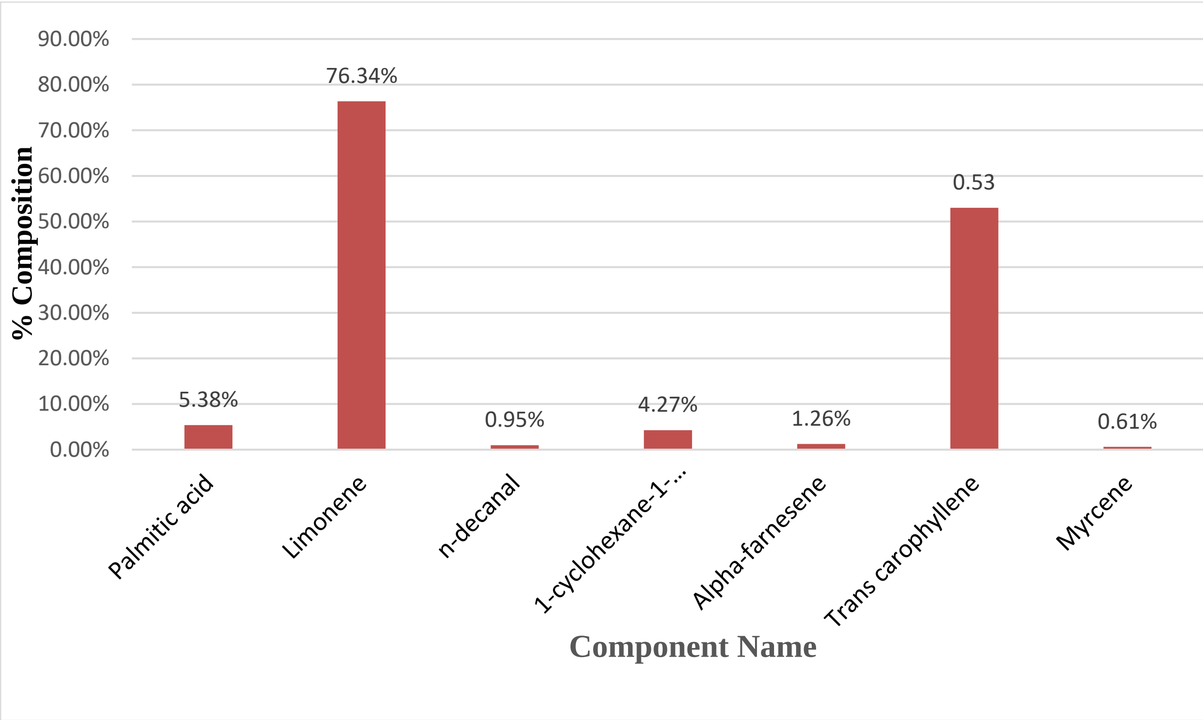


Fig 3 showing the components

The chemical compounds identified in the oils extracted from the pineapple peels using GC-MS are presented in Table 3.1 and Fig. 3. seven compounds were identified to be present in the oil and these were palmitic acid, n-decanal, 1-cyclohexene-1-carboxaldehyde, alpha-farnesene, trans caryophyllene, myrcene, and limonene**.** Limonene was found to be the major constituent of the oil constituting over 75% of the oil. Limonene was also the major constituents of the fruit peel oils studied by Bozkurt *et al*, (2017) and Fiuza *et al*, (2015). Limonene is a useful substance commonly applied as a dietary supplement and as a fragrance ingredient for cosmetic products. It is also used in the manufacture of food and some medicines. 1-Cyclohexene-1-carboxaldehyde is an α,β-unsaturated aldehyde. It is use in the synthesis of benzopyrans and azomethine imines. Packaging in glass bottle.(https://www.sigmaaldrich.com › product › aldrich). Alpha-farnesene is used as perfume in cosmetics. trans caryophyllene act as anti-inflammatory agent, they have analgesic, antipyretic, and platelet-inhibitory actions. Myrcene is said to be have powerful antibiotic, antimutagenic, analgesic, anti-inflammatory, and **sedative** effects. (Myrcene; CAS No. 123-35-3 Ad·https://www.sigmaaldrich.com/myrcene/123-35-3)

## 4. CONCLUSION

The chemical constituents of pineapple peels have been identified using GC-MS. The components identified include palmitic acid, n-decanal, 1-cyclohexene-1-carboxaldehyde, alpha-farnesene, trans caryophyllene, myrcene, limonene. Limonene was found to be the most abundant compound present in the pineapple peels oil constituting over 75% of the oil. It could be concluded that pineapple peels are a potential source for obtaining limonene.

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