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Essential oil and antioxidant properties of Silver nanoparticles and methanol extract of *Cinnamonum cassie*

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Abstract
The essential oil and antioxidant properties of Cinnamonum was successfully carried out. Figure 1, shows the SEM/EDX of $AgNP_S$ Ci. The SEM shows the shapes, dispersion and agglomeration of the sample, while the EDX confirms the SEM and the presence of some compounds; O K (Potassium oxide), Ca K (Calcium), Ag L (Silver iodide), C K (Cyanogen chloride), P K (Phenol), S K (Potassium). The FT-IR reveal the $AgNP_S$ capping and reducing the particular biomolecule from the functional group for identification as shown in table 1. The importance of food industry is extracting nutrition from raw material that will improve and prevent adverse effects on health of consumers. The 14 bioactive compounds of Ci viewed on the GC-MS has shown to have different antioxidant role they play in human health and body. The DPPH of both Ci methanol is higher than the $AgNP_s$ at 500 and this also represented in the IC50 table. The reducing power of Ci $AgNP_S$ was higher than the Ci methanol. Therefore, Cinnamonum can be beneficial in nutraceuticals industry.

Keyword; *Scanning Electron Microscope / Energy Dispersive X-Ray (Sem/Edx), Silver Nanoparticles ($AgNP_s$), Fourier-Transform Infrared (FT-IR), Spectroscopy Gas Chromatography–Mass Spectrometry (GC-MS), Cinnamonum (Ci), 2, 2-diphenyl-1-picryl-hydrazyl radical scavenging (DPPH), Silver Nitrate ($AgNO_3$)*

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I. Introduction

Spices have been applicable as food additives. They improve the flavour, taste and colour of food, as well as extending the shelf life of food by inhibiting the growth or decreases the food borne pathogens. Plant known as natural antimicrobials which have long been applied for the preservation of foods. Spices for examples cinnamon, garlic, ginger, mint, etc can substitute the health remedies.

Most of spices show antioxidant and antimicrobial activity against bacteria, yeasts, and moulds. The biological activity of spices based on the phenolic compounds, so can be effectively applied as food preservatives. Spices can be classified according to their antioxidant and antimicrobial activities into three categories; the first classified as strong (cinnamon, clove, mustard), the second as medium (all spices, sage, bay leaf, caraway, coriander, cumin, rosemary, thyme, oregano), and the third as weak (black pepper, red pepper, ginger) Tarik *et al*., 2016.

Nanotechnology is an emerging field, which utilizes nanoparticles (NPs) in various applications such as in food packaging, as preservatives, in cosmetics, as carriers of therapeutic agents in nanomedicine (Shalaby *et al.*, 2015; Alsammarraie *et al.*, 2018). In the last decade biosynthesis of nanoparticles has received increasing attention due to a growing need to develop environmentally friendly technologies in material synthesis. The biosynthesis method employing plant extracts has increased some attentions as a simple and viable alternative to chemical procedures and physical method synthesizing metal nanoparticles only in recent years. Alsammarraie *et al.*, 2018

Nanotechnology is becoming increasingly important for the food and health sectors promising result and applications are already being developed in theoretical nutrient and drug delivery system through bioactive Nano encapsulation, biosensors to detect the quality pathogens, as well as moved resources for the evaluation and the development of newer, safes, and effective dry formulation. (Cos *et al.*, 2006).

Silver nanoparticles (AgNPs) have been applied as antibacterial antifungal, antiviral, and anti-inflammatory and catalytic activity due to its distinguishable physical, chemical, biological and prevention of biofilm (Gurumathan *et al.*, 2014).

The conventional chemical method is recognized as being dangerous, energy and wealth exhaustive removing the conventional techniques to be environmentally friendly. Chemical synthesis of silver nanoparticles mostly ended in aggregation as the storage time extends while biosynthesis of nanoparticles using plant extracts also known as synthesis is low-cost, environmentally kind and produce stable nanoparticles (Sharma *et al.,* 2014).

Silver nanoparticle, may be added in nontoxic concentration of food as several studies carried on the toxicity of silver nanoparticles (Ivask *et al.,* 2014) verified studies nanoparticles had no cytotoxicity to mammalian cells at 26.7mg/L. in another investigation recorded that AgNPs couldn't affect the mammalian cells morphology up to 6,500ng/ml concentration (Arora *et al*., 2008). Nanoparticles have the ability to discover food spoilage and food pathogens through Nano sensors. Also, nanoparticles used in food packaging consisting of polymers in combination with Nano devices is known as smart packaging. Natural, edible Nano laminates can also carry antioxidants and antimicrobials. For extension of shelf-life (Ramachandraiah *et al*., 2015).

The process of using aqueous extract of the sample spices for the biosynthesis of silver nanoparticles without usage of hazardous and toxic solvent has several advantages with low cost, compatibility, against skin infection pathogen (Halawani, 2017).

Natural products, such as plant extract, either as pure compounds or as standardized extracts, provide unlimited opportunities for new drug discoveries because of the unmatched availability of chemical diversity (Cos *et al*., 2006). According to the World Health Organization (WHO), 2019, more than 30% of the World's population relies on traditional medicine for their primary healthcare needs. The use of herbal medicines in Asia represents a long history of human interactions with the environment. Plant used for traditional medicine contain a wide range of substance that can be used to treat chronic as well as infectious diseases (Duraioandiyan *et al*, 2006).

Due to the development of adverse effects and microbial resistance to the chemically synthesized drugs, men turned to ethno-pharmacognosy. They found literally thousands of phytochemicals from plants as safe and broadly effective alternatives with less adverse effect. Many beneficial biological activities such as anticancer, antimicrobial, antioxidant, antidiarrheal, analysis and wound healing activity were reported. In many cases the people claim the good benefit of certain natural or herbal products. However, clinical trials are necessary to demonstrate the effectiveness of a bioactive compound to verify this traditional claim. Clinical trials directed towards understanding the pharma-kinetics, bioavailability, efficiency, safety and drug interactions of newly developed bioactive compounds and their formulations (extracts) require a careful evaluation. Clinical trials are carefully planned to safeguard the health of the participants as well as answer specific research questions by evaluating for both immediate and long-term side effect and their outcome are measured before the drug is widely applied to patients.

Cinnamonum has for generation to generation been used as a spice, fragrance and herbal treatment. The available in vitro and animal in vivo evidence suggests that *Cinnamonum* has anti-inflammatory, antimicrobial, antioxidant, antitumor, cardiovascular, cholesterol-lowering, and immunomodulatory effects. In vitro studies have demonstrated that cinnamon may act as an insulin mimetic, to potentiate insulin activity or to stimulate cellular glucose metabolism. Furthermore, animal studies have demonstrated strong hypoglycemic properties. However, there are only very few well-controlled clinical studies, a fact that limits the conclusions that can be made about the potential health benefits of cinnamon for free-living humans. The use of *Cinnamonum* as an adjunct to the treatment of type 2 diabetes mellitus is the most promising area, but further research is needed before definitive recommendations can be made (Shen *et al.,* 2002), Anderson *et al*, (2004), Cao *et al*, (2007), Taher *et al*, (2004), Jarvill-Taylor *et al*, (2001).

Studies have also shown that *Cinnamonum* is an antimicrobial agent (Gende *et al*, 2008. Prabuseenivasan *et al*, 2006). Several studies on medicinal plants and their components have indicated the anti-inflammatory activities of *Cinnamonum* (Matu *et al*., 2003).

The administration of *Cinnamonum* to mice positively affected the lipid profile, whereby the high-density lipoprotein (HDL) cholesterol levels decreased, and plasma triglycerides were reduced (Kim *et al.*, 2006). Another study by (Rahman *et al*., 2013) found a reduction in the total cholesterol, triglycerides, and low-density lipoproteins in rats administered *Cinnamomum cassia* powder (15%) for 35 days. Additionally, cinnamon oils reduced the cholesterol levels in broiler chickens (Ciftci *et al.*, 2010). A study by Khan *et al*, (2003). reported that the administration of *Cinnamonum* at 1, 3, and 6 g doses per day caused a reduction in serum glucose, Evidence-Based Complementary and Alternative Medicine, lowers triglyceride, total cholesterol, and LDL cholesterol levels in humans (Khan *et al.*, 2003).

II. Materials and Methods

Material collections

Cinnamonum cassie was purchase at Wuse market Abuja.

NIPRD (Nigeria Institute for Pharmaceutical Research and Development) was the laboratory facility used.

Method

Raw Materials Preparation

The sample was subjected to post-harvest treatment before experimental use. The modified method described by Adewole *et al*, (2013) was used accordingly. The particle size of the sample was determined manually by sieve analysis (Jillavenkatesa *et al*., 2001). The sample was sorted in an air tight container for experimental analysis.

Fresh *Cinnamonum*
↓
Cleaning and Sorting
↓
Washing
↓
Air drying (2 days)
↓
Seed
↓
Coarsely milled (warring blender)
↓
Maceration/Hydro-distillation

Flow diagram for processing of *C. cassie* sample for Maceration / Hydro-distillation

Extractions

Maceration of Methanol Extract

Cold maceration was the method of extractions for the methanol extract. The solvent used was methanol, the volume of the solvent was twice the physical size of the extract, the sample was crushed put in a big conical flask, the solvent added, covered and kept at a room temperature for 24 hours, shaken at intervals. After maceration, the plant sample was filtered using muslin, the extract was put in a rotary-evaporator to reduce the volume in the extractant after which it was transferred into a stainless plate and put in a water bath for complete drying. The dried extract was collected (using a spatula) and put in an air-tight bottle containers, kept in a cool dry place for laboratory analysis.

Hydro-Distillation - Essential Oil

The essential oil was done using hydro-distillation process. The plant sample was undergoing post-harvest treatment (check flow chat) put in a round bottom flask, water was added (the water was almost the size of each sample in the flask), then set up in a glavenger and switched on. The extraction started, 0.5 ml of m-hexane was added into the pipe, where there was a mixture of water and oil to trap the oil. The water heating up and escaping within different pipes together with the essential oil.

in the cylinder of the glavenger, water and oil-mix (which comes out from the sample), the water was down while the oil was up, and before the process begins, little water was added through a small opening up and a small wool is used to cover the opening so that the oil does not escape and the water added helps to cool the cylinder when the process starts heating too much. As the oil extract and drop through the pipe, the oil is collected into a bottle, until the process is complete in about 2-3 hours. Using a syringe to remove the little water in the oil, then the volume of the essential oil is taken, the oil is put in an amber bottle kept in the NIPRD laboratory fridge for GC-MS analysis.

Silver Nanoparticle Characterization

Synthesis Of Silver Nanoparticles

Cinnamonum AgNPs extract was synthesized by adopting the method described by Gloria *et al*, (2017). A 20g of the sample was weighed into conical flask of 250ml and 100ml of water was added at 60°C in a water bath for 10 minutes respectively. Each extract was cooled, filtered using watchman filter paper. Fifteen (15) ml of the extract was added into 45ml aqueous silver nitrate ($AgNO_3$) (0.1M solution) at room temperature and stirred continuously with a magnetic stirrer for 15 minutes so as to get a solution of extract and $AgNO_3$ in the ratio of 1:3. Each conical flask containing the respective extract was wrapped in aluminum foil and kept in the dark to prevent auto-oxidation of silver. After 24 hours, each extract containing silver Nanoparticle ($AgNP_s$) was centrifuged at 3000 rpm for 10 minutes and the resulting pellets were dried in an oven at 100°C for 24 hours. The resultant $AgNP_s$ of each extract was used for antimicrobial assay.

Characterization of silver nanoparticles

After 24 h, the solution containing AgNPs was centrifuged at 3000 rpm for 10 min, the resulting pellets was dried in an oven at 100°C for 24 h. The purified AgNPs was characterized using the following techniques.

The formation of AgNPs was monitored by visual assessment of the colour changes of the solutions. The reduction of silver was measured periodically at a wavelength range of 300–700 nm using a UV-Vis spectrophotometer (UV-3000 PC, UK). The UV-Vis spectra of AgNPs produced was plotted and recorded as a function of bio reduction time (15 min intervals) at room temperature at a resolution of 0.5 nm. Size, shape, and morphology of the nanoparticles was determined by scanning electron microscopy (SEM) (ZEISS prdt, Evo/LS10), the samples for SEM assays were sonicated for 5 min to make a suspension of AgNPs in distilled water. A drop of the suspension was then placed on double-sided-coated carbon stubs, allowed to dry, and observed using SEM at a voltage of 15–20 kV at different magnifications. Fourier Transform Infrared (FTIR) (Nicolet iS5, Thermo-scientific Berlin Germany). Analysis was used to determine the possible biomolecules responsible for the reduction of silver ions to AgNPs. The samples were analysed using a spectrometer. Spectra was collected from 50 scans at a resolution of 4 cm−1 in the range of 500-4000. The remaining pallet was used for AgNPs Antimicrobial and AgNPs Antioxidant in comparism with Methanol extract.

Antioxidant Assay

The antioxidant activities of the spice's methanol extract and AgNPs was evaluated using 1,1-diphenyl-2-picrylhydrazyl (DPPH) and Reducing power.

Free Radical Scavenging Assays

2, 2-diphenyl-1-picryl-hydrazyl radical scavenging (DPPH) Assay. The DPPH is a stable free radical and is widely used to assess the radical scavenging activity of antioxidant compounds. This method is based on the reduction of DPPH in methanol solution in the presence of a hydrogen-donating antioxidant due to the formation of the non-radical form DPPH. this transformation results in a colour change from purple to yellow, which is measured by a spectrophotometer. The disappearance of the purple colour is monitored at 517nm. The free radical scavenging activity can be measured by using 2, 2-diphenyl-1-picryl-hydrazyl. The reaction mixture consists of 0.1 ml of DPPH in methanol (0.3mM), 1.0ml of the extract and 1.0ml of methanol. It is incubated for 10min in dark, and then the absorbance is measured at 517nm. In this assay, the positive controls can be ascorbic acid. The percentage of inhibition can be calculated using the formula:

Inhibition % = $\frac{A0-A1}{AO}$ X 100

Where AO is the absorbance of control and A1 is the absorbance of test.

Reducing Power Assay (RP)

Reducing power is associated with antioxidant activity and may serve as a significant reflection of the antioxidant activity. Compounds with reducing power indicate that they are electron donors and can reduce the oxidized intermediates of liquid per oxidation processes, so that they can act as primary and secondary antioxidants.

The reducing power can be determined by taking 1.0 ml of extract with 2.5 ml of phosphate buffer (200 Mm, pH 6.6) and 2.5 ml of potassium ferricyanide (30 mM) and incubated at 50^0C for 20min. thereafter, 2.5 ml of trichloroacetic acid (600 mM) is added to the reaction mixture, centrifuged for 10 min at 3000 rpm. The upper layer of solution (2.5 ml) is mixed with 2.5 ml of distilled water and 0.5 ml of $FeCl_3$ (6 mM) and absorbance is measured at 700 nm. Ascorbic acid can be used as positive control.

Gas Chromatography–Mass Spectrometry (GC-MS) Analyses

The bioactive essential oil was analysed by gas chromatography–mass spectrometry (GC-MS) using Shimadzu QP-2010 GC with QP-2010 SE Mass Selective Detector [MSD, operated in the EI mode (electron energy=70 eV), scan range of 45-700 amu, and scan rate of 3.99 scans/sec], and Shimadzu GC-MS solution data system. The Gas chromatography column was Optima-5MS fused silica capillary with 5% phenyl-methylpolysiloxane stationary phase, with length of 30 m, internal diameter of 0.25 mm and film thickness of 0.25 µm. The carrier gas was helium with flow rate of 3.22 mL/min. The program used for Gas chromatography oven temperature was at 60°C held for 2 minutes, followed by 60-260°C at a rate of 13°C/min, then held at 260°C for 2.5 min. The injection port temperature was 250°C, ion source temperature 230 °C, while the interface temperature was 250°C. Diluted sample (1/100 in hexane, v/v) of 1.0 µL was injected using autosampler and in the split mode with ratio of 10:1. Individual constituents were identified by comparing their mass spectra with known compounds and NIST Mass Spectral Library (NIST 11). The percentages of each component are reported as raw percentages based on the total ion current.

III. Results

***Cinnamonum*;**

Quantity of sample – 100g
Quantity of solvent - 500ml
Yield of extract – 13.1g
Days of drying – 2 days

As the extract dries up, the extracts stains, while the remaining clusters together and the colour changes was remains deep brown (burn colour) while the stains look deep or dark red. The appearance was little but coarse. The smell was as good as the raw *Cinnamonum*; very soothing.

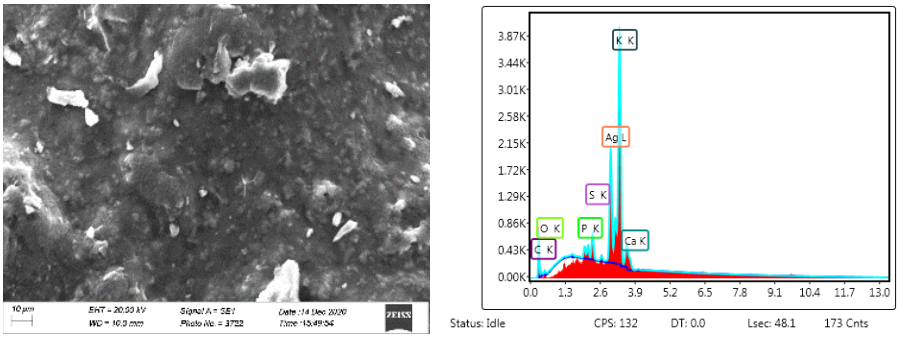

Figure 1: SEM/EDX for *Cinnamonum*

SEM *Cinnamonum* **EDX *Cinnamonum***

Figure 1, shows the SEM/EDX of AgNP$_S$ Ci. The SEM shows the shapes, dispersion and agglomeration of the sample, while the EDX confirms the SEM and the presence of some compounds; O K (Potassium oxide), Ca K (Calcium), Ag L (Silver iodide), C K (Cyanogen chloride), P K (Phenol), S K (Potassium).

Fourier-Transform Infrared Spectroscopy

The absorbance of the sample as a function of wave number (cm^{-1}) was determined using FTIR (Nicolet iS5, Thermo-scientific Berlin Germany). The FTIR was carried out to identify the functional groups and the types of bonds occurring at the range of 500-4000 (cm^{-1}). Figure below, presents the FTIR spectra of Ci.

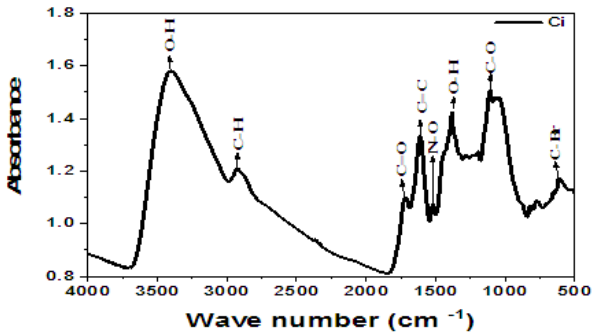

Figure 2: FT-IR spectra of *Cinnamonum*

Table 1: Vibrational frequencies and wave number of *Cinnamonum*

Wave number (cm^{-1})	functional group	compounds
3404.76	O-H stretching	alcohol (strong)
2925.42	C-H stretching	alkene (medium)
1719.76	C=O stretching	conjugated acid (strong)
1612.32	C=C stretching	α,β-unsaturated ketone (strong)
1518.74	N-O stretching	nitro compound (strong)
1384.58	O-H stretching	carboxylic acid (strong)
1108.47	C-O stretching	aliphatic ether (strong)
616.27	C-Br stretching	halo compound (strong)

Antioxidant of *Cinnamonum*

Table 2: IC50 OF DPPH

Samples	IC50
Ci AgNP$_S$	1697
Ci methanol	512.9

The IC50 of Ci methanol is higher than the Ci AgNP$_S$

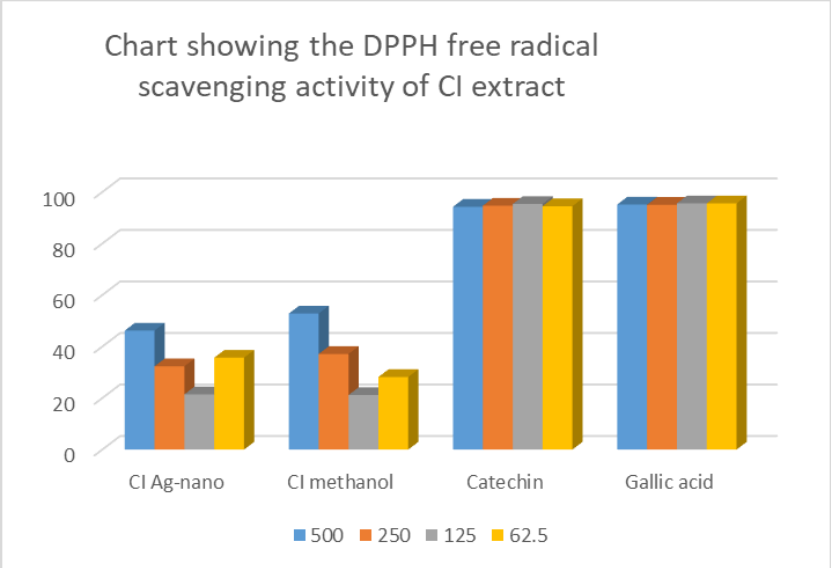

Figure 3: DPPH of *Cinnamonum* Samples

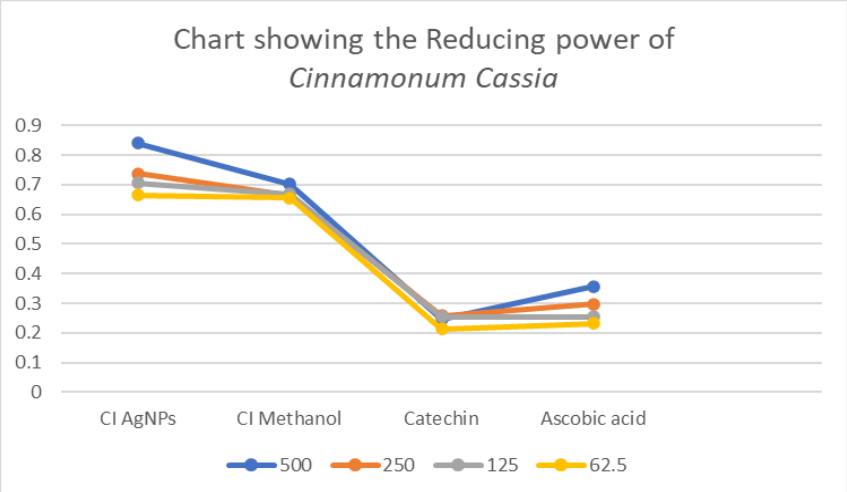

Figure 4: Reducing Power of *Cinnamonum* Samples

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Table 3: *Cinnamonum* Bioactive Compounds

Peak No	Ret Time	% Composition	Name
1	5.691	72.62	Artificial Almond Oil
2	5.909	0.39	Methyl phenyl ketone
3	6.355	0.84	psi.-Cumene
4	6.890	2.56	D-Limonene
5	8.569	0.48	Linderol
6	8.738	0.35	4-Terpineol
7	11.118	0.29	Germacrene D
8	12.293	0.37	alpha.-Muurolene
9	12.495	0.59	Cadina-1(10),4-diene
10	13.466	0.45	4-epi-cubedol
11	13.581	1.43	delta.-Cedrol

12	18.441	6.44	Cyclopent-2-enone, 2-methyl-3,4-diphenyl-
13	18.820	10.35	Benzo[d]-1,2-diazacycloheptan-3,7-dione, 5,5,6,7,9-pentamethyl-
14	19.030	2.82	4,6,6-Trimethyl-2-(3-methylbuta-1,3-dienyl)-3-oxatricyclo[5.1.0.0(2,4)]octane

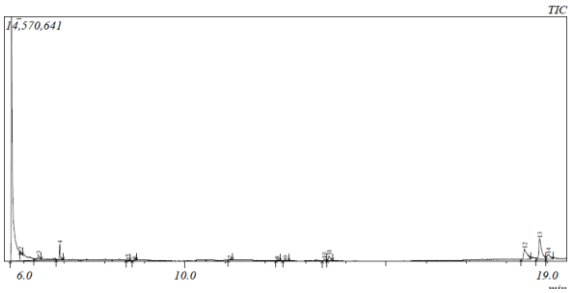
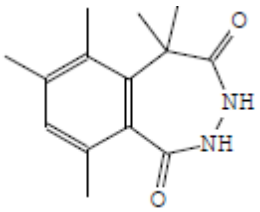


Figure 5: Chromatogram of *Cinnamonum*



Benzo[d]-1,2-diazacycloheptan-3,7-dione, 5,5,6,7,9-pentamethyl

IV. Discussion

Silver nitrate is a chemical reducing agent widely used for synthesis of $AgNP_S$ (Hyllested *et al.*, 2015) which also play a role in the colour change, which changes from light yellow to dark brown. Colour change is an important factor for the synthesis of $AgNP_s$. $AgNP_s$ appear brown in aqueous medium as a result of surface Plasmon vibrations Banerjee *et al,* (2014).

SEM analysis of the $AgNP_s$ reveals the size, shape, morphology and organization because $AgNP_S$ have ability to agglomerate as a result of high surface tension and high surface energy in the extreme fine particles of $AgNP_S$, Theivasanthi and Alagar, 2012. The EDX measures the distribution of X-ray signal generated by an electron beam on a specimen which was confirmed by the $AgNP_S$ synthesis of the extract carried out (Song and Kim, 2009). Stated that the weak peaks from the EDX was a result of biomolecules bounded to the surface Ahmad *et al*, (2010).

The FTIR, is used to reveal the $AgNP_S$ capping and reducing the particular biomolecule from the functional group for identification. Also play a role as identification and characterization of functional groups (Sasidharen *et al*, 2011). Liu *et al.,* 2007. Khanna and Nair 2009. Also reported similar observations from the FTIR. Some of the functional group studied in this work belong to hydrocarbons, esters, alcohols, acids which are mostly (monoterpenes and sesquiterpenes of bioactive compounds seen in 90% of the GC-MS essential oil). The esters are very important in aroma of food because the low carbon atoms of ester are highly volatile at ambient temperatures and the perception thresholds are much higher (Nogueira *et al*., 2005). The make of the plant flavours and are used in food flavouring industries. Example, in Korean, organic acids have been used as major aroma compounds in barley bran (Steinhaus and Schieberle, 2007). The alcohol has been shown to have antibacterial and promote shelf-life in food (Onyenekwe *et al.*, 2012).

Bioactive, like coenzyme, vitamins, iron, calcium, curcumin, etc., have been widely tested in Nano delivery systems (He and Hwang, 2016). Different Nano delivery vehicles have been developed such as association colloids, lipid-based nanoencapsulations/nanocarriers, Nano emulsions, biopolymeric nanoparticles, nanolaminates, nanofibers, etc. These Nano delivery systems can increase the bioavailability of bioactive by different pathways. Nanoencapsulation can enhance bioavailability of bioactive compound $AgNO_3$ and after oral administration through targeted delivery systems. Such nanoencapsulation enables to control the release of flavors at the desired time and also to protect the degradation of these flavors during processing and storage (Yu *et al.*, 2018).

Nowadays people are requiring more nutritional supplements because of the fact that many nutrients in food are being destroyed in the digestive tract. Each part presents a completely different environment, from oral cavity to the colon. In other words, there are a number of factors which decide the absorption of food in the body for infants, children, adults, old people, and those who are suffering from any type of gastrointestinal diseases. A nutrition delivery system is a system or nanocarrier that delivers nutrition to specific places (Maestrelli *et a.l*, 2006). Although a delivery system has numerous functions, one of them is to transport a

functional ingredient to its desired site. Just like taste, texture, and shelf life, major functions of a delivery system for a food product are that it should protect an ingredient from chemical or biological degradation, such as oxidation, and controlling the rate of release of functional ingredient under specific environmental conditions. Nano dispersions and nano capsules are ideal mechanisms for delivery of functional ingredients because they can effectively perform all these tasks.

One of important part of the food industry is extracting nutrition from raw materials. Conventional methods for food processing are being replaced by newer techniques like nanotechnology, which played a major role here. These techniques may improve food processing yields and decrease waste or spoilage of nutrition. Nutrition delivery systems must be prepared with biodegradable materials to prevent adverse effects on health of consumers.

Antioxidants control oxidative reactions by inhibiting, delaying or hindering the oxidation of the biomolecules (Kumar *et al.*, 2011). Non enzymatic antioxidants can also neutralize radicals for example water soluble substances such as Vitamin C, glutathione or fat-soluble substances such as Vitamin E, β-carotene (Trombino *et al.,* 2004). In recent years there has been an increased in the search for effective, non-toxic, natural compounds with antioxidative activity. Some nanomaterials have been seen to exhibit strong antioxidant property. In this study, phytochemical screening and *In vitro* antioxidant activity of the synthesized AgNPs and corresponding methanol extract of the plants were studied by analyzing antioxidant capacities which are indicative of the antioxidant potential of the synthesized AgNPs, which Vivekanandhan *et al,* 2012 also reported.

DPPH is a stable organic free radical that has been used for investigating the free radical activities and thus antioxidant activity of various natural products (Rushender *et al.,* 2012). The DPPH was considered to be a model of lipophilic radical. A chain reaction in lipophilic radicals was initiated by lipid auto-oxidation. Being a stable free radical, DPPH is regularly used to determine radical scavenging activity of natural compounds. In its radical form, DPPH absorbs at 517 nm and its absorbance decreases upon reduction with an antioxidant (Lateef *et al.,* 2015). The IC50 values for DPPH scavenging activity of synthesized AgNPs were presented in table 2 above. Figure 3 shows the dose response for the DPPH scavenging activity of the synthesized AgNPs and methanol of the extract. The AgNPs synthesized from the methanolic extract are potential free radical scavengers with effective inhibition activity in a dose dependent manner. The varying concentration of the AgNPs significantly scavenged DPPH, however, these activities are less than that of Ascorbic acid and Catchen, the standard reference used.

The Reducing Power of a compound is related to its electron transfer ability and therefore may serve as a significant indicator of its potential antioxidant activity (Gülçin *et al.,* 2003). The reducing power of the samples increased with increasing number of concentrations. The reducing property of the extracts implies that it is capable of donating hydrogen atom in a dose dependent manner.

The identification of various bioactive compounds present in Ci oil were determined by GC-MS. The full scan from the Chromatogram is on figure 5. The major compositions identified are presented on the table 3. The reference peak and retention time were noted. The oil yield was 1.58ml, colour is golden yellow and the oil appear thick and thicker over months. The major bioactive compound analyzed by the GC-MS were found to be 14 in numbers. Some of those compounds are Benzo (d) -1,2, diazacyeeloptan – 3, 7 – dione, 5,5,6,7,9 - pentamethyl (10.32%), cyclopent – 2 – enone, 2 – methy 1-3,4- dipyenyl (6.44%), 4,6,6 – trimethyl-2- (3 methylbuta-1,3 dienyl) -3-oxatricyclo (5,1,0,0 (2,3) octane (2.82%), D-limonene (2.56%), psi-cumene (0.84%).

According to WHO 2009, benzodiazepines are use in medicine to treat clinical disorders. Benzo 1,2 – diazepines are use in drying formulations, primarily for treating anxiety and other conditions like seizure, insomnia, muscle relaxation, nausea/vomiting, pression and pan attacks, (Annette, 2021). Kaiser Foundation, 2014, explain that Benzodiazepines are gam and ma-aminobutyric (GABA) receptor agonists that have hypnotic, anxiolytic, muscle relaxant, and anticonvulsant properties. At the same time there are some concerns just like every other or most drugs on usage and side effect so they went on to advise on usage, side effect risk and need to use it discontinuation. So, patients who need to use such drugs need to consult their physician.

Psi-cumene is an aromatic phenolic group that have antioxidant activities. Researchers have reported that is effective in suppressing conidial germination (Hong *et al.,* 2015) also when combine with fruits can reduce the activities of anthocyanins without any phytotoxin effect contributing to antioxidant activities (Kordali *et a.l,* 2008). Psi-cumene corresponds to the one gotten from (Yu *et al.,* 2020).

V. Conclusion

The essential oil shows that the *Cinnamonum* has a good oil yield and nice perfume. The Bioactive compounds has a lot of health benefits. Ci methanol extract and the synthesized Ci $AgNP_S$ could be used in nanomedicine and in nutraceuticals.

Furthermore, the AgNPs which is a new novelty, shows that the synthesized extract can be used for making not only food product but food film packaging material that will prevent peculation of chemical from

the packaged material into the food, thereby leaching chemical/toxin substances into the food. If this is done, nutritional content of the food will be retained, shelf-life will be enhanced, and the food will be safe for human consumption

Conflict of interest: The authors declare there was no conflicts of interests.

Reference

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