ZIBELINE INTERNATIONAL™ PUBLISHING

***ISSN: 2521-5051 (Print)***
***ISSN: 2521-506X (Online)***
***CODEN: ASMCCQ***

**Acta Scientifica Malaysia (ASM)**

*DOI: http://doi.org/10.26480/asm.01.2022.06.09*

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*RESEARCH ARTICLE*

# GREEN SYNTHESIS APPROACH, CHARACTERIZATION, AND APPLICATIONS OF MgO NANO PARTICLES USING CURRY LEAF (*MURRAYA KOENIGII*)

**Kaywood Elijah Leizou[a], Muhammad Aqeel Ashraf[b]**

***[a] Department of Chemical Sciences, Niger Delta University, Wilberforce Island, P.M.B 071, Yenagoa, Nigeria***
***[b] International Water, Air & Soil Conservation Society INWASCON 59200 Kuala Lumpur, Malaysia***
****Corresponding Author's Email: pastorkayeleizou@yahoo.com***



**ARTICLE DETAILS**

***Article History:***

Received 23 January 2022
Accepted 28 February 2022
Available online 07 March 2022

**ABSTRACT**

Nanotechnology has emerged as a state-of-the-art and cutting-edge technology with multifarious applications in a wide array of fields. The goal of this study was to create magnesium oxide nanoparticles using an aqueous extract of curry leaves (murraya koenigii or bergera koenigii). The morphology, elemental content, shape, and size of the produced MgO nanoparticles were determined using scanning electron microscopy (SEM) and energy-dispersive X-ray spectroscopy analysis (EDX). According to the SEM data, the MgO nanoparticle forms were well disseminated, with a spherical shape and particle sizes ranging from 20 to 100 nm. While the EDX pattern infers the sample's elemental composition, the average occurrence of Mg was 32.45 percent. Plant extracts were used to successfully produce MgO nanoparticlse, which is an essential alternative technique because it is non-toxic, biocompatible, and environmentally benign.

**KEYWORDS**

*Green synthesis, characterization, MgO nano particles, murraya koenigii*

## 1. INTRODUCTION

Plants or plant leaf extract provide a biological technique for the controlled and exact creation of a variety of metallic nanoparticles with well-defined different sizes and forms. Researchers are increasingly interested in inorganic nano metal oxides such as (TiO2, MgO, CaO, and ZnO) because to its safety, stability, and multifunctional properties (Rajiv et al., 2013; Shravana et al., 2016). Traditional methods have been utilized for many years; however, research has demonstrated that green synthesis methods are more efficient in producing nanoparticles with fewer failure chances, are less expensive, and are easier to characterize. Because of their toxic metabolites, physical and chemical methods of synthesizing nanoparticles have put a lot of strain on the environment (Abdelghany et al., 2018; Irshad et al., 2017; Ammulu et al., 2021). Green synthesis has numerous advantages over chemical and physical approaches, including the ability to be cost effective, ecologically benign, and easily scaled up for large-scale synthesis.

Biosynthesis of magnesium oxide nanoparticles has been reported from a variety of plants, including mangrove Rhizophora lamarckii, Moringa oleifera, Vernonia amygadalina, and Occimum gratissimum, Rosmarinus officinalis L. (Rosemary) (Sharma et al., 2017; Abdallah et al., 2019; Prasanth et al., 2019; Shittu et al., 2020). Pterocarpus marsupium rox.b heartwood; curry leaves (Ammulu et al., 2021; Shravana et al., 2016). Magnesium oxide nanoparticles, combined with wood chips and shavings, can be utilized to create materials such as sound-proof, lightweight, heat-insulating, and refractory fiber board, as well as metallic ceramics. The following are some of the potential applications for magnesium oxide nanoparticles: High-temperature dehydrating agent used in the manufacture of silicon steel sheet, high-grade ceramic material, electronic industry material, adhesive and additive in chemical raw material; Electric insulating material used in the manufacture of crucible, smelter, insulated conduit, electrode bar, and electrode sheet; High-frequency magnetic-rod antenna, magnetic device filler, insulating material filler, and various carriers used in radio industry (Daisy et al., 2015). The current work aims to synthesis MgO nanoparticles utilizing curry leaf extract as a reducing and capping agent, as well as characterize the nanoparticles using SEM and EDAX analysis.

## 2. MATERIALS AND METHODS

### 2.1 Description of plant

Murraya koenigii is the scientific name for the curry tree, which belongs to the Rutaceae family (Figure 1). It is indigenous to India and is typically found in tropical and subtropical climates. It is grown in a number of places, including China, Australia, Nigeria, and Ceylon. Curry leaves are thought to have a variety of therapeutic qualities, including anti-diabetic, antioxidant, antibacterial, anti-inflammatory, anti-carcinogenic, and hepatoprotective characteristics. Moreover, the roots have been used for treating body aches and the bark is used for snake bite relief. Curry leaves include carbohydrate, fiber, calcium, phosphorus, iron, magnesium, copper, and other minerals, as well as vitamins such as B3 (nicotinic acid, C, A, B, E), antioxidants, plant sterols, amino acids, glycosides, and flavonoids (https://www.healthline.com).

**Figure 1:** Curry leaves (murraya koenigii or bergera koenigii)

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Cite The Article: Kaywood Elijah Leizou and Muhammad Aqeel Ashraf (2022). Green Synthesis Approach, Characterization, and Applications of MgO Nano Particles Using Curry Leaf (*Murraya Koenigii*). *Acta Scientifica Malaysia, 6(1): 06-09.*

### 2.2 Materials, apparatus, reagents and chemicals

Lab coat, lab shoes, eye protection glass, metal salt (magnesium oxide, MgO), deionized water, curry leaf (Murraya koenigii or bergera koenigii), 250mL beaker, 250mL conical flask, stirrer, hot plate, burette, restort stand, measuring cylinder and thermometer(http://www.instanntnano)

## 3. COLLECTION OF PLANT

(Murraya koenigii or bergera koenigii) leaf (Figure 1) was acquired from Amassoma, Bayelsa State, Nigeria for this study. A plant taxonomist from Niger Delta University, Department of Biological Science, Wilberforce Island, Bayelsa State, identified and authenticated the plant.

## 4. CHEMICAL PRECURSOR

Magnesium oxide, which was employed as a precursor salt, as well as other necessary reagents and chemicals, were obtained from a dealer in Lagos, Lagos State, Nigeria.

## 5. EXPERIMENTAL PROCEDURE

The leaves were properly washed with tap water to remove soil and grime before being rinsed with distilled water. The leaves were then sliced into little pieces, and 25 grams were placed in a 250 mL beaker containing 100 mL distilled water and boiled for 10 minutes at 80-90°C. To obtain the aqueous plant extract, the extracts were filtered through Whatman No. 1 filter paper. In burette, employ the green extract as a reducing and capping agent. On a hotplate, dissolve 10g of metal salt in 50mL of deionized water, adjust the temperature to 60-70oC, and then add leaf extract dropwise very slowly until there is a color change (http://www.instantnano.com).

## 6. RESULTS AND DISCUSSION

### 6.1 Scanning electron microscopy analysis

The morphology of green synthesized nanoparticles was examined using a scanning electron microscopy to determine the shape and size of the particles. Scanning electron microscopy (SEM) is useful in confirming the morphology of nanoparticles. The SEM images are shown in Figure 2. (a-d). The MgO nanoparticles formed were well dispersed, with a spherical shape and particle sizes ranging from 10 to 100 nm. Scanning electron microscopy, SEM is a surface imaging method, capable of resolving different particle sizes, size distributions, nanomaterial shapes and surface morphology of the synthesized particles at nanoscales (Zhang et al., 2016). The optical and electronic properties of metal nanoparticles are known to be heavily influenced by the shape of the nanoparticles (Wei and Xu, 2012; Benakashani et al., 2016). Particle aggregation could be caused by Van der Waal forces and interactions between magnesium oxide nanoparticles (Essien et al., 2019). The presented surface morphology has applications in catalysis and medicine (Navalon and Garcia, 2016; Narendhran et al., 2019).

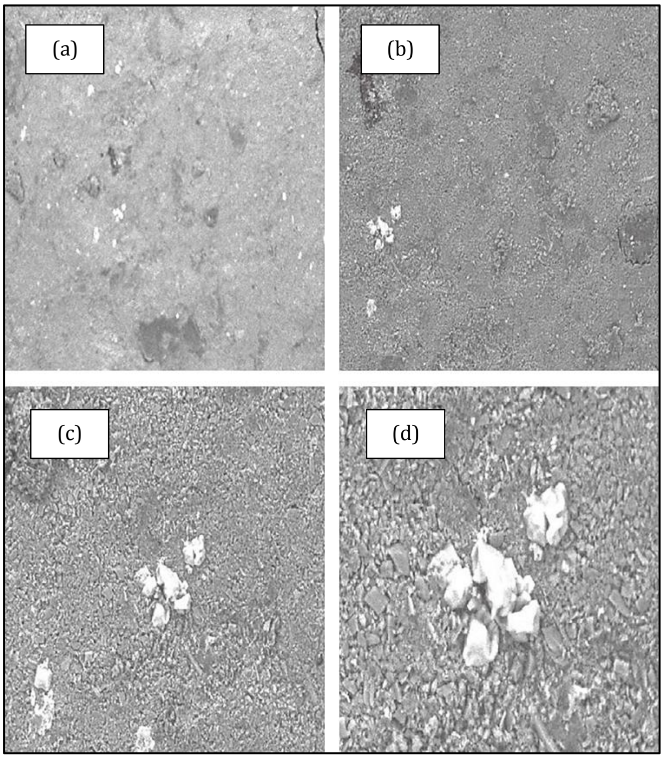
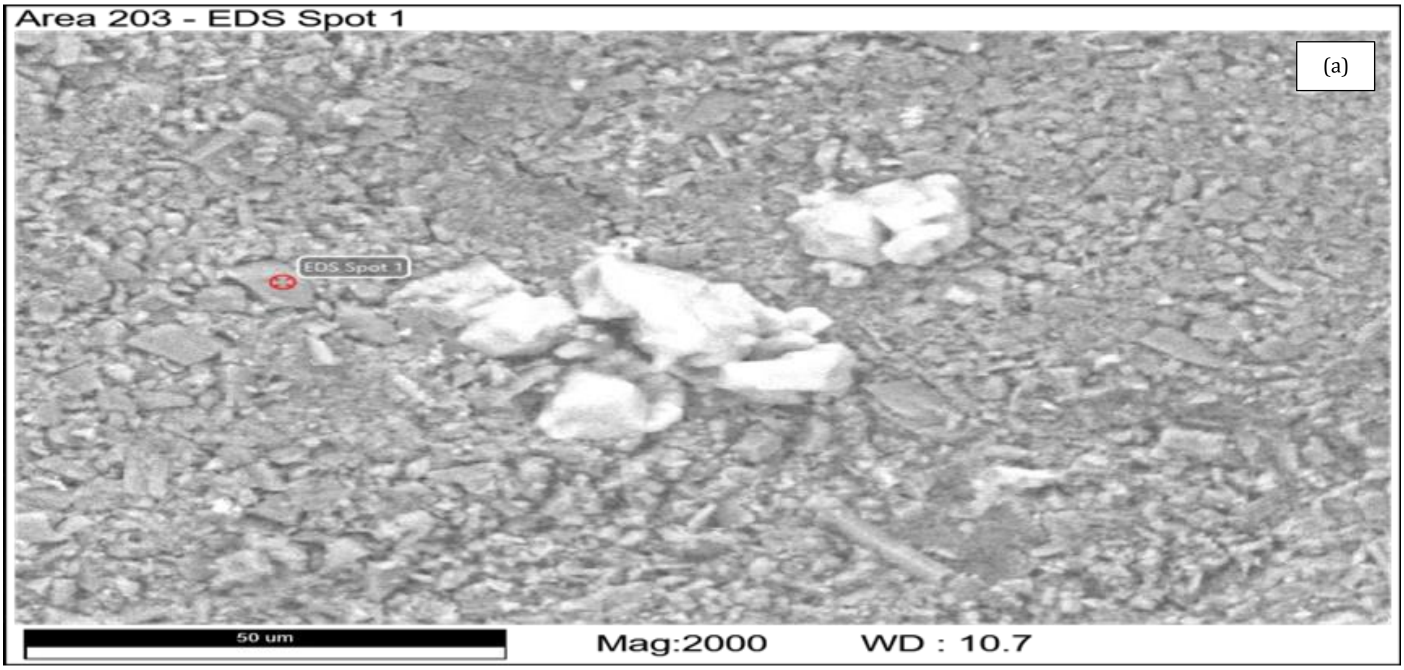


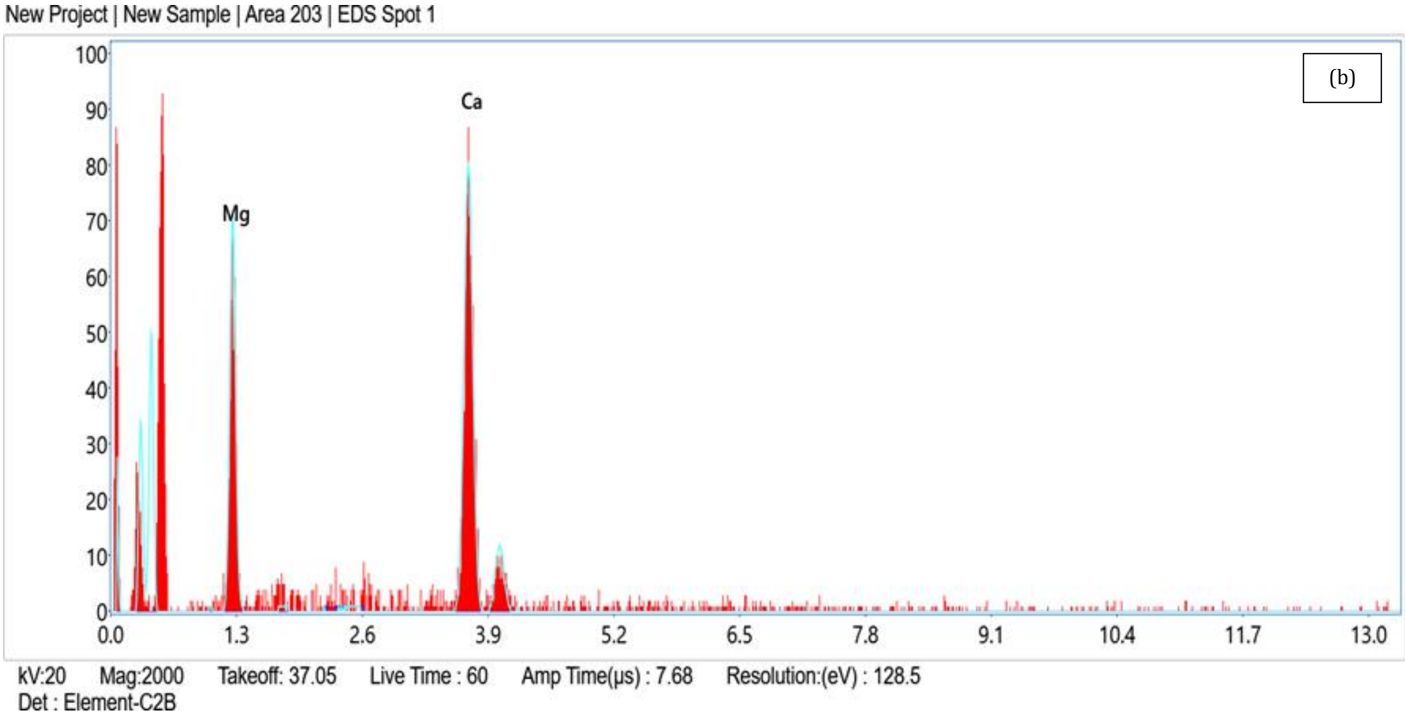

**Figure 2:** (a-d) Magnesium oxide nanoparticles with SEM

### 6.2 EDS analysis

Energy-dispersive X-ray spectroscopy (EDS, EDX, or EDXA) is a strong technique for determining the elemental composition of a material. The ability of high intensity electromagnetic radiation (X-rays) to eject 'core' electrons (electrons that are not in the outermost shell) from an atom is the main operational principle that permits EDS to function.

EDS is comprised of three basic components: an emitter, a collection, and an analyzer. These components are also commonly seen on an electron microscope such as a SEM or TEM. The combination of these three pieces enables analysis of both the number of X-rays released and their energy. The EDS data is presented as a graph with KeV on the x-axis and peak intensity on the y-axis (http://www.chem.libretexts.com).






| Elements | Weight (%) | Atomic (%) | Error (%) | Net Int. | R |
|---|---|---|---|---|---|
| Mg | 32.45 | 44.20 | 11.97 | 9.00 | 0.8845 |
| Ca | 67.55 | 55.80 | 5.80 | 15.47 | 0.9183 |

c

**Figure 3:** (a-c) EDS profile of green synthesized MgO nanoparticles

MgO nanoparticles were successfully synthesized using curry leaf extracts (Murraya koenigii or bergera koenigii), which is a significant alternative method due to its non-toxic, biocompatible, and environmentally friendly properties. The EDX pattern infers the sample's element composition, and the average presence of Mg was 32.45 percent (Figure 3a-c). These findings are consistent with those reported by (Prasanth et al., 2019; Shittu et al., 2020; Essien et al., 2020; Sharma et al., 2017; Abdallah et al., 2019).

## 7. Conclusion

MgO nanoparticles were successfully produced using curry leaf extracts (Murraya koenigii or bergera koenigii) in this investigation. The elemental composition of the sample is determined utilizing characterization techniques such as SEM and EDS on the produced MgO nanoparticles. According to the SEM results, the MgO nanoparticles formed were well dispersed, with a spherical shape and particle sizes ranging from 10 to 100 nm. The elemental composition of the sample was inferred using an EDX pattern, and the average presence of Mg was 32.45 percent. Nanotechnology has developed as a cutting-edge technology with several applications in a variety of industries. Because of the limitations of physical and synthetic processes for the formation of nanoparticles, the primary focus of research has shifted to the development of safer and pure green synthesis methods.

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