UNIVERSITY OF BABYLON

COLLEGE OF SCIENCE

DEPARTMENT OF BIOLOGY

Forming Of Manganese Nanoparticles by Leaves of Datura

Graduate research submitted by:

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بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

يَرْفَعِ اللَّهُ الَّذِينَ آمَنُوا مِنكُمْ وَالَّذِينَ أُوتُوا الْعِلْمَ دَرَجَاتٍ

صدق الله العلي العظيم

المجادلة: 11

Deduction

إلى أسمى آيات العطاء البشريّ،

أمي وأبي الغاليين،

أهدي ثمرة جهدي المتمثلة في هذا البحث المتواضع،

عسى أن أكون مصدر فخر لكما

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Abstract

content

Chapter One: Introduction and Literature View

1.1. introduction:

The rapid advances in biotechnological processes, approaches, and technologies have revolutionized agricultural research by developing a better understanding of plant genomes, gene discovery, genomic variations, and manipulation of desired traits in plant species. Additionally, these approaches also help researchers in developing a better understanding beyond genomes such as plant-pathogen and plant-environment interactions. The advanced technology support has helped to track the entire journey from genomes to phenotype using different "omics" approaches such as genomics (DNA/genome/genes), epigenomics (epigenetic modifications on the genetic material), transcriptomics (transcripts/RNA), proteiomics (proteins), metabolomics (metabolites), interactomics (protein interactions), and phenomics (phenotype). The other important intervention is nanobiotechnoloy (a combination of nanotechnology and biology), which provides very sophisticated technical approach/devices for tracking, understanding, and solving biological problems. [Varshney et al., 2018]

1.2. Datura stramonium:

is an erect shrub with spreading branches. A perennial herbaceous plant, belonging to the Solanaceae family can reach a height of 1.5m. Leaves are simple, alternate, dark green, broadly ovate, shallowly lobed and glabrous. Flowers are large, solitary, and trumpet-shaped with a sweet fragrance usually appreciated in the mornings and evenings, with a wide range of colours, ranging from white to yellow and light to dark purple. The flowers are hermaphrodite and are pollinated by insects. The fruit is in the form of a capsule covered with short spines. Datura can tolerate average soil but prefers soil which is rich and moist or even very alkaline soil but hardly survives under shade. It prefers a warm temperature and is distributed in warmer regions of the world. [Monira & Munan, 2012]

Pharmacological effects: antiepileptic effect, anti-asthmatic effect, antimicrobial effects, insecticidal and repellent activities, protective effect, analgesic effects, antioxidant effect. [Al-Snafi, 2017]

Datura drugs and medicinal benefits: Recently, the food and drug administration (FDA) has recognized the medicinal uses of Datura because of the presence of chemical compounds such as scopolamine and atropine. It has been used to treat respiratory problems. Both scopolamine and atropine are used as sedatives and sometimes help in curing motion sickness, nausea, and dizziness. [Rowdy et al., 2016]

1.3. Eucalyptus globule:

Eucalyptus is a genus of over seven hundred species of flowering trees. They have bark that is either smooth, fibrous, hard or stringy, leaves with oil glands, and sepals and petals that are fused to form a "cap" or operculum over the stamens. The fruit is a woody capsule commonly referred to as a "gumnut". [Macphail et al., 2016]

It has a high content of 1,8-cineole (more than 70%), commercially used for the production of essential oils in the pharmaceutical and cosmetic industries. However, Eucalyptus is extensively planted for pulp, plywood and solid wood production, but its leaf aromatic oil has astounding widespread biological activities, including antimicrobial, antiseptic, antioxidant, chemotherapeutic, respiratory and gastrointestinal disorder treatment, wound healing, and insecticidal/insect repellent, herbicidal, acaricidal, nematicidal, and perfumes, soap making and grease remover. In the present review, we have made an attempt to congregate the biological ingredients of leaf essential oil, leaf oil as a natural medicine, and pharmacological and toxicological values of the leaf oil of different Eucalyptus species worldwide. [Dhakad et al., 2017]

1.4. Nanomicrobiology:

Nano microbiology exists at the crossroads of biology and nanoscience. It is an exciting, rapidly evolving field of research made possible by the development of atomic force microscopy (AFM). Nano microbiology gives researchers the power to study cell membranes and live cells in unprecedented detail. Atomic force microscopy works by scanning a sample's surface with a very sharp tip. The tip senses near-physical reactions between the sample and the tip, generating three-dimensional images. These images are generated directly in an aqueous solution. AFM has advantages over other microscopy techniques including minimizing sample preparation and topographic characterization of surfaces at resolutions not possible with optical microscopy. [Davey, 2019]

1.5. X-Ray Diffraction (XRD):

X-ray diffraction (XRD) is a powerful nondestructive technique for characterizing crystalline materials. It provides information on structures, phases, preferred crystal orientations (texture), and other structural parameters, such as average grain size, crystallinity,

strain, and crystal defects. X-ray diffraction peaks are produced by constructive interference of a monochromatic beam of X-rays scattered at specific angles from each set of lattice planes in a sample. The peak intensities are determined by the distribution of atoms within the lattice. Consequently, the X-ray diffraction pattern is the fingerprint of periodic atomic arrangements in a given material. [Bunaciu et al., 2015]

1.6. Fourier-transform infrared spectroscopy (FTIRF):

uses the mathematical process (Fourier transform) to translate the raw data (interferogram) into the actual spectrum. FTIR method is used to obtain the infrared spectrum of transmission or absorption of a fuel sample. FTIR identifies the presence of organic and inorganic compounds in the sample. Depending on the infrared absorption frequency range 600–4000 cm−1, the specific molecular groups prevailing in the sample will be determined through spectrum data in the automated software of spectroscopy. [Shameer & Nishath, 2019]

1.7. Scanning Electron Microscopy (SEM):

uses a focused beam of high-energy electrons to generate a variety of signals at the surface of solid specimens. The signals that derive from electron-sample interactions reveal information about the sample including external morphology (texture), chemical composition, and crystalline structure and orientation of materials making up the sample. In most applications, data are collected over a selected area of the surface of the sample, and a 2-dimensional image is generated that displays spatial variations in these properties. Areas ranging from approximately 1 cm to 5 microns in width can be imaged in a scanning mode using conventional SEM techniques (magnification ranging from 20X to approximately 30,000X, spatial resolution of 50 to 100 nm).[Swapp, 2018]

Chapter two: Methodology

2.1. Plant Collection and Identification

Fresh leaves of Datura stramonium were collected at July 2018 from the house gardens in Hilla, Babylon, Iraq. The specimen of the plant was identified in Plant Harbarium/ Department of Biology /College of Science/ University of Babylon. The leaves of Datura stramonium were dried then ground into a fine powder by suitable grinder.

2.2. Preparation of aqueous leaf extract of Datura stramonium

Datura stramonium leaves extract was prepared by adding 10 gm of dry Datura stramonium leaves powder in 100 ml sterile distilled water and heated using magnetic stirrer at 60˚C and 700 rpm for 30 minutes and left on overnight shaking, then filtered using Whatman filter paper No.1and filtrate was collected and stored at 4˚C for further use (Vaishnav et al., 2017).

2.3. Synthesis of Zinc oxide nanoparticles

One hundred ml of 100 mM zinc sulphate heptahydrate solution (ZnSO4.7H2O) was prepared and kept on a magnetic stirrer at 60 ° C and 700 rpm. Dropwise 25 ml of leaves extract has been added and color changes were observed. By adding 1 M NaOH solution, the pH is checked and adjusted to 12. White cloudy appearance observation marked as initial indicator for the formation of ZnO nanoparticles. The solution was left for

two hours in the same conditions, then incubated overnight at room temperature. Dispersing in sterile purified water and 700rpm centrifugation for 30 minutes three times. The particles with white color were subsequently washed by ethanol for removing the impurities from the final products. After drying by vacuum oven at 60 °C for six hours in order to obtain a white powder (Vaishnav et al., 2017).

2.4. Characterization of ZnONPs

2.4.1. UV-Visible spectroscopic analysis

UV-Visible spectrum analysis necessary to go for reveals the specific type of nanoparticle absorbing a specific wavelength of light. This property can distinguish zinc oxide nanoparticle from others and can also state whether it is zinc oxide or not present in the solution. UV-Visible spectroscopy works on the principle of light absorption depending on the concentration of particles in the solution. The UV–Vis spectroscopy measurements from 200 to 600 nm. The ZnONPs dispersed in deionized water were observed at 300-400 nm (Jayaseelan et al. 2012).

2.4.2. FTIR analysis

In FTIR, the vibration of chemical bonds can be measured because chemical bonds can absorb infrared energy at specific frequencies or

wavelength. The basic structure of the compound can be determined by spectral location of their IR absorption. It can also state about other molecules being associated on the surface of nanoparticle and thus predicts possible interaction of nanoparticles with other molecules. The FTIR range of the dried sample was documented in the range 4000-400 cm-1 (Sadhasivam et al., 2010).

2.4.3. XRD Analysis

The XRD measurement was carried out for the identification of the crystal of Zinc oxide nanoparticles. The biosynthesized ZnONPs were freeze dried powdered in order to analyze XRD pattern. The phase formation and purity of metallic nanoparticles were checked through XRD patterns which were recorded using powder X-ray diffract meter. XRD analysis was performed using at a step size of 0.02˚, scanning rate of 2˚ in 2θ/min and a 2θ range from 30 C˚ to 80 C˚, a voltage of 40 kV and a current of 30 mA with Cu (Sadhasivam et al., 2010).

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