



Review Article

Study on the Effect of Rainfall Level on the Size of Silver Nanoparticles Synthesized by Plants of the Lamiaceae Family in Different Regions of Iran

Maryam Saberiyan Sani ^{1*} and Mohammad Hossein Sayadi Anari²

^{1*} PhD student, Department of Environmental Sciences, Faculty of Natural Resources and the Environment, University of Birjand, Birjand, Iran

² Associate Professor, Department of Environmental Sciences, Faculty of Natural Resources and the Environment, University of Birjand, Birjand, Iran

* Tel.: +98 (911) 9546196

*E-mail: negarsaberyan.negar@birjand.ac.ir

ABSTRACT

Nanotechnology could be a very important field of recent research dealing with medical, industrial, environment. Silver nanoparticles are the topics of researchers because of their distinctive properties (size, shape depending optical, antimicrobial, and electrical properties). The synthesis of safe nanoparticles by biological organisms is recommended due to the environmental friendliness and low costs compared to physical and chemical methods. Recently, researchers tend to use a biological synthesis of nanoparticles by biological methods such as plants. This research aimed to study on the rainfall level on the biosynthesis of silver nanoparticles by Lamiaceae family plants in different regions of Iran. T-test student was used to examining the relationship between the size of nanoparticles and rainfall, using spss version 22 software. The study shows phenol concentration in low rainfall areas is more than high rainfall

area, which is the main factor for the synthesis of nanoparticles. The result of the study demonstrated that the highest size of synthesized nanoparticle is 50 nm and the lowest size 10 nm, which are related to high rainfall and low rainfall regions respectively. The results showed the relationship between synthetic nanoparticles sizes and rainfall are significant $p\text{-value} < 0.05$. As the present study could be, conclude that the rainfall amount is effectively factor for the synthesis of the nanoparticle while other factors such as temperature, altitude and climate play a key role for properties of the plant, which is affect for size of nanoparticles.

Keywords: Plant, Green synthesis, Nanoparticle, Climate

Introduction

Nanotechnology is emerging as a new field of research dealing with the synthesis of nanoparticles (NPs) for their applications in various fields such as electrochemistry, catalysis, sensors, biomedicines, pharmaceuticals, healthcare, cosmetics, food technology, textile industry, mechanics, optics, electronics, space industry, energy science, and optical devices. The particles size lie in the dimension area of 1–100 nm is called nanomaterials. These materials are found to show enhanced properties based on size, distribution and morphology. Metal NPs and metal oxide NPs are considered as most efficient as these contain remarkable enhanced properties such as antimicrobial properties due to their increased surface area [1-10]. Physical and chemical methods for the synthesis of nanoparticles have been taken into consideration in recent decades, but many techniques are inefficient in terms of energy consumption and are considered as environmental pollutants. In most chemical methods, toxic and hazardous substances for humans and the environment . In addition, the chemical stability of particles in the chemical synthesis method is controversial and scale is very difficult. In addition, physical methods need to provide favorable conditions such as high temperature or high pressure. For this issue, the demand for nanoparticle synthesis has increased with environmentally friendly methods .Nanobiotechnology is a potential technology emerging from the combination of biotechnology and nanotechnology, which aims to produce nanoscale materials by developing environmentally friendly bio-based methods. Much Synthesis of nanoparticles using microorganisms, fungi, plants and algae, is a substitute for physical and chemical methods.Green synthesis is safe, simple, non-toxic and efficient compared to other mechanical strategies. The most necessary advantage of the plant