ID 3014

Green Synthesis of Zinc Oxide Nanoparticles using Basilica Leaf Extract and Their Potential Effect Application in Sunscreens

Khanfri Nassima [1*], Boucenna Ali[1]

[1] Petrochemical synthesis laboratory 1, Faculty of Hydrocarbon and Chemistry, M'Hamed BOUGARA University, Independence Boulevard 35000 Boumerdès, Algeria

*Corresponding author's email: n.khanfri@univ-boumerdes.dz

ABSTRACT

This diploma thesis focuses on the optimization of operating conditions for the green synthesis of ZnO nanoparticles, using Ocimum basilicum leaf extract as a reducing and stabilizing agent. Ocimum basilicum leaf extract as a non-toxic reducing and stabilizing agent, as well as characterization studies using X-ray diffraction (XRD) and infrared spectroscopy (IR). Optimization of operating conditions includes the variation of parameters such as temperature and pH. These influence the size, morphology and properties of the synthesized nanoparticles. In addition, we also addressed the preparation of solar cream based on zinc oxide, followed by pH tests, evaluation of antibacterial activity and determination of SPF levels, to guarantee their efficiency. To optimize the effect of T and pH, our results show that that only pH has an effect on the yield and size of NP's. The FTIR and XRD characterization of NP's confirms the formation and crystallization of the products obtained. The creams prepared with zinc oxide show an anti-irritant and protective against solar effects confirmed by the antibacterial effect and SPF test.

Keywords: Green synthesis, Nanoparticles, Zinc oxide, , SPF, X-ray Diffraction, Infrared spectroscopy, Suncream.

1. Introduction

Chemical and physical syntheses of nanoparticles cannot be easily developed to large-scale production due to several drawbacks such as the presence of toxic organic solvents, the production of hazardous by-products and high energy consumption. This could lead to an increase in particle reactivity and toxicity, which could harm human health and the environment due to the ambiguity composition and lack of predictability [1]. Therefore, the use of new biological methods that could be more environmentally friendly and cause no harm to the health of human and domestic animals, designing processes to control the morphology and size and size distribution of nanoparticles during their elaboration is thus necessary [2]. The present research topic enables us to learn about the synthesis of zinc oxide nanoparticles using Ocimum basilicum leaf extract. It is a strong commitment to give much more importance in the pharmaceutical, cosmetic and ecological fields.

2. Experimental

2.1 Preparing the extract

A weighed quantity of Ocimum basilicum powder was heated with of distilled water to 50°C under continuous stirring for 30 min. The extract obtained from the plant leaves was then filtered through Whatman filter paper and stored in a dark place until the time of use [3].

2.2 Preparation and optimization of ZnO nanoparticle biosynthesis

A solution of the previously prepared aqueous basil leaf extract was stirred for 30 min at room temperature and pH equal to 6, while a zinc sulfate precursor solution was slowly added to ensure proper dispersion of the zinc molecules in the reducing solution. The complete bio-reduction of zinc sulfate to Zn^{2+} ions was verified by formation of a precipitate. The resulting product was filtered and dried in an oven at a temperature of 110°C. then dried and calcined in a muffle furnace to obtain the white ZnO NP's product used for further studies [4].

DOI: 10.21467/abstracts.169 ISBN: 978-81-970666-4-1 (eBook)

2.3 Characterization

The composition of green synthesized both the ZnO NPs and CuO NPs is determined via Fourier transform infrared (FTIR) spectroscopy using Perkin Elmer (Model: Spectrum RXI – Mid IR, Range 400 to 4000 cm-1 Resolution 1 cm-1).The morphology of the NPs was studied by scanning electron microscopy (SEM, Quanta 400) a. The crystallinity of the NPs was evaluated by X-ray diffraction (XRD, Xpert-Pro, using Cu-Kα (1.54056 A) and 45 kV/40 mA).

2.4 Preparation of Sunscreen Cream

Sunscreen creams were developed by preparing the aqueous (Phase A) and oil (Phase B) phase separately [5]. The ingredients of the base sunscreen cream formulations are shown in Table 1.

Table 1: *Ingredients of the base sunscreen creams.*

Ingredients	Sweet almond oil	Glycerol	Glycerin	Distilled water	Zinc oxide Nanopartical	Stearic acid
Quantity	6 g	3 g	3 g	30 ml	0.5 g	0.2g

3. Results and Discussion

3.1 FT-IR spectroscopy analysis of synthesised ZnO -SEM analysis of synthesised ZnO -XRD analysis of synthesized ZnO

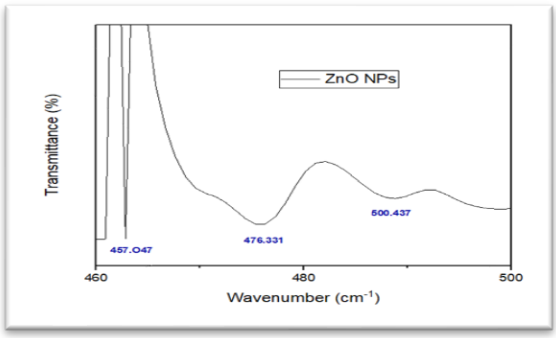

Figure 1: *XRD Pattern for synthesized ZnO NPs*

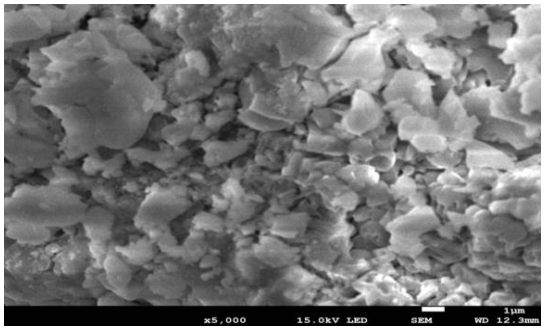

Figure 2: *SEM images of synthesized ZnO Nps*

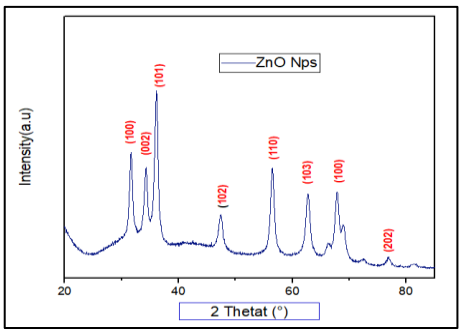

Figure 3: *Powder X-ray Diffraction Pattern for synthesized ZnO NPs*

3.2 SPF Performance of the Sunscreen Creams

The UV-A protective factor (UVAPF) evaluates the effectiveness of sunscreen products against UV-A rays. However, the SPF values for the sunscreen containing ZnONps was 4.94. Therefore, these results indicated that sunscreen containing ZnO Nps low UV-B sunburn protection. Additionally. Therefore, these findings demonstrated the benefits of introducing metal ions into the composite, including increased SPF values and UVAPF

4. Conclusions

In conclusion, this study explored the optimization of operating conditions for the green synthesis of zinc

ISBN: 978-81-970666-4-1
Series: AIJR Abstracts
DOI: 10.21467/abstracts.169

oxide (ZnO) NP's, using ocimum basilicum as a reducing agent. The aim was to improve the efficiency and durability of these materials while minimizing their impact on the environment. For the characterization of ZnO NP's, we carried out a number of analyses. The sun protection properties of zinc oxide as a UV filter have been exploited to formulate an effective and safe sunscreen.

References

[1]: Arumugam, Manikandan, et al. "Green synthesis of zinc oxide nanoparticles (ZnO NPs) using Syzygium cumini: Potential multifaceted applications on antioxidants, cytotoxic and as nanonutrient for the growth of Sesamum indicum." Environmental Technology & Innovation (2021).

[2]: Dadi, R. Synthèse de nanoparticules d'oxydes métalliques et leur activité antibactérienne [Phdthesis, Université Paris-Nord - Paris XIII]. (2019).

[3]: Espitia, P., Soares, N., Coimbra, J., Andrade, N., Cruz, R., & Medeiros, EZinc Oxide Nanoparticles : Synthesis, Antimicrobial Activity and Food Packaging Applications. Food and Bioprocess Technology, 5. . (2012).

[4]: Sastry, M., Ahmad, A., Khan, M. I., & Kumar, R. Biosynthesis of metal nanoparticles using fungi and actinomycete. Current Science. (2003).

[5]: Gabros, S., Nessel, T. A., & Zito, P. M. Sunscreens and Photoprotection. In StatPearls. StatPearls Publishing. (2023).

[6]: Dutra, E. A., Oliveira, D. A. G. da C. e, Kedor-Hackmann, E. R. M., & Santoro, M. I. R. M. Determination of sun protection factor (SPF) of sunscreens by ultraviolet spectrophotometry. Revista Brasileira de Ciências Farmacêuticas. (2004).

ISBN: 978-81-970666-4-1

Series: AIJR Abstracts

DOI: 10.21467/abstracts.169