

Biomedical Applications of Zinc Oxide Nanoparticles from *Spirulina Platensis* in Yae Khar Lake, Myanmar

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Abstract

The natural *Spirulina Platensis* is produced from the natural lake of Yae Khar lake in Myanmar. The aim of this poster is to apply biomedical application of Zinc Oxide nanoparticles from *Spirulina platensis*. Average crystallite size of zinc oxide nanoparticles from *spirulina platensis* was observed to be 17.74nm by using Debye Scherer equation with X ray Diffraction(XRD) instrument. It was found that zinc oxide nanoparticles can be used safely for the use of body lotion, face cream and nano balm because of the pH value and microbial testing (total plate count, yeast and mold count) of these products and they are under the acceptable level compared literature values.

Keywords: *Spirulina platensis*, nano balm, yeast

Introduction

Spirulina is a blue-green microalgae which grows in alkaline water. It is highly nutritious and actually a total food for human nutrition. Human can survive with *spirulina* and water without taking any other food. The *spirulina* can be found in the volcanic crater lakes and the natural lakes, having high pH level (9.5). *Spirulina* is gaining more attention in the medical science because of its nutraceutical and pharmaceutical importance. The natural *spirulina* is also produced from the natural lake of Yae Khar which is located between Sagaing Hill and Min Wun Hill in Sagaing Region of central part of Myanmar. (Ghaeni & Roomiani 2016).

Aim of this work

The aim this work was to achieve zinc oxide nanoparticles from *Spirulina platensis* by green synthesis and its biomedical applications. *Spirulina* samples were collected in Yae Kharr lake in Sagaing Region, Myanmar. Zinc oxide nanoparticles from *Spirulina platensis* synthesis were done by green synthesis. The prepared zinc nanoparticles were characterized by XRD and SEM techniques. The

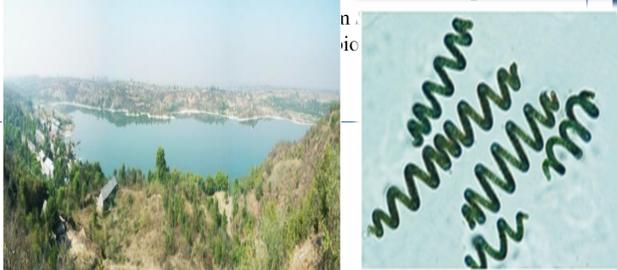


Figure 1. Location of *Spirulina Platensis* at Yae Khar Lake

Methods and Materials

The samples were collected from Sagaing June Pharmaceutical and Foodstuff Industry Ltd, Yae Khar Inn, Sagaing Division located at North Latitude 22° 02' 57.4" and East Longitude 95° 53'17.4". Yae khar lake produces *Spirulina platensis* naturally (Fig 1). All experiments and measurements were carried out at the Department of Chemistry, University of Yangon. The synthesized zinc nanoparticles were characterized by XRD (Rigaku Multiflex 2kW X ray diffractometer , Japan), SEM Scanning electron microscopy (SEM) (ZEISS) (Germany) and Atomic Force Microscope(AFM)(Bruker), N8 Rados (Germany). Dried powder *Spirulina platensis* (10 g) was extracted in 100 mL of deionized water in 250 mL beaker and mixed with 100mL of 1M zinc nitrate solution and adjusted to reach pH 7 and shaken and stirred for 30 min in a magnetic stirrer at 100 rpm at room temperature. Supernatant solution was removed and the pellet of this solution was taken. It was concentrated and heated in an oven (Tactical 308, Gallenkamp, England at 50°C for 8 hour until zinc oxide nanoparticles was obtained (Ali et al.,2015).



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Preparation of Face Cream on *Spirulina platensis* and zinc oxide nanoparticles

Beewax (1% wt) was placed in a 250 mL beaker and heated at 50°C. (9 % wt) of stearic acid, (5% wt) of lanolin, (10% V) of olive oil and (0.1% wt) of titanium dioxide were added into the mixture and then the mixture was stirred at 80°C for 20 min. The oil phase was obtained. Then *Spirulina platensis* 5 g was dissolved in distilled water (60% mL), and (2 mL) of triethanolamine were added into a 250 mL beaker and stirred for 10 min the water phase was obtained. The water phase was added into the oil phase at 80°C. The mixture was continuously stirred and cooled to room temperature. After cooling, (2% V) of fragrance oil was added into the mixture and stirred by using magnetic stirrer at the rate of 400 rpm. The spirulina face cream was filled into a bottle and then packed. Similarly, zinc oxide nanoparticles 0.1 g for face cream was carried out as mentioned above.

Preparation of Nano balm

Petroleum jelly and Paraffin wax are mixed and heated for 10minutes. It is marked as solution A. Camphor, Menthol, Eucalyptus oil and Peppermint oil are mixed and added 0.1g of zinc oxide Nanoparticles. It is marked as solution B. Solution A and B are for 15 minutes and kept to solidify to obtain Nano balm.

Apparatus used in the Characterization of Zinc Oxide Nano Body Lotion, Face Cream and Nano Balm

Arsenic Test Kit by Lovibond Tintometer GmbH (Germany), Autoclave, Stomacher (Homogenizer), Colony counter (magnifier-illuminator), 3 M petrifilm aerobic count plate, 3 M yeast and mold count plate, Incubator, and Bunsen burner were used in this work. Incubator, and Bunsen burner.

Dermatological Test

The dermatological test of body lotion, face cream and nano balm was determined using the open diagnostic patch test. The open patch test was best formed on the sensitive part of the skin like the bend of elbow, popliteal space, the skin behind ears in some instances, skin of the upper eyelid. The suspended cosmetic as actually was applied to 1 inch square of the skin and left uncovered. The patient was instructed not to wash it off or remove it in any other way. The site of the skin was inspected at the end of 6 h and if there was no reaction, the cosmetic may be applied to the some site of the skin. These tests were performed with persons and the results are tabulated in Table 1.

Results

Table 1 Characteristics of the Prepared Face Cream, body lotion and nano balm by using zinc oxide nano particles on *Spirulina Platensis*

Sr. No.	Characteristics	Experimental Values		
		Zinc oxide nano body lotion	Zinc oxide nano face cream	Nano balm
1.	pH	6.8	7.1	7
2.	Moisture (%)	6	7.34	8
3.	Total Plate Count (cfu/g)	<10 ³	<10 ³	<10 ³
4.	Yeast and Mold (cfu/g)	< 10 ²	< 10 ²	1 x10 ³
5.	Lead	ND	ND	ND
6.	Arsenic	ND	ND	ND
7.	Free Alkali	ND	ND	ND

Dermatological Test for body lotion, face cream and balm by using zinc oxide nanoparticles was performed with 10 girls practically. It was observed that there is no irritation on these girls by using these lotions

Table 2 Dermatological Test for Nano body Lotion, Face cream and Nano Balm by using Zinc Oxide Nanoparticles
Size of skin = 1 square inch
Testing time = 4 hours

Sr. No.	Males/ Females	Age (years)	Observation
1.	female	23	no irritation
2.	female	23	no irritation
3.	female	23	no irritation
4.	female	23	no irritation
5.	female	22	no irritation
6.	female	22	no irritation
7.	female	22	no irritation
8.	female	22	no irritation
9.	female	22	no irritation
10.	female	22	no irritation

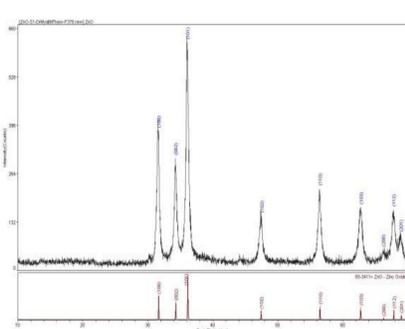


Fig.2 X ray diffractogram of prepared zinc oxide nanoparticles from *spirulina platensis*

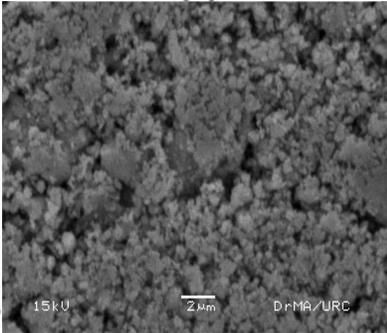
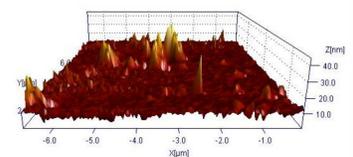


Fig 3 Morphology of Zinc Oxide nanoparticles by using SEM

Fig. 4 AFM image of zinc oxide nanoparticles from *spirulina platensis*

Discussion

Biomedical Application of Zinc Oxide Nanoparticles for the Production of Body Lotion, Face Cream and Nano Balm

The most favorable condition for the ingredients of prepared nano body lotion, face cream and nano balm by using zinc oxide nano particles were successfully achieved in this work. Quality and hazard of characteristics of zinc oxide nano body lotions, face cream and nano balm were investigated by determining pH, moisture, total plate count, yeast and mold, emulsion type, lead and arsenic. These results are shown in Table 1 and 2.

The prepared nano face cream, body lotion and nano balm have no skin irritation effect, and lead, free alkali and arsenic are in this product from for 2 months to till now. There is no hazard for human being according to the microbial profiles of all prepared skin lotion. Therefore, microbiological testing is essential to ensure the quality and integrity of the products. These applied research work shows that production of nano body lotion, face cream and nano balm by using zinc oxide nanoparticles were done in this work..

Conclusion

Production of zinc oxide nanoparticles was achieved by green synthesis and its method gave simple, eco friendly and low cost in this study. Average crystallite size of zinc oxide nanoparticles was found to be 17.74 nm by using Debye Scherrer equation. Results presented that zinc oxide nanoparticles exhibited a pronounced ability on biomedical applications. There is no hazard for the use of nano body lotion, face cream, nano balm based on the results and determination of pH, moisture, total plate count, yeast and mold, emulsion type, lead and arsenic.

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