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SYNTHESIS OF SILVER NANOPARTICLES FROM TISSUE EXTRACTS OF MARINE PUFFERFISH *AROTHRONSTEL LATUS*

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Abstract

Nanoparticles are having one dimension 100nm or less in size and due to their large surface area, they tend to react differently than larger particles of the same composition, allowing them to be utilized in novel applications. In the present investigation, acetic acid extract of skin, intestine, muscle and liver of puffer fish *Arothronstellatus* were used to synthesize silver nanoparticles using spectrophotometric analysis. Maximum level of nanoparticles present in muscles followed by intestine and liver. Silver nanoparticles are absent in skin. The optical analysis of the silver nanoparticles from muscles, intestine and liver extract demonstrated Plasmon peak absorption band at 440 nm and 600 nm.This baseline study will be a good reference document for the further research on marine fishes to develop drug from sea through the synthesis of nanoparticles .

KEY WORDS *Arothronstellatus*, Nanoparticles, marine fishes, peak absorption.

INTRODUCTION

Synthesis of silver nanoparticles by biological means is an important aspects of nanotechnology (Mohaerrer, *et.al.*,2012). Nanotechnology is an emerging scientific and considered to have a potential to generate new and innovative materials. Nanotechnology provides the ability to engineer the properties of materials by controlling their size and this has driven research towards a multitude of potential uses for nanomaterials (Saifuddin,2009).The medical properties of silver have been known for over 2,000years.Since the nineteenth century, silver based compounds have been used in many antimicrobial applications. Nanoparticles have been known to be used for numerous physical, biological, and pharmaceutical applications. Silver nanoparticles are being used as a antimicriobial agents in many public places, and they are said to show good antimicrobial action (Haefeli,1984).

Silver nanoparticles find use in many fields, and the major applications include their use as catalysed, as optical sensors of zeptomole (10^{-21}) concentration, in textile engineering in electronics, in optics, and most importantly in the medical filed as a bactericidal and as a therapeutic agent. Silver ions are used in the formulation of dental resin composites, in coatings of medical devices; as a bactericidal coating in water filters; as an antimicrobial agents in air sanitizer sprays, pillows, respirators, socks, wet wipes, detergents, soaps, shampoos, toothpastes, washingmachines and many other consumer products; and bone cements; and in many wound dressing (Li*etal.*,2010)

Biologically synthesized nanoparticles are of considerable interest in the area of biology and medicine due to their unique particle size and shape-dependence and their physical, chemical and biological properties (Ko*et al.*, 2007). Most of the previous studies employed biomolecules (proteins, amino acids, carbo-hydrates and sugars), different type of whole cells of various microorganisms (bacteria, fungi and algae), dissimilar plant resources (roots, leaves, flowers, bark powders, seeds, roots and fruits),extract of collagen(fish waste) or fish scale extract (*Labeorohita*) for the synthesis of metal nanoparticles (Dahl *et al.*, 2007; Kumar and Yadav, 2009; Huang et al., 2009; Laura *et al.,* 2010,Ramya, 2012, Sinha*et al.* 2014). Marine organisms are rich source of bioactive compounds with remarkable impact in the field of pharmaceutical, industrial and biotechnological product developments. In recent years, the researchers focusing research on synthesis of nanoparticles from marine sources (Asmathunisha and Kathiresan, 2013) and as such they'are both biocompatible and biodegradable which includes seashells, pearls and fish bones, and the particles ranged from 1 to 100 nm size. In the present work, the synthesis of silver nanoparticles from acetic acid extract of muscle, intestine and liver of marine puffer fish *Arothronstellatus* is carried out. Further silver nanaparticles were measured using UV-VIS spectrophotometer.

MATERIAL AND METHODS

Collection of specimen

Specimens of puffer fish *Arothronstellatus* (Laecepede, 1958) were collected from fish landing centre at Fishing harbour, Thoothukudi. Then they were washed with seawater and transported to the laboratory in dry ice and stored in deep freezer at 20^{o}C.

Preparation of acetic acid extract

Specimens of *Arothronstellatus*was thawed and dissected out in to tissues like skin, intestine, muscle, and liver. Ten grams of each tissue was homogenized with 50ml of 0.1% acetic acid and were kept in water bath around 45^{o}C for 10 minutes, cooled and centrifuged off. Then it was stored at the deep freezer for further used at -20^{o}C (Kawabata, 1979).

Synthesis of silver nanoparticles

Silver nanoparticles were prepared by AstaSileikaite *et al*, (2006).To the 5 ml of acetic acid of skin, intestine, muscle and liver of *Arothronstellatus*, 5 ml of 1 mM and 2 mM $AgNo_3$ were added separately and incubated at room temperature for 24 hours. After incubation period the samples changed into light brown indicating the synthesis of silver nanoparticles and were measured in spectrophotometer at 400 to 600 nm.

Results

In the visual analysis, the change of color indicated the synthesis of silver nanoparticles. Among the four tissue extracts tried, the muscle showed the maximum colour change yellow to brown followed by intestine and liver. The muscle produced maximum colour and showed the positive result. The skin produced no colour change and showed the negative result. The UV VIS spectra showed characteristic surface Plasmon peak adsorption band at 440 nm and 600 nm (Plate-1 Fig-1-3).

DISCUSSION

Biosynthesis of nanoparticles by means of physical and chemical processes is highly expensive. In order to reduce the inevitable expenses in downstream processing of the synthesized nanomaterials and to increase the application of nanoparticles, the scientific community targeted the biological organisms. Nature has devised various processes for the synthesis of nano- and micro- length scaled inorganic materials which have contributed to the development of relatively new and largely unexplored area of research based on the biosynthesis of nanomaterials (Mohanpuria*et al.*, 2008). In the present study , we have tried the synthesis of silver nanoparticles from the acetic acid extract of various tissues of puffer fish *Arothronstellatus*. The silver nanoparticles were confirmed by the formation of brown colour in muscle, liver and intestine.The UV spectrometric analysis peak value formation in the range of 440nm to 600nm

Sinha et al., (2014) have successfully developed an environment friendly, green, cheap and simple method for the synthesis of self assembled silver nanoparticles using a waste material extract of *Labeorohita* which itself played a dual role of stabilizing and reducing agent. Ramya (2012) described a cost effective and environment friendly technique for the synthesis of silver nanoparticles from 1mM silver nitrate solution through the extract of collagen obtained from fish waste. Divya and Sharma (2015) reported that the green synthesis of silver nanoparticles and effect of Coriandrumsativum in cadmium chloride induced white molly fishes.

Synthesis of nanoparticles with the help of marine resources accomplishes the need for safe, stable and environment friendly particles since it involves diverse marine ecosystem that is freely available and moreover this biological synthesizing method does not involve harmful solvents.and reduced downstream processing steps which shrink the cost for their synthesis.. The field of nano biotechnology is still in its infancy and more research needs to be focused on the mechanistics of nanoparticle formation from the marine resources which may lead to fine tune the process ultimately leading to the synthesis of nanoparticles with a strict control over the size and shape parameters.

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Photographs showing the synthesis of silver nanoparticles from acetic acid extract of skin, muscle, intestine and liver of *Arothron stellatus*

S - Skin
I - Intestine
M - Muscle
L - Liver

FIGURE – 1

UV – VIS absorption spectrum of silver nanoparticles in muscle of*Arothronstellatus*

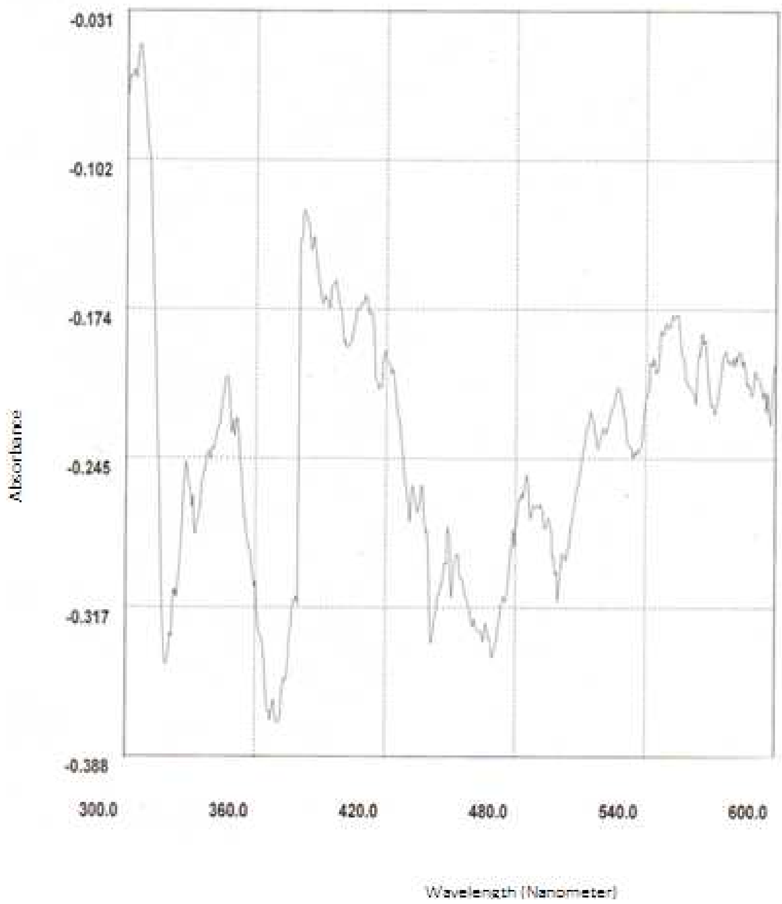


FIGURE – 2

UV – VIS absorption spectrum of silver nanoparticles in intestine of *Arothronstellatus*

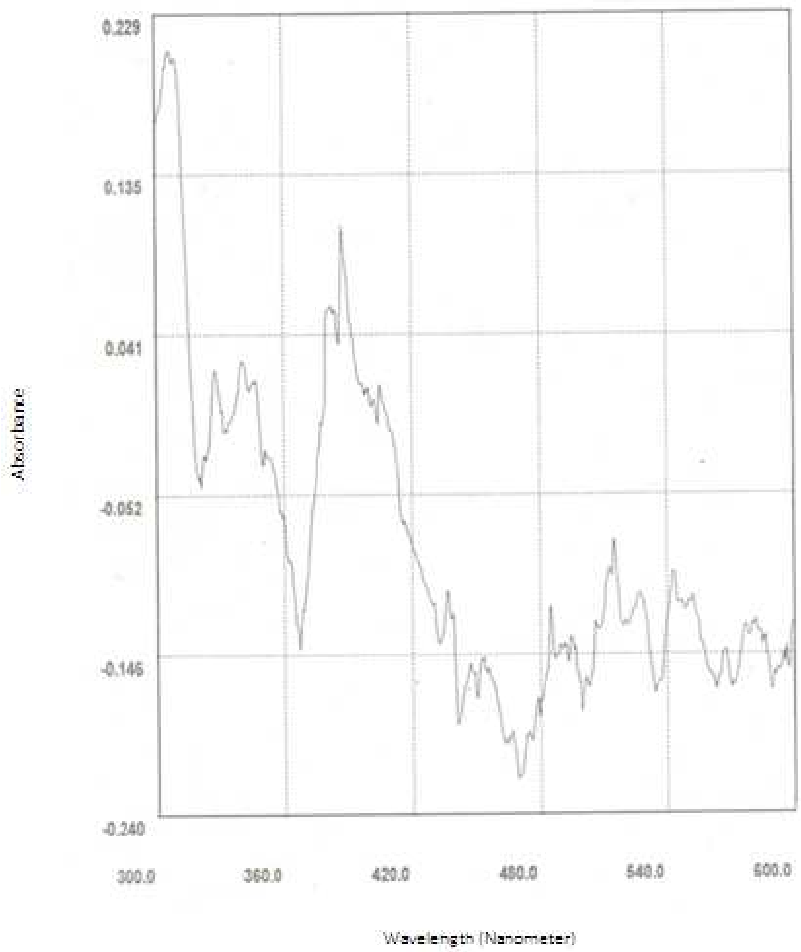
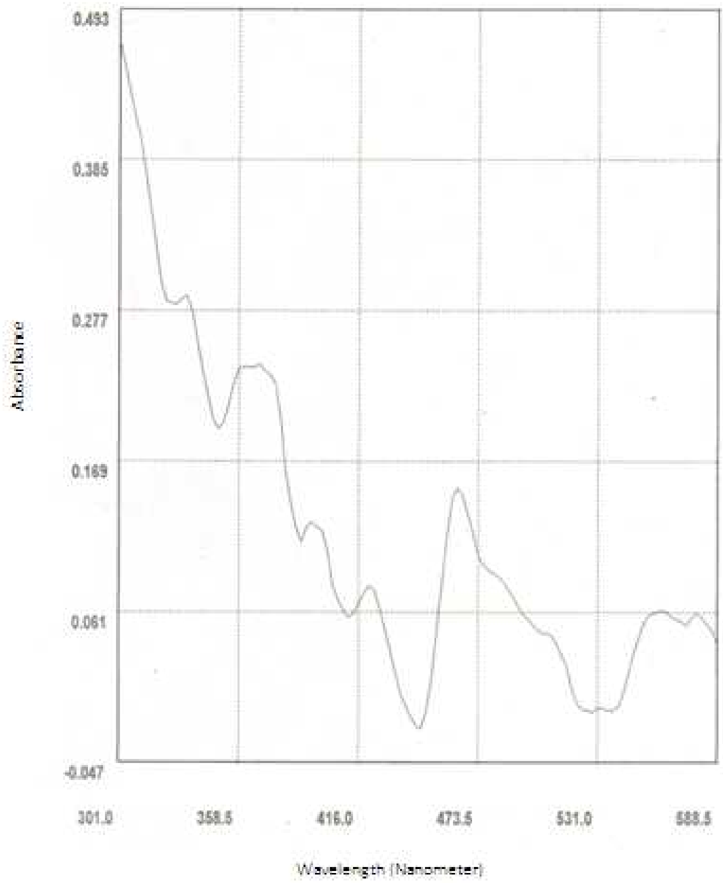


FIGURE – 3

UV – VIS absorption spectrum of silver nanoparticles in liver of *Arothronstellatus*



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