Green Synthesis of Selenium Nanoparticles using a Native Strain of Lactobacilli-An Innovative Approach

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Introduction

Selenium (Se), a trace element is fundamental and necessary to the mammalian health. This metal, in the form of selenocysteine, functions as a redox center of an array of selenoproteins, some of which have important enzymatic functions for homoeostasis, such as glutathione peroxidase (GPx), phospholipid hydroperoxide glutathione peroxidase (PHGPx) and thioredoxin reductase. Though its Recommended Dietary Allowance for adults is 55 µg per day, yet evidences suggest that higher intake (200 µg per day) can help protect the human body against free radicals which can cause degeneration and age related diseases as well as certain types of cancers. Se has been reported to enhance immunity, growth, reproductive performance and inhibition of pathogens. Elemental Se is considered as the least toxic of all selenium forms and supplementation with its nano-size particles has better bioavailability compared to its salts. Hence, it has significant importance in food, feed supplements and functional foods. A biogenic application employing microbial cultures as a better regulated process than chemical synthesis for the production of Se nanoparticles is an attractive functional strategy.

Objective

To produce and characterize Se nanoparticles from a native strain of Lactobacilli.

Methodology

The study involved evaluation of probiotic strain, *Lactobacillus reuteri* NCDC 77 (Sr-2) for its ability to produce Se nanoparticles.

Determination of elemental Se

The activated culture of *Lactobacillus reuteri* NCDC 77 (Sr-2) was inoculated in MRS broth containing different concentrations of sodium selenite and then incubated at 37^{o}C for 24-48h. The broth tubes were further centrifuged at 5000rpm for 10 min to obtain a pellet of elemental Se. It was subsequently dissolved in sodium sulphide and its absorbance was measured at 500nm.

Production of Se nanoparticles

Sodium selenite was added to the MRS broth containing *Lactobacillus* culture and incubated at 37^{0}c for 36-48 h. The cell pellet was obtained by centrifugation followed by cell lysis which was done by using 1.5X HCl. It was then incubated at room temperature for 5 days. After acid removal, it was centrifuged and ultrasonication was done to separate the aggregated selenium nanoparticles into separate entities. The Se nanoparticles so obtained were characterized by using Particle size analyzer (Malvern Mastersizer 2000) and Scanning electron microscope (Zeiss, Tokyo, Japan).

Result and Discussion

The optical density of the elemental Se solution obtained after dissolving the elemental Se in sodium sulphide varied from 0.068-0.104 at 500 nm. The particle size of the organic Se nanoparticles ranged from 117.2 – 269.9 nm as measured by particle size analyzer. The SEM images showed Se nanoparticles of 115-200 nm size.

Conclusion

The results of present study indicated that *Lactobacillus* species of indigenous origins are endowed with the ability to produce red and grey elemental Se nanospheres. These can be further characterized as a national bio-heritage to produce Se nanoparticles in the food and pharmaceutical industry as functional micronutrients.