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Preparation and Evaluation of Antifungal Activity of Arrow Root Mediated Selenium Nanoparticles Against Candida Albicans

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ABSTRACT

Aim: To determine antifungal activity of arrow root mediated selenium nanoparticles.

Introduction: The field of nanotechnology is one of the most active researches in modern material science. Nanotechnology is emerging as a rapid growing field with its applications in science and technology . It has also been used as the antifungal property and agriculture and anticancer therapy. The production of Se NPs increase the accidental exposure to humans and animals.

Materials and Methods: Selenium nanoparticle was prepared using arrow root extract and confirmed by UV-Visible spectrophotometer .The antifungal activity of the synthesized arrow root mediated selenium nanoparticle against Candida albicans was tested by well diffusion technique by standard procedure and the zone of inhibition exhibited by the selenium nanoparticle against the test pathogen the zone of inhibition was measured and graph was made.

Result: In the case of 50µL, the zone of inhibition for Candida albicans is 25 mm. This showed that Candida albicans has more activity in 50 µL concentration than standard . In the case of 100µL Candida albicans has the zone of inhibition of 29 mm shows that Candida albicans have the zone of inhibition more than standard. In the case of 150µL the Candida albicans the zone of inhibition is 32 mm. The nanoparticle has a greater zone of inhibition than standard.

Conclusion: From this we conclude that arrow root mediated selenium nanoparticle has very good activity against candida albicans which is more than standard antifungal drug. This might be a drug of choice in future.

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KEYWORDS

Selenium nanoparticles, Arrowroot, Antifungal, oral pathogens, Candida albicans

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INTRODUCTION

Arrowroot also is known as Maranta arundinacea. L. It is a less utilized local crop that is mainly developed in parts of Indonesia. This plant is cultivated or developed because it serves a very potential carbohydrate source and is considered to be one of the functional foods in Indonesia [1]. The other regional name of the plant is arrowroot, obedience plant, araru, ararao Bermuda arrowroot, maranta, hulan keeriya. The properties of the starch prepared from the arrowroot are its easy digestibility. It is also used in numerous foods such as cookies, vegetable sauces, puddings, and other baked goods items in the way of thickener. Arrowroot plant is mild tasting thus it is considered to be bland which makes it better for diets which is neutral[2]. It is especially suitable for people who are feeling nauseous. It is believed that the arrowroot plant helps to get relieved from the stomach ache. This is the main reason due to which it is used in health food stores mainly in arrowroot cookies in Indonesia. A large amount of starch and other related compounds are present in the arrowroot tuber. The starch obtained from arrowroot flour has a composition of nutrient variables such as 0.58% ash, 25.9% amylose, 11.9% water, 0.14% protein, 25.9% amylose, 8.7% insoluble dietary fiber, 0.84% fat, , and 5.0% soluble dietary fiber[3].The arrowroot tuber powder also has its specific action on the immune system as it might contain resistant starch acting as dietary fibers[4]. The immunostimulatory effects dealt with dietary fibers of arrowroot and prebiotics have been extensively studied [5]. Arrowroot contains a considerable quantity of iron, potassium and vitamin B, which has greater effects for the circulatory system, metabolism of cells and heart health-related problems. Arrowroot is also very helpful in decreasing the effects of constipation. It is also involved in controlling blood sugar levels [6].

Nanoparticles are tiny sized particles that have been synthesized by a series of different chemical and physical methods. The methods by which nanoparticles are synthesized include a photochemical method, reduction through a chemical method, c-radiation, and ablation by laser. Silver nanoparticles of silver between 1 nm and 100 nm in size . There are some superior and novel properties to Nanosized materials compared to macro-sized materials. Homogeneous nanoparticle suspensions play a very significant role in numerous industrial and scientific applications. For example, in colloidal science, high thermal conductivity fluids, nanotoxicological studies and nanofluidics [7] . Selenium (Se) is an essential element in the animal and human body in low concentration. Selenium is a necessary constituent of diet in at least 25 selenoproteins of human and selenocysteine containing enzymes [8]. The chemical synthesis selenium nanoparticles are mediated by acid decomposition, precipitation and catalytic reduction which is mediated by ascorbic acid, sulfur dioxide, glucose and sodium dodecyl sulfate[9]. Also, green synthesized selenium nanoparticles were found to be almost spherical shaped with a size range of 40 to 90 nanometre. This article provides information about the synthesis of selenium nanoparticles from the arrowroot and its effect on antifungal activity [10,11,12,13].

MATERIALS AND METHOD

Preparation of Arrow Root Extract

Fresh arrowroot powder extract is collected from the market, Chennai. 1g of these freshly prepared arrow root powder extract is mixed with 100 mL of water and boiled for 3-5 minutes in the heating mantle. Then these powder extract is filtered using filter paper into a conical flask (figure 1).

Figure 1: Preparation of arrowroot plant extract

Preparation of Selenium Nanoparticles

0.861grams of sodium silicate is added to 50 ml of distilled water. To this 50 ml of freshly prepared arrow root extract is added(figure 2). The solution is kept in the shaker. Readings should be taken for every two hours for analysing the synthesis of nanoparticles.Then after two hours the solution should be kept in magnetic stirrer and readings are noted down(figure 3) .After reaching the desired PH, The mixture was allowed in stirrer for two hours until the formation of white precipitate was observed and then this mixture is centrifuged for 10minutes and the pellet is collected.

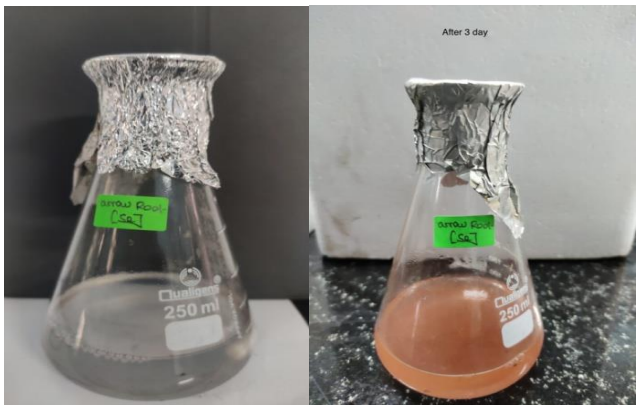

Figure 2: Green synthesis of arrow root mediated selenium nanoparticle.

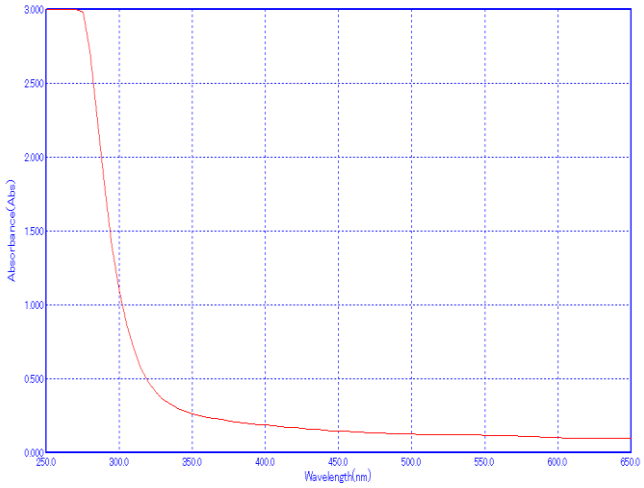

Figure 3: UV-Visible spectroscopy of arrow root mediated selenium nanoparticle

Preparation of Agar Plates

Similarly Ros Bengal powder was added to 100ml of water in a conical flask which was used for checking the antifungal activity. These two flasks were then kept in a pressure cooker for 3 whistles and the solution was collected . The solution was then poured in the sterile Petri dishes and thus the culture media was prepared for determining the antifungal activity of Se nanoparticles.

Preparation of Test Pathogen

The test organism Candida albicans are kept in nutrient broth for 24 hours and used for further experimental procedure. The agar plate is then autoclaved and solidified later. Following the preparation of nutrient agar, Candida albicans is spread on rose agar media on petri dishes and was well created.

Antifungal activity

The arrow root mediated silver nanoparticles were evaluated for its antifungal activity against Candida albicans using Rose Bengal agar medium. 50µL,100µL and 150 µL of the arrow root mediated selenium nanoparticles were loaded into the wells and incubated for 48 hours.The zone of inhibition was compared with standard drug fluconazole. After the incubation the appearance of a clear zone around the well which depicts the confirmation of antifungal property. The zone of inhibition was measured using scale and mean values were noted and corresponding graphs were made.

RESULT AND DISCUSSION

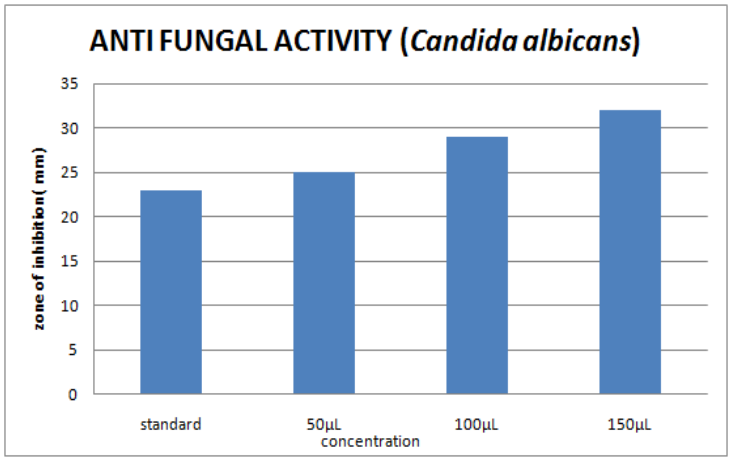

Figure 4 :Antifungal activity of arrow root mediated selenium nanoparticle against C.albicans

In the case of 50µL, the Candida albicans the zone of inhibition is 25 mm.This showed that Candida albicans has more activity in 50 µL concentration than standard . In the case of 100µL Candida albicans has the zone of inhibition of 29 mm shows that Candida albicans have the zone of inhibition more than standard. In the case of 150µL the Candida albicans the zone of inhibition is 32 mm (figure 4,5). This showed that Candida albicans has more activity than standard . As the arrow root mediated selenium nano particle has a great antifungal activity when compared with standard fluconazole standard drug for antifungal. Various studies showed selenium nanoparticles has a good antifungal activity similar to this study [14,15,16].

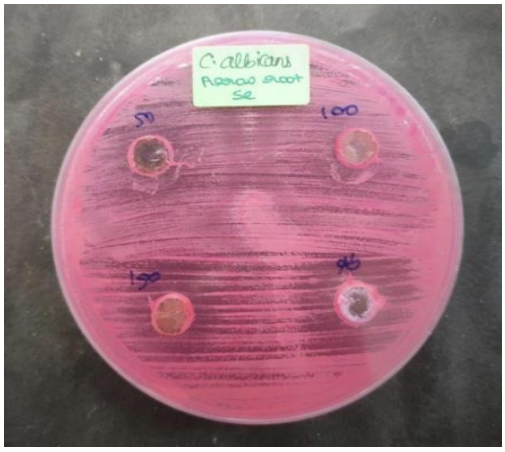

Figure 5: Antifungal activity of selenium nanoparticles

CONCLUSION

Arrow root mediated selenium nanoparticle showed good activity against tested fungi when compared to standard. Candida albicans show more antifungal activity than standard antifungal drugs This might help us to develop many drugs and products against fungi in future studies.

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CONFLICT OF INTEREST

The author declared that there is no conflict of interest regarding the publication of the article.

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