Antibacterial activity of selenium nanoparticles synthesized using *Maranta arundinacea* root extract

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**ABSTRACT**

*Maranta arundinacea* is otherwise known as arrowroot. It promotes weight loss, treats diarrhoea and stimulates the immune system. As Arrow root is rich in starch, it helps in good digestion by mild laxative in regulating the bowel movement. Also it reduces stomach pain and bloating. Selenium is a semiconductor so it is used in making electrical wires. It is used in potent chemotherapy. It is an anti-cancer agent due to its invasion of apoptotic pathway and cell cycle arrest. Usually the arrow root extract is available as powder. The powder is diluted and mixeds into sodium selenite solution and this combination is observed for 3 days. After 3 days, it is centrifuged and collected in a pellet form. The lactobacillus and streptococcus mutants are used for culture of organism for 1 day. The extract is tested for anti-bacterial activity. Result: It shows the sector where it can inhibit in Streptococcus mutans and lactobacillus.

**INTRODUCTION**

The metal nanoparticles were widely used in many biomedical applications such as treatment and diagnosis, especially the silver, gold, selenium, cerium oxide, copper and zinc oxide nanoparticles (Agarwal et al., 2017; Rajeshkumar and Bharath, 2017). The synthesis of selenium nanoparticle has gained interests because of their distinctive chemical and biological properties and are essential for potential applications in various fields (Santhoshkumar et al., 2017; Menon et al., 2017). Selenium as a micronutrient at an appropriate concentration is essential for human health due to its antioxidant effect (Rajeshkumar and Naik, 2018; Agarwal et al., 2018). Selenium deficiency leads to heart disease, hypothyroidism, and a weakened immunity (Menon et al., 2018; Shanmugam, 2016). Selenium nanoparticle have excellent biocompatibility, bio efficiency, and low toxicity as compared to various organic and inorganic form of selenium (R et al., 2019). Selenium nanoparticle plays a major role in human body by accomplishing essential biological functions like oxide reduction, anti oxidant defence, thyroid hormone metabolism and immune response (Guibliers et al., 2017). Elemental selenium nanoparticle are useful in medicine, in environmental remedies and in material science. Biosynthesized selenium nanoparticle by bacteria are cheap, eco friendly and have a lower cytotoxicity in comparison with chemically synthesised one (Xu et al., 2018). Selenium nanoparticle particle have extensive application. The bio fabrication of selenium nanoparticle can be potentially useful in various field. Selenium is a semiconductor which is used in many applications like photovoltaic cell, rectifiers, photographic exposure meter, etc. Selenium serves as a strong...
Figure 1: Preparation of extract of *Maranta arundinaecea*

Figure 2: Green synthesis of selenium nanoparticles using arrow root

Figure 3: UV visual spectroscopic analysis of selenium nanoparticle
Figure 4: Antibacterial activity of S. mutans and Lactobaccilus sp

Graph 1: Antibacterial activity of SeNPs against Lactobaccilus sp

antimicrobial and anti carcinogenic agent against a variety of cancer (Sharma et al., 2014). Selenium has been investigated for various medicinal applications. Selenium reduces risk of cancer (Webster and Tran, 2011). Plants have been an important source of medicine for years. Maranta arundinaceae has properties of antioxidants and free radical scavenging. Common name for *Maranta arundinaceae* is arrow root. It is an edible rhizome which can be easily digested as edible starch. The name arrowroot derives from its medicinal use as a poultice to remove arrow poison from wound. It has a long history of use in traditional herbal medicine and this plant is used as a natural source of calcium and used in treatment of indigestion, diarrhoea and urinary infection (Ruba and Mohan, 2013). Arrowroot contains plenty of starch and other compound. The starch from arrowroot flour has a composition of water, amylose, protein, fat, insoluble dietary fibre and soluble dietary fibre (Kumalasari et al., 2012). *Maranta arundinacea* is a tropical and perennial tuberous plant and belongs to the family of Marantaceae. It contains starch 20% of starch in its tuber. Arrowroot increases digestion and it is used as nourishing diet for convalescents, mainly in bowel illness. Arrowroot is a traditional medicine for its demulcent properties (Rahman et al., 2015). *Maranta arundinacea* is a medicinal plant used to treat diarrhea and urinary track diseases (Shintu et al., 2015). Selenium is usually found in the selenium nanoparticle which is used as new member of drug as nano-carrier in medicine (Alagesan and Venugopal, 2019).
MATERIALS AND METHODS

Preparation of plant extract

Figure 1 shows the powdered extract of Maranta arundinaecea. 100 ml of distilled water was added to arrowroot extract. Arrow root extract is available as a powdered arrowroot rhizome and the boiling of the extract for 5 minutes and it is filtered with the help of funnel and filter paper. It is filtered drop by drop. 0.519g of sodium selenite is added to the extract. Thus the extract is prepared. 60ml of water was added to a sodium selenite solution. 40 ml of extract was added to sodium selenite solution with the help of measuring jar.

Synthesis of selenium nanoparticle

It is observed for three days with the help of shaker and magnetic stirrer. Figure 2 shows the selenium nanoparticle on the first day of preparation. The readings of the extract were taken through UV visual spectrometer at an interval of 2 to 8 hours. Figure 2 shows that colour change of selenium nanoparticle after 3 days. Further to the change of colour from white to pink, it is centrifuged at 8000 rpm. Figure 2 shows the centrifuged selenium nanoparticle and it is collected in a pellet. Nanoparticle possesses increased surface area and therefore increasing the area of interaction with pathogenic bacteria. It enters the bacterial surface then micron particle due to smaller size, exerting stronger effect on bacterial target (Singh et al., 2014).

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The culture plates are prepared with Muller Hilton agar for one day. The bacteria used for culture are streptococcus mutans and lactobacillus. Figure 4 shows the zone of inhibition in Streptococcus mutans and Lactobacillus in culture plate. Streptococcus mutans cause dental caries and lactobacillus. Selenium nanoparticle that were made into pellets are collected in a micropipette and it is loaded in the culture plate.

RESULTS AND DISCUSSION

Visual observation

Reduction of metal salt into metal nanoparticle by bio molecules is always used accompanied by colour change of selenium nanoparticle (Forssten et al., 2010). In the present study it shows that selenium nanoparticle is synthesised using arrowroot extract that gets converted to pink coloured solution. Usually colour change indicates the production of nanoparticle synthesis of nanoparticles (Figure 2).

UV visual spectroscopy

Figure 3 shows the analysis of selenium nanoparticle at second day in UV visual spectroscopy. From first day it shows some reduced peak in graph. Then, it gradually shows the graph attains a steady slope. This steadiness shows that the production of selenium nanoparticle. This UV spectroscopy study takes place in three days.

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Figure 4 shows its inhibition on streptococcus mutans and lactobacillus. Thus, it shows antibacte-
trial effect. Streptococcus mutans is a gram positive bacteria in cocci. It causes tooth decay which in turn causes dental caries. It is also called oral streptococcus. Lactobacillus is a bacteria which is found in milk. It is a good bacteria which helps milk in converting to curd overnight. Thus it also causes dental caries when consumed excessively. The dental caries is the most common and costliest disease in the world which may be cured using nanoparticles (Rajeshkumar et al., 2019).

Graph 1 describes that lactobacillus shows maximum sector of inhibition at 50 μl of selenium nanoparticle and least zone of inhibition shows an absence of the selenium nanoparticle. Graph 2 describes that streptococcus mutans shows maximum zone of inhibition at 150 μl of selenium nanoparticle and least zone of inhibition shown at absence of selenium nanoparticle.

Lactobacillus shows maximum zone of inhibition at 50 μl which is the least concentration of selenium nanoparticles. Streptococcus mutans shows its maximum zone of inhibition at 150 μl which is the highest concentration of selenium nanoparticle.

CONCLUSIONS

Selenium nanoparticle synthesised using *Maranta arundinacea* that is commonly called as arrow root exhibits an inhibition in Streptococcus mutans and Lactobacillus. It can be further developed as toothpaste and some other dental products to control the dental caries.

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Conflict of Interest
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