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Synthesis of Silver Nanoparticles from *Fargesia Sp*. Jiuzhaigou leaf and investigating it's effects on plant growth

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ABSTRACT

Silver nanoparticles are assumed to enhance nutrients efficiency in plants. Silver nanoparticles are one of the most widely used and expected to enter natural ecosystem. Nanoparticles have potential to improve growth and yield of wheat plant. They interact with plant causing many morphological and physiological changes. The present work highlights the role of nanoparticles on plant development. The study focuses the impact of silver nanoparticles on root length, shoot length, seed germination rate. The green synthesis was done by using the aqueous solution of Fargesia sp. Jiuzhaigou (Bamboo) leaf extract and AgNO3. A fixed ratio of plant extract added into $AgNO_3$. The solution was prepared and the colour change was observed which proved formation of nanoparticles. The nanoparticles were characterized by XRD. The size of nanoparticles is observed in the range from10-30 nm. The study indicates that the silver nanoparticles synthesized have positive growth promontory effects on growth of wheat seedlings.

Keywords: Silver Nanoparticles, root length, shoot length, plant growth.

1. INTRODUCTION

Use of nanoparticles in agriculture is consistently increasing. Silver nanoparticles have remarkable uses in crop production [1]. Application of nanoparticles has been found to improve germination, enhance growth and physiological activities, fertilizers use efficiency [2]. Plants provide a better platform for nanoparticles synthesis. They are free from toxic chemicals and provide natural capping agents. Moreover, use of plant extracts also reduces the cost of microorganisms isolation and culture media enhancing the cost competitive feasibility over nanoparticles synthesis by microorganisms. Nanoparticles interact with plants causing many morphological and physiological changes [3]. Efficacy of nanoparticles is determined by their chemical composition, size, surface covering, reactivity, and most importantly the dose at which they are effective.

2. METHODOLOGY

a. Preparation of agar:

Take about 0.8%agar (8gm in 1000ml) in distilled water. With continues stirring boil the mixture (Fig.1). Now pour the boiled mixture in beaker and cool-down the mixture naturally.

Fig.1: Agar preparation

b. Preparation of the nanoparticle solution:

The major advantage of using plant extracts for silver nanoparticle synthesis is that they are easily available, safe, and nontoxic. Fresh and green leaves of bamboo (*Fargesia sp. Jiuzhaigou*) were collected from the garden. They were washed several times with distilled water to remove dust particles on leaves. The leaves were obliterated by cotton and cut by plastic knife into small pieces. The leaves were boiled in the distilled water for 20 minutes. The extract is filtered by simple filter paper. Filtrate solution is kept in cold storage. 10 ml of filtrate is taken for further experiments and 2 mm concentration of $AgNO_3$ and 100 ml double distilled water is added in it. Resulting mixture is heated for 20 minutes. The colour change is noted (from faint white to dark brown) indicating confirmation of silver nanoparticles [4].

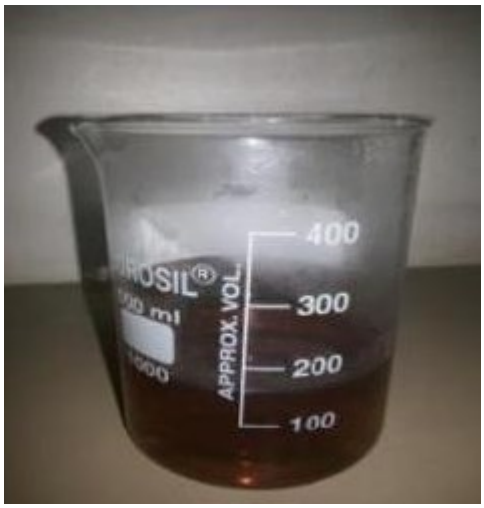

Fig.2: Nanoparticle solution

c. Germination of seed:

Wheat seeds were soaked in distilled water for controlled observations. Similarly wheat seeds were soaked in silver nanoparticle solution for 1hour, 1.5 hour and 2 hours respectively. After treatment seeds were sown in 0.8% agar gel at room temperature along with control. Observations were taken after 10 th day.

3. RESULT AND DISCUSSION

The seed germination rate, root length, shoot length were measured for 10 days. Photoshots on 5th day,7 th day,9 th day and 10th day are shown in Fig3, Fig.4, Fig 5, and Fig 6 respectively.

Fig.3: Photoshot on 5th day (Controlled, 1 hr, 1.5 hr, and 2 hr soaked)

Fig.4: Photoshot on 7th day (Controlled, 1 hr, 1.5 hr, and 2 hr soaked)

Fig. 5: Photoshot on 9th day (Controlled, 1 hr, 1.5 hr, and 2 hr soaked)

Fig. 6: Photoshot after 10 day(Controlled, 1 hr, 1.5 hr, and 2 hr soaked)

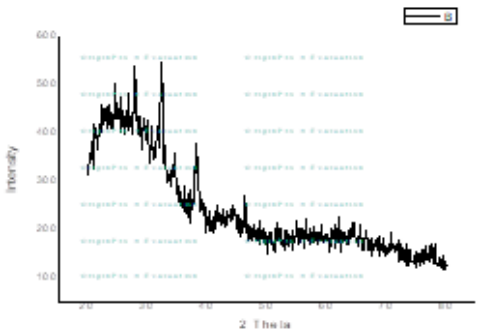

Fig.7: XRD of silver nanoparticles

A typical XRD spectrum of silver nanoparticle is shown in Fig7 and particle sizes are shown in Table1.

Table 1: A typical XRD spectrum of silver nanoparticle

Peak	2θ	β	D nm
111	0.59	0.0051	28.45
200	0.45	0.00392	35.35
220	0.15	0.002616	45
110	0.4	0.0035	39.63

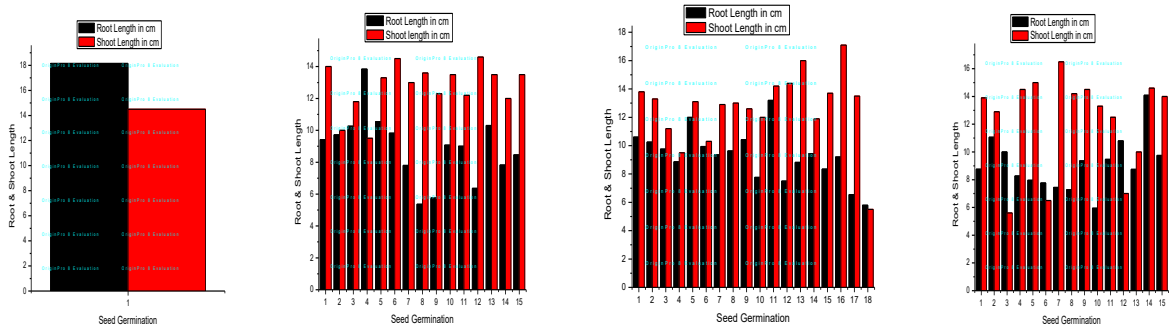

Fig.8: **Normal Wheat** **1 Hour Soaked** **1.30 Hour Soaked** **2.00 Hour Soaked**

Variation in Root Length & Shoot Length:

The changes in root length and shoot length when seeds are soaked in nanoparticles for 1 hour, 1.30 hours and 2 hours are shown in Fig.8.

CONCLUSION

The synthesized nanoparticles under laboratory conditions It is observed that nanoparticles they play an important role in seed germination and seedling growth of wheat. When seed were soaked in silver nanoparticles there was a significant enhancement in germination percentage as compared to control conditions. The number of seeds germinated increased in the case where wheat seeds were soaked in nanoparticles for 1 and half hour. A significant positive influence on root length and shoot length was observed for all seeds in compared to those of unexposed control germination. Present study indicated that shoot length after treatments has considerably increased in place of root length. Nanoparticles can promote Plant germination in earlier stages, significant enhancement in germination percentage as compared to control. The number of seeds germinated increased when soaked in nanoparticless for 1 and half hour and there is significant increase in root length and shoot length.

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