

Green Synthesis of Silver Nanoparticles from In-Vitro Propagated Eucalyptus Plant: Agriculture and Therapeutic Applications

INTRODUCTION:

The use of plants in medicinal as well as commercial area is increasing as world is now rapidly moving towards organic products and this huge change has been seen due to the great success gained by plants in each field. Eucalyptus is a herbal plant that belongs to Myrtaceae family which consist of approximately 650 species and considered to be the second largest group of widely implanted herbal plant all over the world . Species of eucalyptus are gaining interest for the researcher due to its huge importance in all commercial, industrial and pharmaceutical sectors. Eucalyptus is planted in the areas that are prone to drought conditions and used as a wind breaker for the farmers, windbreaks are useful for reducing the amount of water use by the crops. For increasing the yield of crop fertilizer are used .Chemical fertilizer are the inorganic source of nitrogen, phosphorous and various other chemicals that are the fundamental need of plants ,while organic fertilizer are the by product or remains of organisms.

For more and better yield of crops different and modern techniques are used, Nano technology is an emerging field of science and with the passage of time this technology is also implemented in agriculture sector. Nano particles made from organic source are used as a nanofertilizer,nanopesticide which not only reduces the cost of the product but also provide the sufficient amount of nutrient for longer period of time.

PROBLEM:

The use of chemical fertilizer has been decreasing day by day as its harmful effect are being notified daily .The main problem of using chemical fertilizer is the acidification of soil and land

erosion by its too much utilization ,while reducing its quantity it results in stunting growth of plant ,reduction in the nutrient and pH alteration. However, applying excessive amounts of fertilizer leads to the release of harmful greenhouse gases into the atmosphere and the hyper tropic condition of our water. Basically the use of fertilizer is not reducing but it is being shifting towards the utilization of organic fertilizer. Organic fertilizer are the fertilizers that are naturally synthesized from organic waste i.e. kitchen waste, fruit peels with the use of microorganisms etc which are used as a nutrient providing material and are necessary for the growth of plants. Introducing organic fertilizer provides an eco-friendly environment and removes all the harmful effect that were seen by the use of chemical fertilizer but hence this makes the product costly and the main problem still resides there that is the unwanted or excessive amount of fertilizer are drained off into lakes and river and badly effect the marine life ,by the formation of unrestricted amount of algae which decreases the oxygen needed by the aquatic ecosystem.

SOLUTION:

The use of fertilizer can't be reduced but its alternative can be made, the best alternative for organic fertilizer is the nanofertilizer. Nanofertilizer is based on an approaching field called Nano technology , and it is a technology in which the matter is been produce up to the nano scale to manipulate it in different structure with different function. Using nano technology to produce nanofertilizer has a great advantage i.e. it removes environmental contaminants like heavy metals and inorganic and organic pollutants. It is responsible for providing one or more types of nutrients to growing plants, which ultimately increases agricultural yields. Eucalyptus plant is a herbal plant with a crucial component 1, 8-cineole.and their major active compounds which has exhibit toxicity against a huge range of microbes, including fungi, bacteria, soil-borne and post-harvest pathogens. Enhancement of those secondary metabolites with various chemical elicitors such methyl jasmonate and salicylic acid in the suspension culture of Eucalyptus plant and producing nanoparticles from the callus of the plant will provide better substitution of these fertilizers as it increases the surface area of the compound thus reducing the quantity. The most favored nanoparticles as a nano-fertilizer are made up of silver, copper and zinc. Nanoparticles are used to boost chemical reaction. It has been already reported that metabolites are present in much more higher concentration in *In Vitro* propagated culture than the normal plant. So the production of nanoparticles from the callus of Eucalyptus will provides higher yield of crops.

OBJECTIVES:

- To obtain in-vitro propagated cultures of eucalyptus plants.
- To enhance the secondary metabolites of eucalyptus with various elicitors by using in -vitro propagated callus, cell suspension cultures.
- To synthesize the silver nanoparticles from in-vitro propagated eucalyptus cultures and perform their characterization such as UV Spectroscopy, SEM and FTIR.
- To evaluate the effect of these Ag nanoparticles on various biological activities such as anti-microbial, anti-oxidant and its effect as nano-fertilizers on different plants growth parameters.

COST:

| s.no | PHASES | COST |
|-------------|--|-----------------|
| 1 | Tissue culturing and secondary metabolites enhancement | 2,50,000 |
| 2 | Synthesis and Characterization of Silver Nano particles | 1,00,000 |
| 3 | Biological activities | 1,25,000 |
| 4 | Total | 4,75,000 |

certain biological analysis of nanofertilizer such as total phenolics content, protein estimation, concentration of photosynthetic pigment will be done with the collaboration of Institute of Sustainable Halophyte Utilization (ISHU), University of Karachi

TIME LINE:

It is a one year based study ,it include micro propagation of Eucalyptus plant by indirect organogenesis ,elicitation of secondary metabolites , formation of silver nanoparticles from the callus and leaves of normal plant, and testing it on different plant to check its properties as a nanofertilizer. It is a comparative study.

SUMMARY:

Eucalyptus plant has been studied in a wide spectrum for different purposes both nationally and internationally but still the use of eucalyptus for the agriculture purposes such as green synthesis of nano-fertilizers, nano-pesticides requires great attention. The eucalyptus plant itself consist of an active compound known as Cineole which provides anti fungal, antibacterial effect ,firstly the *in vitro* propagation of eucalyptus plant is necessary for two reason as Micro propagation has the potential to provide very high multiplication rates by providing true type clones. And secondly we can provide an additional step of increasing its secondary metabolites by various chemical elicitors and then forming silver based nanoparticles from the callus of the plant and using it as a nanofertilizer is believed to produce better and faster growth of other plants. The green synthesized nanoparticles are gaining interest in the field of agriculture due to its low to no-side effect as compared to synthetic fertilizers and pesticides. and also Nano-fertilizer offers a slow and gradual release of nutrients for a more extended period of time. This resolves the problem of the fertilizer i.e. it does not affect the marine life.

Working on the betterment of plant is important as the economy of our country highly depends on Agriculture. The production of Ag based nanoparticles from the *Invitro* propagated eucalyptus cultures with the enhancement of secondary metabolites will provide better utilization of these Nps both in health and agriculture sector.