

Green Synthesis of Nanoparticles (Plant metabolites)

Abstract:

The chemical reaction usually involves organic compounds like Flavonoids, Alkaloids, Terpenoids, Polyphenols etc, reacting with metal ions to create a metal nano-particle. The chemical constituents of plant extracts in the process act as reducing agents as well as stabilizing agent for the nano-particle. There are a number of ways of synthesizing nanoparticles, one such way is using biomolecules from plant extracts to reduce metal ions to nanoparticles in a single step. The process is quick, easy and can readily be scaled up. The process also has an added advantage of being environmentally benign, as it majorly involves water soluble plant metabolites. Majorly silver and gold nanoparticles are processed using these metabolites. There are a number of methods of making nanoparticles using plant extracts.

Introduction

Nanotechnology is the term given to those areas of science and engineering where phenomena that take place at dimensions in the nanometre scale are utilised in the design, characterisation, production and application of materials, structures, devices and systems. Nano technology is one of the most rapidly progressing fields of technology and it has opened up numerous new frontiers of research for us. Its advent into the field targeted drug delivery, therapeutic actions and as bio sensors has captured the imagination of the scientific community and various methods are being devised to form new nanoparticles with more specifications, scientists are striving to come up with methods which let us control the shape, size, specificity and other characteristics of the particles more closely. One of the most useful and revolutionary techniques coming up presently is synthesis of nanoparticles using plant extracts and their subsequent action. The formation of nano particles using plant extracts has a major edge over methods in terms of its interaction and effect on the environment; it is completely environmentally friendly and does not pose any threats even from its waste. The time required for the formation of particles is also within acceptable limits and with the ease of getting the requisite plants make it one of the best options available in this field to develop the particles. In this report we will expound various methods and the uses of manufacturing nano particles, which are fast becoming indispensable to us, using plants.

Significance of Plant Metabolites and Uses:

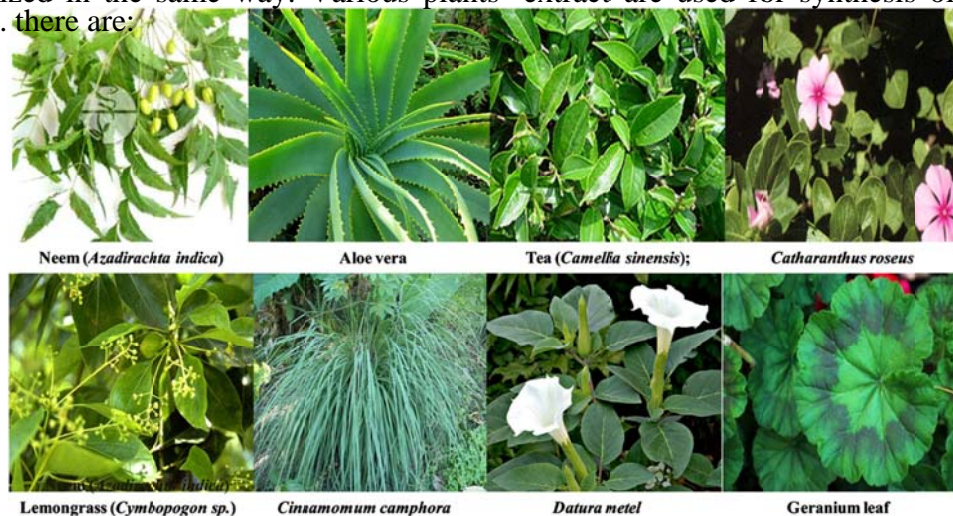
This report concerns synthesis of metal nanoparticles using plant metabolites. Even though nano particles can be developed using physiochemical techniques, they're lack of being environmentally benign causes a lot of problems. Especially, when there intended use is for the development of medicines. Environment factors are not the only reason biological synthesis is preferred, also because it can be used to produce large quantities of nanoparticles that are free of contamination and have a well-defined size and morphology. The use of plant metabolites to reduce metal ions has been known for a long time, although the nature of the reducing agents had been unknown for a long time. Processes for making nanoparticles using plant extracts are readily scalable and may be less expensive compared with the relatively expensive methods based on microbial processes or whole plants.

An important significance of plant extracts, in context of synthesizing nanoparticles, is that they act as both reducing and stabilizing agents. The nature of nanoparticle synthesized depends on the source of the plant extract. This aspect can also be utilized in making nanoparticle of preference. This happens because different sources of plant contain different concentrations and combinations of organic reducing agents.

Plants being used to reduce metal ions has been done for a long time, dating as back as early 1900s. But this practice was restricted to the use of whole plant extracts or plant tissues only. Compared to this the use of plant extracts to synthesize nanoparticles is much simpler. They act as both reducing agents and stabilizing agents.

Use of Plant Extracts in Nano Particle Synthesis:

During the process of production of metal nanoparticles, the plant extract is simply mixed with a solution of metal salt at room temperature. It is a quick reaction and usually takes only minutes to complete. Nanoparticles of Gold, Silver and various other metals have been synthesized in the same way. Various plants' extract are used for synthesis of metal nanoparticle. there are:



(Taken from reference No. 2)

Nanoparticle properties and production time depend on various characteristics of Plant extract, namely:

- its concentration,
- the concentration of the metal salt,
- the pH,
- temperature; and
- contact time

Advantages of using Plant extracts:

1. The production of nano particles using the chemical methods has been raising concern among the environmentalists as they have an adverse affect on their ecology, hence the use of plant extracts for the formation of nano particles is being favoured due its salubrious nature towards the environment. Even in the industry it produces much less toxic waste.
2. The plants supplement both the reducing as well as stabilizing agents for the nano particles which otherwise have to be externally added in other methods.
3. The chemical method is being proven less economically beneficial as compared to the plant method as the maintenance cost is much less and the waste disposal requires less effort among other factors.
4. This method is even better than using the biological method as the maintenance of whole plant system is much less than a culture of bacteria which needs a myriad of phenomena to be taken care of.
5. Recent studies have shown that the therapeutic effects of plants , from which the nano particles are being derived, can also be imbued upon the particles hence providing us with perfect vehicles to the therapeutic materials to act upon the site of action as well as eliminating the need to artificially develop a drug for that particular ailment.

Source:

<http://nptel.ac.in/courses/118107015/10>