5. SUMMARY AND CONCLUSION

The biogenic synthesis of silver nanoparticles (AgNPs) and gold nanoparticles (AuNPs) have been carried out using four different plant extracts as reducing agent as well as stabilizing agent for the nanoparticles. We have synthesized AgNPs and AuNPs at different experimental conditions under room temperature condition. The influence of temperature on particles growth, pH of the medium and optimize the amount of plant extract required for the complete reduction. To avoid the decomposition of the biologically active compounds and some of the plant enzyme, we have heated the samples at low temperature ranges (upto 80°C). We have synthesized the different shape Ag and AuNPs with the assistance of the plant extracts. Sometimes the plant extract act as stabilizing agent as well as shape directing agent. Microwave heating also have demonstrated which have an additional advantages like uniform heating the samples in all directions. Also the reaction medium reaches the maximum temperature within a short period of time. Thus this technique also called as green chemistry method for the synthesis of nanoparticles. Because of microwave heating, the shape and size of the particles are very much affected. By keep all facts in mind, we have taken all necessary precaution to synthesis Ag and AuNPs by microwave irradiation.

We have demonstrated the plants and fruit extract such as Aloevera, Ficus carica, Cardiospermum helicacabum and Phyllanthus niruri could be an excellent bioreductant and stabilizing agent and easily available plant source for green synthesis
of silver and gold nanoparticles. The results obtained from the overall studies we have concluded entire results in the subsequent paragraphs.

1. The bioactive compound present in the plants and fruit extract like aloin, quercetin, phyllanthin and cardiospermin were identified by HPLC technique. We believed that these are the bioactive compound which are mostly responsible for the reduction of silver ion and gold ion to yield brilliant colored silver and gold nanoparticles.

2. The progress of the reduction of auric chloride and silver nitrate in presence of the plant extracts which were collected by either water or methanol as solvent. The shape of silver and gold nanoparticle is spherical in nature which were synthesized at room temperature. The average particle size of the silver and gold nanoparticles obtained in this study is less than 50 nm and 100 nm by using biogenic approach. The influence of pH, extract concentration and the order of the addition were optimized to obtain uniform size particles. The influence of heating rate on particles growth is also investigated. At higher temperature ranges the particles are bigger in shape and some times the shape and size can be altered.

3. When the heating of the reaction mixture was carried out under microwave irradiation condition the silver nanoparticles tuned to octahedron, tetrahedron, rod, denticrinitic, nanocube and distorted spherical shape. Similarly we have obtained cubic shaped gold nanoparticles under microwave irradiation. Thus the mode of heating is also affecting the size and shape of the particles.
4. The nature of binding of stabilizing agent, particles size, shape and crystallinity were analyzed with FT-IR, XRD, SEM, and TEM techniques.

5. The overall observation within a hour about 90 % yield of nanosized Ag and Au using the natural extracts as reducing agent which are faster and time consuming when compared with conventional chemical synthesis. Hence this biogenic synthesis is also called green chemistry approach.

6. It is well established that silver based nanoparticles can be utilized for the antibacterial studies. From the antimicrobial studies it is inferred that the silver nanoparticles containing plant extracts exhibit excellent bacteriostatic effect against microorganism. The combined form of the plant extract containing silver nanoparticles show an enhanced antimicrobial effect. Hence we can use the combined extract nanocomposite to cure microbial resistant microorganism and

7. Metal complexes of gold and silver and anticancer agent stabilized gold and silver nanoparticles anticancer activity has been reported in the literature. Hence we have done detailed studies to find out the anticancer activity of gold and silver nanoparticles synthesized by the green chemistry approach.

The proposed green chemical synthesis of gold and silver nanoparticles using plant extract is simple, convenience and can be used for the large scale synthesis without use of any toxic chemical and harmful solvents. So the proposed method is considered as environmentally benign approach for the synthesis of nanoparticles.
FUTURE WORK

These finding are important milestone for the future finding. The findings in this study have led to other research questions which answered may increase the knowledge and understanding the importance of inorganic metal nanoparticles in nanotechnology. From this study, it would be important for the relevant applications of biosynthesized nanoparticles to,

1) Optimize the condition responsible for the synthesis of homogeneous size and shaped nanoparticles by using medicinal plants extracts.

2) Understand the mechanism that leads to the oxidizing/reducing of metal ions from bioactive molecules attached to or interacted with these particles.

3) Determine the mode of inhibition of antibacterial and cytotoxicity of these nanoparticles establish them as a antimicrobial or anticancer agents.

4) Other than the biological application, we are planning to utilize the plant extract stabilized gold and silver nanoparticles for catalytic reduction of nitrophenols, textile effluents and removal of organic pollutants.