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A STUDY OF GOLDEN ASH AS NANO-PARTICLE: METHODS OF FORMATIONS AND APPLICATIONS

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ABSTRACT: Gold particle is one of the most non-reactive metals known to mankind till date. In this context for making the gold therapeutically useful, there are mainly two requisites. First is reduction in particle size of the element. Unless the particle size is not reduced, it will not be absorbed or metabolized and will not impart any of the mentioned therapeutic effects. The second most important criteria are existence of metal in human body in ionic form. Non-reactive substances will not impart any effect and will lie inert. In this paper we are studying a relationship of gold particle and nanotechnology and a significant uses of Au particles in different discese of human life.

INTRODUCTION

Gold ash has been characterized as globular particles of gold size 56-57 nm. Gold ash nano-paricles prepared by modern method are quite comparable with respect to TEM and SAED analysis. Nano-sized gold particles (27±3) nm have been proven tobe effective in ameliorating symptoms of mycobacterial, collagen and pristine-induced arthritis in rat models. Antioxidants/ restorative effect of golden ash against global and focal models of aschaemia have also been reported [1]. Typical features of golden ash have been demonstrated through TEM and atomic force microscopy [2]. A further study has shown golden ash principally constituted of globular gold particle of 56-57 nm. Brown also reported golden ash to be devoid of any other heavy metal or organic material by its screening through atomic absorption spectroscopy (AAS) and infrared spectroscopy (IS).

Golden ash is an ancient concept of reduction of the particle size of gold and making it a little reactive, so as to enable it pharmacological properties. Recently cinder is considered to be biologically produced nano-particles. As per the classical reference in ancient text of Ayurveda, Golden ash is prepared by Putapaka method. This method involves mainly three steps i.e. Shodhan (Purification of gold to haul out physical impurities), Bhavna (wet grinding for reduction of particle size) and Maran (incineration for further reduction in particle size under temperature). These procedures of Bhavna and Maran are repeated several times on the metal as the classical references.9 The incinerated matter is then well grinded and a brownish red powder i.e. Golden ash is obtained[2-4].

Brown et al [5] in their study evaluated the physico-chemical characterization of Golden ash by using atomic absorption spectrometer, FT infrared spectroscopy, transmission electron microscopy, Atomic force microscopy and x-ray diffraction analysis. Atomic absorption spectroscopy revealed that Golden ash contain 92% gold. Cold vapor method of atomic absorption spectroscopy demonstrated absence of mercury which can considered as a marker for proper incineration. No organic compounds were found through infrared spectrum of Golden ash. Same study has shown Golden ash principally constituted to globular gold particle of 56-57 nm. These results implicate that, particle size of gold in Golden ash is in nanometer dimension. In a recent investigation, instrumental neutron activation analysis and electron microscopy was used to study the gastrointestinal uptake and subsequent distribution of 4, 10, 28 and 58 nm diameter metallic colloidal gold

particles following oral administration to mice. Studies show that particle uptake occurred in small intestine by per sorption through single degrading enterocytes in the process of being extruded from a villus. Golden ash principally constituted globular gold particle of 56-57 nm and thus it is possible that these particles would reach the target site of action through blood after gastrointestinal uptake [6].

IMPORTANCE OF PARTICLE SIZE REDUCTION

During putapaka method, size of particles of materials reduces more effectiveness of cinder with increasing number of putapaka is mentioned in classics. Putapaka is needed for different purposes as follows [7]: simple therapeutic, 10-100; aphrodisiac 10-500 and for immunomodulation of cinder 100-1000.

PARTICULARS OF NANO-STRUCTURE FORMATION BY MECHANICAL ACTIVATION

Golden ash is nearer to nano-crystalline materials. In term of nano-technology, nano-crystalline materials are solids composed of crystallites with size less than 100nm in at least one dimensions [8] formation of nano-crystalline material during mechanical alloying and milling was first suggested by Koch et al [9] and was validated by Fecht et al [10]. Similar crystalline sizes may be obtained through conventional ball mills and other techniques, suggesting that it is total strain, rather than milling energy, that decides minimum attainable grain size by mechanical milling [11]. Milling temperatures, nature of products, no. of phases present during mechanical milling and alloying and other parameters have a pronounced influence on limiting attainable grain size and product phases [12].

DETECTION OF NANO-PARTICLES IN GOLDEN ASH

Methodologies used to test nano-particles size are environmental electron microscopy, scanning electron microscopy, transmission electron microscopy, fast freeze fracture, confocal laser scanning microscopy, quasi-elastic light scattering, energy dispersive analysis, atomic absorption spectroscopy, X-ray induced photoelectron spectroscopy etc. process of nano-particles testing in form of ash involves five steps:

a. To establish presence of nano-particles in test sample.
b. To ascertain whether chemical composition is homogeneous
c. Whether nano-particles are crystalline or amorphous.
d. Nature of defects in the sample
e. Sample has to be biological tested to check their bioactivity.

Gold in Conventional system of medicine:

Gold is predominantly used for its illunomodulatory activity in present era although its uses in diagnostic tools are also reported [13]

Effect on skin condition (Pemphigus):

Concentration of gold in skin achieved during systematic chrysotheraphy inhibited prostaglandin synthesis in vitro, using a sheep vesicular gland dioxygenase system. Two human epidermal enzymes, acid phosphatase and tryptophanyl-tRNA synthetase, were also inhibited by gold in vitro. These findings suggest some possible mechanisms of gold action in pemphigus, such as interruption of the inflammatory cycle and inhibition of skin enzymes involved in blister formation [14].

Effect of gold nano-particles in B-chronic Lymphocytic Leukemia (BCLL):

B-chronic Lymphocytic Leukemia (BCLL) is an incurable disease predominantly characterized by apoptosis resistance. The induction of apoptosis with gold-AbVF was significantly higher than CLL cells exposed to only AbVF or GNP. The gold-AbVF treated cells showed significant down regulation of anti- apoptotic proteins and exhibited PARP cleavage [15].

Effect on Reproductive function in immature female albino rats:

Significant increase in ovarian and uterine weight Δ^5 - 3β hydroxysteroid dehydrogenase activityand elevation of serum estradiol level were observed following gold chloride (0.2 mg/kg body weight/day), s. c.

administration in immature female albino rats. Historical study of ovary also showed Graafian follicle with ovum in rats proving stimulation of reproductive function [16].

Form of gold used in modern science:

In the west, alchemists sought a form of golf that can be orally consumed as potable gold for a plethora of diseases. Western tradition, the gold was generally used in ionic form as pure salt like fold trichloride, gold bromides etc [17].

Nano gold in Cancer detection: (anti EGFR)

Binding gold nano-particles to a specific antibody (EFGR) for cancer cells could make cancer detection much easier. Gold nano-particles stick to cancer cells and make them shine and are very good at scattering and absorbing light. Many cancer cells have a protein known as Epidermal Growth Factor Receptor (EGFR), all over their surface, while healthy cells typically do not express the protein as strongly. By conjugating, or binding, the gold nano-particles to an antibody for EFGR, suitably named anti-EFGR, researchers were able to get the nano-particle attach themselves to the cancer cells [18].

Application of gold as Diagnostic tools:

In fact nano-particles of metal or metal sulphides, including gold nano-particles are being considered to have great potential in various therapeutic and diagnostic applications in modern medical system [19].

Effect of modulation of the immune response:

The effect of gold on immune responses was reviewed. Gold salts used therapeutically can be followed by a decline in serum immunoglobulin levels and rheumatoid factor titers in rheumatoid arthritis, in pemphigus there is similarly a drop in anti-epithelial antibody titers gold inhibits stimulation of immunoglobulin, secreting cells [20].

CONCLUSION

Manufacturing methods of gold ash are in true of nanotechnology of contemporary era and proved advancement of rasashastra; a branch of ayurveda, which may cover scientific validation of today. This is very true that application of golden ash is time tested in Indian civilization with a praiseworthy therapeutic efficacy, now it has been established that golden ash in range in nano-particle size and remains mostly in form of mono atomic gold.

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