Synthesis of Nanogold and Stability Test of This Colloidal as Essential Material in Drug, Supplement and Cosmetics

Titik Taufikurohmah¹, Rusmini², IGusti Made Sanjaya³, Afaq Baktir⁴, Achmad Syahrani⁴

¹, ²Chemistry Department, University State of Surabaya
³Chemistry Department, Airlangga University
⁴Pharmacy Department, Airlangga University

Abstract: Nanogold has been used in cosmetics material as anti-aging and sunscreen. Nanogold was an activity to reduction free radical. Nanogold reduced wrinkles and aging, support tissue connecting, increase cell proliferation and increase collagen biosynthesis. Nanogold used drug material at degenerate deses for example cancer, diabetes mellitus, tumor and ect. This research purpose to synthesis of nanogold and analysis of stability nanogold colloidal. Nanogold synthesis used glycerin as matrix. The value of stability of nanogold colloidal occur after 5 weeks at 5, 10, 15, 20, and 25 ppm. Nanogold colloidal at 30 ppm of concentration was not stable, because there was aggregation. Conclude that nanogold colloidal with 5, 10, 15, 20, and 25 ppm of concentration are recommended as support material in drug, supplement, and cosmetics.

Keywords: nanogold, synthesis, stability, drug, supplement, cosmetics.

1. Introduction

Nanogold is a small object composed of gold and, which has one, two or three dimensions on the nanoscale, i.e., a sheet, a rod, or a particle. Nanogold refers to the gold moiety alone, while nano-construct infers a moiety that consists of a core of nanogold which has been adsorbed or covalently bound to a biomolecule or xenobiotic (drug, therapeutic, analytic), forming a more or less defined overall structure. A nanogold construct formulation defines the character and often the proportion of bound entities to the nanoscale gold core. Whether biomolecules or drugs were build bound physically or chemically to the gold surface (1). Modern medicine has begun evaluating the use of nanogold in medicine and many specific functional studies of nanogold (2).

Potential activity of nanogold are cellular trafficking (3), drug delivery (4) and optimization in building multi-component nano-construct, their efficacy for gene regulation (5). Once nanogold is exposed to any protein-containing biological fluids, that protein readily adsorb or may covalently bind to surface gold atom via sulfur-gold bonds (6). The simple application of nanogold in therapies as adducts in photo-thermal method to cancer therapies (7).

There have been many investigations of interaction both nanogold and biomolecule substituent. These interactions have largely for two reasons. Firstly, non-specific binding of biomolecules (over-binding) will mask any directing peptides or antibodies that have been specifically bound in order to direct the nano-construct for in vitro or in vivo targeting, and interfere with specificity of that targeting. Secondly, non-conjugated nanogold appears to be unstable and will readily aggregate. Thus, specific capping of nanogold using bio-molecules improves both nanoconstruct stability and retains at least partially, the capacity for targeting (1).

Nanogold has been used in cosmetics material as anti-aging because nanogold has activity to reduction free radical (8). Free radical destruct tissue connecting, cell and collagen. This activity caused wrinkles and aging, degenerate deses for example cancer, diabetes mellitus, tumor and ect. The in-vitro test used artificial free radical diphinylphikrylhidracyl (DPPH) results that nanogold 5, 10, 15, 20, 25, 30, 35 and 40 ppm reduction DPPH 47.66%, 52.02%, 56.14%, 56.85%, 66.27%, 52.34%, 47.11% and 35.15% (8). The pre-clinical test used mice (Mus Muscullus), nanogold increased cell proliferation and biosynthesis of collagen (9). These test are support the using of nanogold as medicines, cosmetics and food supplement.

Nanogold has high activity as catalyst in many chemical reaction and mechanism (10). Nanogold acts upon the pituitary gland, inducing an increase in hormonal production, and is thus a rejuvenating agent. Nanogold has reduced inflammation in rheumatic arthritic deses (11). These acts caused that nanogold recommended for drug and medicinal purposes. The other acts nanogold strengthens the heart, enhances the production of red blood cells in the bone marrow and increases the production of semen. Nanogold-peptide nanoconjugates are a useful platform for intracellular delivery of therapeutics (6).

Nanogold helps to develop keen insight and psychic abilities that this acts support using of nanogold as supplement or Food Additives. Nanogold can serve as colorings for cakes, candies, coats of chocolate and alcohol. It can be added into alcohol to make new wine mellow and reduce aldehyde quantity, thus decreasing the human body’s absorption of toxic ethanol and thereby avoiding hangovers. It can also reduce the spiciness in alcohol, making it soft and mellow. Gold nanoparticle is the non-toxic form of Gold. It also reduces the spiciness in alcohol, making it soft and mellow. Gold nanoparticle is the non-toxic form of Gold. It also reduces the spiciness in alcohol, making it soft and mellow.
and some medicinal plants such as red grapes, eggplant and violets. Nanogold had catalysis activity in many biologicals
process and biochemistry in the living (12). In recent years, Nanogold was known and used in the Pharmacopoeia of
Western Medieval Alchemy. Standard Therapeutic Dosage
recommendation for adults; one tea cup 5.0 oz. (150 mL) of
10 ppm Colloidal nanogold morning and / or evening to be
administered sublingually (hold each sip under the tongue
for one to two minutes before swallowing) for treatment of
serious health conditions until symptoms disappear. This can
be taken for a few weeks at a time as directed by your health
care provider. As a nutritional supplement one to two
tablespoons morning / bedtime for prolonged periods of
time. Nanogold was increases body stamina, increases and
balances the production of hormones, thus being useful for
the purpose of rejuvenation (13).

Cellular uptake mechanism of nanogold supported with
anionic or hydrophobic substituent in cells traffic nano-
construct system. Including substituent in the system cell is
 glutathione which as endogenous antioxidant. Nanogold
constructed glutathione to working together and building
synergies effect (14). These effects cause antioxidant
activity increase in the long time. The other hand the body
or cells have higher endurance system to survive from many
deses. Nanogold is helpful in the treatment of Parkinson’s
disease and many other brain degradation conditions.
Reduced tremors and increased face expressiveness are
among the most frequent victories against this unforgiving
health problem. Nanogold can also be used to relieve pain
in patients with Rheumatoid Arthritis and Huntington’s and
type 2 diabetes. It cures serious types of fever, particularly
chronic fever, nervous disorders, heart disease, tuberculosis,
afflictions of voice, schizophrenia, epilepsy, hysteria,
bronchitis, asthma, chronic diarrhea, serious types of anemia
and cancer (15).

It is necessary to know about stability of nanogold colloidal.
Nanogold used as safety cosmetics pigment in many
cosmetics product (16). Nanogold used in cosmetics as anti-
ageing materials. Nanogold can support the cell
proliferation and collagen biosynthesis in tissue of skin.
Nanogold was support sunscreen activity of cynamate
derivate in cosmetics formulation (17).

Nanogold had synthesized in wool matrix as safety colorants
in cosmetics, textile and many products (18). This research
pursued to synthesis of nanogold and analysis of stability
nanogold colloidal. It is important to measure value of
nanogold stability, because the character of nanogold
colloidal is very unstable. The phenomena can see at
Figure1 that different condition of stable nanogold and un-
stable nanogold. This research was to be done for prepare
the materials to be able as material product in industry.
Nanogold synthesis used glycerin as matrix. The function of
glycerin is support colloidal stability. The stability of
nanogold colloidal was to be analysis at 6 weeks with 5, 10,
15, 20, 25 and 30 ppm of concentration.

2. Material and Method

Base Materials is HAuCl₄ Solution 1000 ppm concentration
are colored yellow. Sodium citrate is reducing agent and
glycerin as matrix. The reaction to be done in aqua base,
with boiled process in temperature 100°C. Starting prepare
glass instruments backer glass 300 ml. (100-x) ml of
distilled water is heated up to boiling. Added x ml HAuCl₄
Solution 1000 ppm concentration (x= 0.5, 1.0, 1.5, 2.0, 2.5
and 3.0 ml) to get colloidal gold 5, 10, 15, 20, 25 and 30
ppm. Add Sodium Citrate in every solution, than coloring
change happen was Yellow, no color, blue, red, grape of
The solution was change to be colloidal or colloid in the
synthesis process.

3. Result and Discussion

The results of this research or synthesis is colloidal gold
with color is red of grape series. The analysis of colloidal
gold color used UV-Vis instrument with resulted dates are λ
maximum absorption and Absorbance value. The
measurement repeat every week for 6 weeks. The stability of
colloidal gold showed that Absorbance value and λ
maximum absorption are constant. Absorbance value is
expression of nanogold concentration in the colloidal
system. The Absorbance high if the concentration is
increase, λ maximum absorption is expression of cluster
diameter. If the cluster diameter bigger, the λ maximum
absorption move to big value.

<table>
<thead>
<tr>
<th>Concentration of nanogold</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 ppm</td>
<td>524.20</td>
<td>524.00</td>
<td>525.80</td>
<td>524.80</td>
<td>525.80</td>
<td>525.80</td>
</tr>
<tr>
<td>10 ppm</td>
<td>521.60</td>
<td>522.80</td>
<td>523.00</td>
<td>525.40</td>
<td>523.60</td>
<td>525.80</td>
</tr>
<tr>
<td>15 ppm</td>
<td>524.40</td>
<td>524.20</td>
<td>526.80</td>
<td>528.20</td>
<td>530.60</td>
<td>528.60</td>
</tr>
<tr>
<td>20 ppm</td>
<td>523.60</td>
<td>524.40</td>
<td>526.80</td>
<td>527.20</td>
<td>530.00</td>
<td>528.20</td>
</tr>
<tr>
<td>25 ppm</td>
<td>520.20</td>
<td>523.20</td>
<td>525.80</td>
<td>525.60</td>
<td>529.00</td>
<td>526.20</td>
</tr>
<tr>
<td>30 ppm</td>
<td>526.00</td>
<td>527.20</td>
<td>527.40</td>
<td>528.60</td>
<td>530.40</td>
<td>531.20</td>
</tr>
</tbody>
</table>

Table 1: The Relationship of λ Maximum and concentration of nanogold at different week

Figure 1: The differents stabil and un-stabil kollodial gold.

Figure 2: The Graphic of λ Maximum versus concentration of nanogold at different week
Figure 2. Show that the clusters diameters are smaller at 1 week than 2 weeks. The big cluster absorption the light with big wave length (λ) too. On the other hand at 3 weeks the clusters diameters bigger than the clusters diameters at 2 weeks. In common, the clusters diameters are bigger at long time, except at the 5 weeks. These are acts that cluster forming occur a long time. After 5 weeks the clusters diameters stop aggregation. These phenomena were mind that cluster forming equilibrium to be coming. Next, suggest that nanogold colloidal used after 5 weeks as essential material in the formulation of drug, supplement and cosmetics.

The concentration of nanogold in colloidal system was decrease for 6 weeks showed in Figure 4. Decreasing the nanogold concentration was show by decreasing of absorbance value. These phenomena were support that the aggregation process was continuous for a long time. The aggregation process cause the nanogold clusters get out colloidal system and falling down in base of system. In other hand the concentration of nanogoldin the colloidal system continuous decrease. The characteristic of colloidal system showed by differences the graph in Figure 4. The information get from Figure 4 was concentration change process continuous at 1-4 weeks. These phenomena show that the stability of colloidal was not yet occur. The aggregation process was continuous occur for 4 weeks. After 5 weeks these phenomena stopped, the clusters diameters not were bigger and bigger. The characteristic of graph at 5 weeks and 6 weeks were not increase again but were decrease. The equilibrium of concentration nanogold in the colloidal system was come at 5 weeks. This information is match with information showed on Figure 1 that colloidal system of nanogold stabile at 5 weeks and recommended to form the formulation of drug, supplement and cosmetics.

Figure 3: The Graphic of λ maximum absorption of nanogold versus week at variance concentrate

In detailed, nanogold at every concentrate has different character showed in the Figure 3. Nanogold at 5 ppm stabile at 3 weeks, the aggregation of cluster was stopped. Nanogold 10 ppm stabile at 4 weeks, than nanogold 15 ppm stabile after 5 weeks. On the other hand nanogold 20 and 25 ppm stabile at 5 weeks too. Nanogold 30 ppm was not stabile at 6 weeks. The diameter of cluster nanogold 30 ppm was continuous aggregation. The clusters diameters of nanogold 30 ppm were bigger and bigger at a long time. Than not suggested that nanogold 30 ppm used in formulation of drug, supplement and cosmetics.

Table 2: The Relationship of Absorption and Concentration at different week

<table>
<thead>
<tr>
<th>Concentration of nanogold</th>
<th>Absorption (A) at Week</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>5 ppm</td>
<td>0.111</td>
</tr>
<tr>
<td>10 ppm</td>
<td>0.240</td>
</tr>
<tr>
<td>15 ppm</td>
<td>0.341</td>
</tr>
<tr>
<td>20 ppm</td>
<td>0.408</td>
</tr>
<tr>
<td>25 ppm</td>
<td>0.452</td>
</tr>
<tr>
<td>30 ppm</td>
<td>0.552</td>
</tr>
</tbody>
</table>

Figure 5: The Graphic of λ Max Absorption versus week at variance concentrate

Actually, nanogold at every concentrate have an stability by different character. Nanogold 5 ppm and 10 ppm have stabile faster with absorbance value change was a little for a long time. It was show by relative flat-graph. The more high concentration had graph-pole with sharp decreasing. It was show that colloidal was not stabile. These were happen at nanogold 15, 20 and 25 ppm. Sharpest decreasing was happen at 30 ppm of nanogold. This graph show that nanogold at 30 ppm very not stabile and not recommended used in commercial formulation.

4. Conclusion

Nanogold had been synthesized with glycerin as matrix. The function of glycerin is increase colloidal stability. The stability of nanogold colloidal synthesized with glycerin occur on 5 weeks. The nanogold colloidal 5, 10, 15, 20 and 25 ppm of concentration have high stability. These parameters of nanogold suggest as essential material in product. Nanogold colloidal at 30 ppm of concentration is not stabile and form aggregation. It is not recommended as essential material. Conclude that nanogold colloidal with 5, 10, 15, 20 and 25 ppm of concentration are recommended as...
support material in drug, supplement, and cosmetics after 5 weeks.

References


Author Profile

Dr. I Gusti Made Sanjaya, M.Si., obtained her Doctoral in Faculty of Science and Technology Airlangga University from 2011-2013 and M.Si Pharm at The same University in Faculty of Pharmacy, in Surabaya, Indonesia from 2000-2003. In 1992, obtained her graduate in Institute Technologyof Sepuluh Nopember Surabaya, Indonesia. She is currently a lecture in Airlangga University of Surabaya, Department of Chemistry and Science Post Graduate in the same university.

Dr. Titik Taufikurohmah, M.Si., obtained her Doctoral in Institute Technology Bandung from 1999-2004 and M.Si Physical Chemistry at The same Institute, in Bandung, Indonesia from 1992-1994. In 1989, obtained hisgraduate in University State of Jakarta, Indonesia. He is currently a lecture in University state of Surabaya, Department of Chemistry and Science Post Graduate in the same university.

Prof. Dr. Afaf Baktir, M.S., Apt., obtained her Doctoral in Faculty of Pharmacy in Institute Technology Bandung and M.S Pharm at The same University in Faculty of Pharmacy. In 1980, obtained her graduate in Airlangga University, Indonesia. She is currently a lecture in Airlangga University, Department of Chemistry and Science Post Graduate in the same university. She is developingdrug formulation and analysis of drug materials.

Prof. Dr. Achmad Syahrani, M.S., Apt., obtained his Doctoral in Faculty of Pharmacy in Airlangga University and M.Si Physical Chemistry at The same University in Faculty of Pharmacy, in Surabaya, Indonesia from 1992-2004. In 1989, obtained hisgraduate in University State of Jakarta, Indonesia. He is currently a lecture in Airlangga University of Surabaya, Department of Chemistry and Science Post Graduate in the same university. He is developingPhysical Chemistry.

Prof. Dr. Achmad Syahrani, M.S., Apt., obtained his Doctoral in Faculty of Pharmacy in Airlangga University and M.S Pharm at The same University in Faculty of Pharmacy. In 1980, obtained hisgraduate in Airlangga University, Indonesia. He is currently a lecture in Airlangga University, Department of Pharmacy and Science Post Graduate in the same university. He is developing drug formulation and analysis of drug materials and microbiology.