International Journal of Multidisciplinary Research and Growth Evaluation.

Traditional Gold Plating Techniques in Ghana: Challenges and Solutions

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Article Info

ISSN (Online): 2582-7138
Impact Factor (RSIF): 7.98
Volume: 06
Issue: 05
September - October 2025
Received: 28-06-2025
Accepted: 29-07-2025
Published: 26-08-2025
Page No: 430-438

Abstract
This study investigated the conventional ways of gold plating that the indigenous goldsmiths in Ghana used. Gold plating is a technique of applying a coating of gold to the surface of base metals or alloys of lower karats to give an inexpensive appearance of solid gold. The plating techniques are described by the researchers and are heavily guarded by craftsmen found in the localities of Ghana in which these techniques are practiced. The study adopted phenomenology research method to gain experiences from participants across the field of traditional gold plating in Nungua, Accra using the data collection instruments of observation and interviews for data collection. The study also investigated other chemical options like immersion and mercury gilding and also discusses major challenges in the industry like base metals leaching, health risks of toxic fumes and the high cost and scarcity of gold. The paper concluded by providing practical recommendations on the safety of workshops, the recovery of gold in spent solutions and the promotion of a well-organized federation of goldsmiths to better deal with economic and regulatory challenges, with the view of conserving and promoting this precious traditional craft.

DOI: https://doi.org/10.54660/.IJMRGE.2025.6.5.430-438

Keywords: Aqua Regia, Goldplating, Karat, Mercury Gilding, Potassium Cyanide

1. Introduction

Once primitive man had fed his most important need, his mind certainly began to think about jewellery. Gold has been with nature as long as time immemorial. In a real sense, there is nothing in the world that has cast so many spells upon man since the beginning of time or had such permanent impact on this history as gold (Boyle, 1987) [5]. For this and for the high value placed upon it by man, the special and enduring physical and chemical properties of gold as well as its rarity have been responsible. There is no doubt that gold has been dubbed as "King of Metals". Unfortunately, however, gold, the most precious of all known metals due to its lustre, resistance to corrosion, workability and ductility is too expensive for most people as asserted by Bernstein (2012) [3].

Only a few people are therefore able to acquire quality gold works which are classified in karats. Karat gold is a measure of fineness. Fine gold itself is 24Kt, very soft and rarely used for jewellery purposes. To give it working properties, it's alloyed with other metals in various combinations and compositions depending on the karat and colour one deserves. Therefore, if an article is made of 18Kt gold, the fine gold in the article is 18/24 of the total weight. Likewise, if it is 10Kt, it is 10/24 fine gold by weight.

Pyykko (2004) posits that due to its attractiveness, gold appeals to many people; therefore, there should be a way of using the least gold in such a manner as to create an illusion of gold on metals of cheaper value for it is to be within the means of all; hence gold plating. Since time immemorial, people have invested their wealth in gold articles because of its quality as a store of value. Further, it appreciates in value over time and is more reliable than paper money. Gold plating may be explained as the

deposition of gold coatings or films on metals. It must be explained however that apart from an illusion of gold being created on the surface of metals of inferior quality such as copper and brass, karat works could as well be gold coloured. Different plating procedures are however used for the different works. It must also be stated that gold plated items are different from other gold filled or gold rolled articles (Hochschild, 2009) [9].

In Ghana, gold filled plate or wire is made by joining a layer of gold alloy to a base metal and then rolling or drawing to the required thickness. Rolled gold plate is made in the same way but it has a lower gold content. Articles having a gold coating of less than 10% fineness normally have no quality mark. Articles with an alloyed gold content of less than 1/20 are marked gold filled, e.g. 1/20 10K gold filled on an article means the article consists of a base metal covered on one or both surfaces with a gold alloy of 10% fineness and that the gold alloy comprises 1/20 parts by weight of the metal in the article exclusive of joints, pin stems, catches or other findings.

Usually, the type of solution used in gold plating depends on the metal and article to be coloured. Many a time, the articles to be coloured are gold alloys with a high proportion of silver making them below standardized karats. After the process, all the gold in the article comes to deposit on the surface of the item. This is because the solution of Alum, Saltpetre and Salt has the ability of "forcing gold out of the article". This has been explained in chapter two. This does not mean however those non-gold bearing alloys cannot be gold coloured. But before the plating of such articles becomes effective, they are given an initial silver coating. In such a situation, the alum, saltpetre and salt solution become ineffective and a more potent solution known as "De gamolle" which is a composition of potassium cyanide and gold chloride is used. The effect of this deposition is the same as that of the gold alloy plating just that the base metal (which is usually copper) is inferior making the final product cheaper.

Researchers had conducted studies on gold plating and its composition. Arrowsmith and Brown (1983) [1] study was on colour of gold or gold alloy. The study posits on the minimum thickness of gold required to cover the colour of the gold and the measurement of the colour of gold electrodeposits. Also, Underwood et al. (1994) [13] opine on the effect of the solution refractive index on the colour of gold colloids. The study indicates how gold sols have attracted interest ever since the Romans began using them as colourants in glasses; the colour of colloidal gold and the absorption spectra of gold sols prepared in solvent.

The aim of the paper posits on plating solutions and procedures both new and old will be welcomed by all practising goldsmiths in which case the research aim will be achieved. Although, of course this collection cannot claim to be complete as there are also many workshop solutions and techniques which are closely and jealously guarded secrets.

Traditional Gold Plating in Ghana

Gold plating in Ghana is not a new process. The application of gold coatings in the local way has been a common practice throughout history in Ghana. Coatings have been applied for decorative as well as corrosion protection (Göttler, 2021) [8]. In addition, the intrinsic quality of gold makes the product a store of value. One outstanding feature about the local gold plating process is the jealously guarded secrecy surrounding every step of the procedure. This makes the process the preserve of only a few goldsmiths who pass down the techniques along their family, sons and nephews learning it after two years in the master's house (Daitey et al., 2024) [7]. These practices have now been affected. Goldsmiths who now wish to learn the gold plating process are taught by older and more experienced ones for a token fee. Gold plating as practised by our indigenous goldsmiths is not a difficult process, but certain conditions must persist before the desired results could be achieved. These include cleanliness which is very important and experience on the part of the worker. Inadequate cleaning of articles before plating gives unsatisfactory results. Similarly, an inexperienced worker who neglects little details will not succeed in his attempt (Baah et al., 2023) [2].

A thorough research has been made into local gold plating and the results, which have been tried on several occasions, have proved very successful. It is hoped that if this is followed to the latter, any novice who tries his hands on it is bound to succeed. It must however be reiterated that for very successful results, experience counts (Panin et al., 2025). The local goldsmith's workshop is a very simple place with a few tools and ingredients which he uses for gold plating. Most of these are obtained locally and at relatively cheaper prices. The local ingredients involved, including alum, salt, saltpetre, and lime. With these, the workshop is complete and the plating process can start.

To begin, the items to be gold plated are cleaned. This is affected by annealing the work in the furnace and pickling by heating in a solution of lime, salt and water or alternatively saltpetre and water. Mostly, a second and third cleaning is required. That is the work should be annealed again and pickled using the same old solution. The articles are then brass-brushed, taking care not to touch already cleaned areas and surfaces as greased areas do not give satisfactory finishes. Now, the solution could be prepared for usage. In this plating process, two main solutions are used. These are known as the 'white' and the 'brown' which are prepared by the goldmiths themselves. It must be said however, that different smiths use different procedures and techniques in preparing their solutions but they all yield the same results (Baah et al., 2023) [2].

Study Area

Nungua is a colourful coastal town in Krowor Municipal District of Greater Accra Region in southeastern Ghana. It is one of the central towns in the area and the eighteenth most populated town given its rich cultural background and beautiful beaches. Nungua is also a historic area, one of the first Ga-Dangme settlements known as Nunma, and a very significant part of the local culture and economy. The town belongs to the Accra Metropolitan Area and it is famous due to its vibrant community, traditional festivals and fishing (Mensah, 2006).

Nungua, a sub-national unit, is located at almost 5 degrees, 36 minutes and 0 seconds north and 0 degrees, 4 minutes and 0 seconds west of the Atlantic Ocean. It had a population of approximately 84,119 as of 2012. The Ga Adangbes are the indigenous people of the Nungua who are grouped into eight clans; Nii Mantse, Nii Moi We, Nii Borte We, Nii Adzin We, Nii Borkwei We, Nii Osokrono We, Nii Djenge. The town has got Kpledzoo festival, which is an important cultural event and is traditionally headed under the leadership of the paramount chief, King (Dr) Odaifio Welentsi III (Ghana Statistics Service GSS, 2012).

Nungua pays much attention to education and there are educational institutions of various levels. Well-established higher education institutions are the Regional Maritime University, Laweh open University College and GCB bank Training school. The community is served by senior high schools like Nungua Secondary School, Nungua Presbyterian Secondary Commercial School, St Peter Anglican Senior High School and Royal technical college. Public schools such as Nungua Methodist '1' and '2' Basic Schools, St. Paul Anglican Basic Schools, Nungua Lekma Basic Schools and Nungua Presby Basic Schools provide basic education.

Nungua has a well-developed transportation, including a station on the eastern national railway network of Ghana, road transport by taxi, tro tro (mini buses), Metro Transit buses and traditional canoe transport on the beach. Connectivity has been improved by infrastructure upgrades including the refurbishment of a major bridge in 2009. Nungua belongs to the Krowor Constituency in politics. The incumbent Member of Parliament is Agnes Naa Momo Lartey of National Democratic Congress and she replaced Elizabeth Afoley Quaye of the New Patriotic Party. The town has a tropical savanna climate (Koppen classification Aw), with both wet and dry periods. The next towns are Somanya, Winneba, and Akosombo at a distance of between 40 and 150 kilometers. All in all, Nungua is a significant and vibrant town in the Greater Accra Region of Ghana because of its rich cultural heritage, educational systems, strategic coastal position and vibrant community life (Ayeh-Kumi et al., 2016)

Fig 1: Nungua, Krowor Municipal District of Greater Accra Region (Ghana Statistics Service GSS, 2012)

Methods

In the study, the framework was a qualitative approach to phenomenological research (Zahavi, 2018) in which verbal data are gathered in the form of personal interviews and focus group discussions. The phenomenological approach was very suitable to this research due to the focus on the individual and common lived experiences of people in Nungua, Accra. Understanding these common experiences was essential to understanding the way the participants engage with plating of gold in the local environment.

The research realized that it is valuable to demystify the general philosophical assumptions of phenomenology. It dwelled on the lived experiences of the participants regarding gold plating in the Ghanaian culture as manifested in Nungua and the ways the participants derive meaning using these traditional processes. This knowledge motivated the researchers in expantiating the processes in traditional plating using artistic arts-based research and their establishment.

The population of the study was the available people in Nungua, Accra. The entire data were taken in this community and the total numbers of people accessible were 60 as shown in Table 1.0. Based on the recommendation that the appropriate sample size is about 30 percent of the available population, which suggests that obtaining substantial and comprehensive data was be ideal (Creswell, 2014) [6], the researchers selected 20 respondents purposely.

Purposive sampling was used to sample the participants who were relevant to the study. Nungua Traditional Council experts on culture who can help immensely on the knowledge of traditional gold and its cultural heritage were present. Also, the students who had studied history at the University of Ghana, and had knowledge of Ghanaian cultural arts were invited to offer important advice. The Nungua coastal area local tour guides were consulted as well and they are accustomed to cultural landmarks and symbolism. Finally, the data collection were assisted by craftsmen and artisans of the artisan communities in Nungua who were involved in the gold plating process, which were engaged in the production of artefacts with Ga-Dangme associations illustrated below.

Table 1: Distribution of the accessible and sampled population of the study

Population of the Study	Accessible Population	Sample Size (30%)
Traditional Council Experts	6	2
History Students in Legon	30	10
Coastal Tour Guides	9	3
Craftsmen at Nungua	15	5
Total	60	20

Source: Researchers Fieldwork (2025)

The research process predominantly involved the use of in-depth interviews involving participants who recounted their experiences and expertise in regard to the traditional gold plating methods in Ghana. The participants were to describe their experiences with the gold plating process, the symbolism, and the meanings that surrounded the colours and the techniques employed and the cultural and social contexts in which these experiences took place. The analysis of data led to the creation of structural descriptions of the experiences of the participants and this aided in the establishment of formulated meanings related to conventional gold plating.

The researchers also made sure that consent of the participants was taken during the overt participant observation process, especially of craftsmen at Nungua, ethical concerns were well noted during the study. Observations were recorded on videos and then translated to English language by two researchers, with the aid of study participants to make sure that the translation would be accurate and culturally sensitive. In order to ensure confidentiality, some individuals opted that their views should not be directly identified with them during the analysis and reporting process.

The researchers comprehensively examined the interview transcripts with thematic analysis, as described by Terry et al. (2017), and identified important statements, phrases or quotations that exemplified the participants' knowledge and experiences with traditional gold plating. These important statements were placed under grouping of meaning and these were divided into themes. Descriptions of the experience of the participants of the conventional methods of gold plating were created through these themes. The thematic descriptions also revealed the contextual factors that influenced these experiences e.g. historical practices, social significance and difficulties encountered in retaining the traditional methods. This led to the emergence of a greater comprehension of the symbols and meanings that are inherent in traditional gold plating and this helps in the maintenance and enjoyment of this significant cultural heritage.

Results and Discussion

Gold Plating Solutions in Nungua, Ghana

Apart from gold plating articles the local way, there are other processes and solutions which are usually employed in the workshop. Those make use principally of chemicals. There are numerous solutions or recipes all of which yield the desired result if the right steps are followed bearing in mind that the practical experience of the workman also plays a major part. Also, before the desired results could be satisfactorily achieved, certain conditions must be fulfilled. The first condition of success is absolute cleanliness, frequent rinsing and clean materials. Secondly, items of different fineness (that is quality) must not be coloured together. Further, the viscosity of the solution must not thicken during the plating process. To avoid this, warm water must be added drop by drop in the course of plating as the liquid evaporates. Moreover, after cleaning the articles, they should not be touched by hand any more. They should preferably be bound together with a gold or silver wire which will serve as a handle. Again, the finished gold-plated items should be boiled in weak, nitric acid to remove all colour stains but the articles should not be left in the solution longer than necessary. Ammonia and soap are then used to bleach off all excess acid. After a number of plating processes, the solution becomes weak which calls for the preparation of a new one which could be mixed with the old one, or alternatively, the old one could be kept and the gold in it recovered later on.

Different solution compositions are used for articles of different fineness but invariably, they all follow the same pattern of plating. Basically, the prepared and already cleansed articles are suspended and moved in the plating solution for about one-and-a-half minutes (1½ minutes.) well rinsed then freely suspended in air. The solution is then diluted with water and boiled after which time the articles are placed in it for approximately two minutes (2 minutes) and rinsed again thoroughly.

Below are a few of the gold plating solutions which are in constant use.

Plating Solution

Many a times, the solution is a mixture of

- 10 parts finely powdered saltpetre
- 5 parts finely powdered salt
- These are mixed together then are added:
- 7.5 parts Hydrochloric Acid (HCL) and
- 3.5 parts water

The mass is boiled until it becomes a liquid of uniform fluidity and viscosity.

Solution for Solid Articles

For this, the following is used

- 10 parts Saltpetre
- 6.5 parts Common Salt and
- 8 parts HCL

Colour for Thin Articles

In the plating of thin and light articles, the following could be used with slight variations in the composition like:

- 10 parts Saltpetre
- 6.5 or 8 parts common Salt
- 5 or 8 parts HCL and
- 5 or 4 parts water using the same mixing procedure as above.

Plating of Karat Gold

In the plating of karat gold articles, considerable skill and experience is needed as it is prone to failure in the first few attempts but with considerable trials, success is achieved.

Again, the ingredients needed to colour karat gold articles differ slightly from that of the other gold plating solutions. For example, in the plating of pet gold article, use

- 2 pints pure Sulphuric Acid (heated to boiling point)
- 1 oz Saltpetre
- a Pinch of Salt. These are mixed together and the

Articles are left in it for about a minute whereupon they take on a brownish colour. They are then rinsed and scratch-crushed and the process repeated until the desired colour is obtained. Inversely, 2 oz of Saltpetre could be mixed with 2 pints of chemically pure Sulphuric Acid.

On a 14Kt gold article, use

- 6 parts powdered Saltpetre
- 4 parts powdered Common Salt
- 3 parts Alum
- 4 parts Hydrochloric Acid and
- 1 part Sulphuric Acid

On the other hand, if it is on 18Kt work use

- 4 parts powdered Saltpetre
- 2 parts powdered Common Salt
- 2 parts Alum
- 2 part Hydrochloric Acid
- 2 parts Sulphuric Acid

Immersion Gilding

Immersion gilding is one of the oldest gold plating methods having been known long before gold electroplating. It does not allow the production of thick deposits as the process can only operate so long as metal displacement takes place and ceases when the gold film completely covers the surfaces. Immersion gilding is still practised today for very inexpensive work which does not justify the application of heavier coatings. An early solution which has the advantage of operating very quickly with the result that the immersion time must not exceed a few seconds has the following composition:

- gold chloride – 0.6g/l
- potassium cyanide – 10g/l
- sodium phosphate – 6g/l
- sodium sulphate – 3g/l
- sodium hydroxide – 1g/l This is used at boiling

Silver Gilding

It is not generally easy or possible to deposit gold on silver by a simple displacement process. It is however possible to achieve a gold deposit if the silver or silver plated parts are first given a copper undercoat or if the parts are contacted with a less noble metal such as Brass, Copper or Iron. Zinc and aluminium are not as satisfactory for this purpose. It is however possible to produce an immersion gold deposit on silver direct from the following acid solution

- gold chloride - 1g/1
- Prissodium Citrate - 30g/1
- Hydrochloric Acid (37%) - 100ml/1

This solution is heated to its boiling temperature and vigorously agitated. As the process deposits gold purely by displacement, however, the coatings are very thin.

Contact Gilding

To contact gild take,
Yellow prussiate of potash - 2oz
Carbonate of Potash - ½ oz
H2O - 1 quart

Begin by boiling the water in a sauce-pan. When boiling, add the salts one after the other. Stir thoroughly and continue boiling for two or three minutes, after that, add slowly a solution of chloride of gold dissolved in a little water stirring the mixture. It is then allowed to cool and stored in a stoppered bottle. Then it is required for gold plating; take a little of the liquid and heat it to nearly boiling point, then place the article thoroughly cleansed on a piece of bright clean zinc and immerse it in the solution when it will after a few moments be covered with a film of gold.

Rubbed-On Gilding

In this type of gold plating, 20gms of gold chloride are dissolved in ½ oz. water to which is added a pinch of saltpetre. The solution is poured onto a small piece of linen which is allowed to dry and then burnt. The residue is powdered and rubbed on with salt water by means of a cork or with the finger. If the colour which results should have a reddish tinge, a little copper is dissolved in the solution. If on the other hand pale yellow is desired, silver is added. A burnisher can then be used to burnish the portion rubbed. Gold chloride plays a very important role in many of the plating solutions.

To make gold chloride thin, gold sheet is cut into small pieces and dissolved in Aqua Regia (A mixture of Nitric Acid and Hydrochloric Acid). The liquid is then evaporated and the remainder, a brownish-red-crust is the ‘chlor-gold’ or gold chloride. In the process of evaporation, every effort must be made to dissolve all separated crystals. This calls for the addition of a little more aqua regia. The chlor-gold is then dissolved in distilled water and filtered. Liquid Ammonia is then added until the mixture smells strongly of ammonia. What results is ammonium aurate which is also filtered and washed thoroughly with hot water. It must be noted however that wet ammonium aurate is harmless but extremely explosive when dry so it should be immediately put into a solution of potassium cyanide which is boiled until the ammonia smell disappears. The potassium gold chloride is now ready and is best kept in a well stoppered bottle.

Mercury Gilding

Mercury gilding is done by means of an amalgam of gold with mercury. It is one of the oldest gold plating processes and still regarded as the best because unlike the others where a thin gold film is deposited on the surface of the metal, mercury gilding permeates the surface area of the material which makes it very adherent and lasting.

To make an amalgam take;
8 parts of white mercury and
1 part of fine gold

To begin, put the gold into a small crucible and heat it until a pasty mass result. Pour the contents of the crucible into a bowl of clean water and wash the amalgam carefully by kneading it. This is to get rid of the excess mercury. In furtherance, take the amalgam and place it in a bit of leather and squeeze out the remainder of the mercury not combined. This excess of mercury contains a portion of gold so it should be kept separately and used when a new amalgam is to be made.

Again, dissolve mercury in pure Nitric Acid in the proportion of;
10 parts of Mercury to

11 parts of Nitric Acid
The solution is then diluted with 20X its mass of H2O; well shaken and kept in a well corked bottle for use. The amalgam is now ready for use.
To begin with, the articles to be gilded must be cleaned and degreased preferably in ammonia and soapy water or with hot soda and the work dipped in the solution of nitrate of mercury. Now, take a small brass brush and use it to spread a small portion of the amalgam carefully over the work. Alternatively, the amalgam could be mixed with the nitrate of mercury and the articles dipped into it. After the dipping, hold the work over charcoal fire. The fumes that come out of mercury burning are very poisonous so caution and care must be taken in handling it. Preferably, place the coal-pot in a fire place with a glass screen across the opening which will enable you to see the progress of the evaporation without the danger of inhaling the vapour of mercury or alternatively, the worker should not face the oncoming fumes.
Further, the work should not be put on the charcoal directly but should be placed in an iron pan or plate over the coals. After the evaporation process, the article is polished with a scratch brush and a little stale beer or with rouge and water on the buff. If after polishing, there are stains and spots on the work, it should be treated with drops of Nitric Acid after which the whole work is plunged into a weak pickle. (8 parts of H2O to 2 parts of Sulphuric Acid), and the defective parts retouched with fresh amalgam.

Problems in Traditional Gold Plating
Gold plating has its problems. In most cases, these problems are not ascribable to the cleaning and surface preparation process preceding gold deposition. These often result from poor, incomplete, or inappropriate cleaning or surface preparation preceding gold plating and not from the gold plating process. Blair (1999) buttresses the point that at times, the works are shoddily brushed and care is not given to the handling of the works which result in the deposition of finger prints on the works. The effect being that the finished coloured work does not get the required finish making it highly impossible to compete with other workshop platings where strict adherence is attached to plating precautions. Other problems are financial, health and moral. These result in distrust of goldsmiths by customers.
Gold chloride, which is used in goldplating is very expensive because of the gold used in preparing it (the preparation of gold chloride has been discussed in chapter three). Because of the price of the gold chloride, minimum amounts are used in plating because of the profit maximisation motive of the goldsmiths. This has the effect of shoddy works being produced to flood our markets.
These articles are also very expensive but lose their lustre in no time making people shun their usage. Further, the gold chloride is diluted at times so plating is not effective most of the time. Next, due to the ignorance of many workers in the preparation of the gold chloride, they depend on the few who know it for their supplies. Thus, any delay on the part of the supplier is shifted on the customer. This makes customers to lose confidence in the goldsmiths. Moreover, the cost of the gold makes the Saltpetre, Alum, Salt Solution not concentrated. This leads to other attendant problems like inadequate preparation of solution and insufficient coatings on the articles.
Most times, the failure of the gold colour may occur if there is not enough gold in the solution. The articles thus appear discoloured, that is, brown or black. One of the essentials of good work/ salesmanship is the creation and retention of confidence amongst customers. Nothing inspires customer confidence than the knowledge that the craftsman knows what he is about and his ability to explain salient points pertaining to the trade. Many a time, users of coloured gold items are misinformed about the quality of the works. Works below standardised karat are dubbed as 14Kt or 18Kt and sold at exorbitant price. If the true karat is found out later on, distrust results. This blame could be put on the workers themselves because most of them are ignorant about alloy calculations.
Another problem with coloured items is their brittleness. This is due to the action of the saltpetre, alum and salt solution which leach out minute amounts of silver and other ingredient materials from the gold alloys with a result that over time and after a number of plating, the piece becomes porous, brittle and fragile. To recoup these properties, the whole work must be melted down and fabricated again. Now taking cognisance of the intricate and delicate nature of some of the works and the time expended, one appreciates its worthlessness. To know why this brittleness occurs, it is imperative to analyse the various different properties of some of the raw materials used in plating and plating.
Salt (sodium chloride) crystallizes in cubes containing water in their interior which on heating, bursts the crystals. When pure, salt is colourless and remains absolutely dry in air. Small amounts of calcium chloride and magnesium chloride cause it to attract moisture. It dissolves readily in water but is insoluble in alcohol. It is found frequently in nature, dissolved in sea water, salt lakes, salt springs, and in solid state, also a deposit from expenses of salt water, the salt of steppes and as rocksalt deposits. It is extensively used as cooking salt, for manufacturing soda and glanber salt, for preparing baths and colour mixtures. It has the power to destroy some of the ingredients in alloys
Alum is a potassium aluminium sulphate which is the natural product of the decay of Marl Slate containing sulphurous gravel (alum slate), but is, in fact, manufactured from this mineral and alum stones. The commercial alum forms a colourless crystal as a clean, thick crust or a white crystalline powder. Alum dissolves in water. Chile Saltpetre (sodium nitrate) is found in Chile and Peru in extensive natural deposits. It forms in pure state, colourless, transparent, rhombohedrous, is readily soluble in water and turns liquid in air. The less valuable impure product serves as a fertiliser; the purer material for making nitric acid, Potassium Saltpetre etc. Potassium Saltpetre crystallizes in large, colourless, columnar longitudinally stripped prisms. Unlike Chile Saltpetre, it remains dry in air. It serves mainly for manufacturing gun powder, for fireworks, for pickling meat and for metallurgical processes like gold plating. It removes oxidisable impurities from an alloy. It will oxidize tin, lead, zinc, iron, cadmium and other foreign metals from alloying metals. When used in large quantities, much of the alloy will be refined away.
What is actually accepted as Hydrochloric acid is actually a solution of gas in water. Concentrated hydrochloric acid is a strong fuming colourless and smelling acid. Hydrochloric acid dissolves most metals and metal oxides forming chlorides. It is used in small quantities in some plating solutions. It would therefore be seen from the above that, common salt, salt petre, alum and hydrochloric acid all have corrosive effects on alloying materials. They leach out the

base metal content of the alloy and leave the layer if gold thereby causing some porosity in the gold pieces being coloured. On medical grounds, most workers become prone to bronchial diseases. For instance, no fume cupboards are used and they inhale very poisonous substances and gases emitted from the preparation of some of the solutions and in some of the plating processes. For example, potassium cyanide is an extremely poisonous salt. As little as 4-8 grams is a dose fatal to man as it quickly paralyses the respiratory centre of the brain. When hydrochloric acid, saltpetre and alum are heated a lethal and poisonous gas is produced which easily asphyxiates. At times, the effects of these poisonous substances are not noticed immediately but it does affect them.

It is therefore not a doubt that most of the goldsmiths the researchers spoke to on their health problems complained of occasional chest infections and other related diseases which unknown to them were caused by these chemicals.

Solutions in Traditional Gold Plating

The problems relating to gold plating are numerous and varied and the solutions to these problems have been carefully analysed and experimented upon. It has therefore been found that if these solutions are strictly adhered to, the problems inherent in gold plating will be completely reduced if not eradicated. For best results and long service life, gold plating and for that matter all gold coloured finishes should be applied only to clean and sound surfaces. Normal practice may require degreasing in an ammonia and soap solution.

In the workshop the work to be coloured is first annealed until a greyish colour is attained and then quenched in a pickling solution made up of 1 (one) part sulphuric acid and 10 parts of water. The acid should always be added to the water and gently as possible as otherwise may result in an explosion. This has the effect of removing all oxide films that have deposited on the work. This process may have to be repeated for about three times and then brass brushed. Next, the cleaned work is put in the solution of ammonia, soapy water and heated for about five minutes by which time all grease would have been removed. Thereafter, the work is rinsed in cold water but great care must be taken not to touch the surfaces as this could lead to an unsatisfactory finish.

In the local goldsmith's workshop, the annealed items are quenched in a solution of alum, salt, lime and water or saltpetre and water with the same precautions as above. For best results; these two procedures are recommended before gold plating in the workshop. Firstly, the articles to be plated are soaked in a boiling solution of NaCN and NaOH for fifteen minutes. This solution should be composed of:

38 g NaCN
38 g NaOH
11 parts H2O

This is followed by a rinse in water and a 15 sec. bright dip followed by a final rinse. This has been recommended for castings which have been heat treated. Secondly, the articles are dipped in a solution of: 60 to 70% (vol.) H2SO4 at 50°C for 30 sec. followed by a rinse (chronic sulphuric acid could replace H2SO4)

Matt coloured articles and those set with delicate stones or pearls are cleaned with sodium bicarbonate moistened with liquid ammonia. This paste is applied to the article which is then brushed with a soft brush. The remaining paste is removed by rinsing in clear water followed by drying in warm saw-dust. It may occur that gold articles, after being boiled in diluted acids show stains. This indicates that the articles were not sufficiently and carefully degreased. Before the grease is dissolved, the acid eats away so many base metals from the degreased portions that the composition of the alloy changes into one having another colour. In some cases, warmed diluted potassium cyanide solution

May be helpful; however, if this has no effect, the articles must be polished again. The forming of stains, however, can be avoided in order to prevent the formation of stains on coloured gold articles; they may be dried, after the plating stage in hot brown tin sand (quenching sand) instead of in saw-dust. This sand is made very hot and poured over the articles lying in a clean dry dish. It is a sad note that gold which is mined in Ghana is so expensive. A survey made recently showed that gold is more expensive in Ghana than in some countries where gold is not mined. This is due to the smuggling of this precious material to other countries thus depleting our own stock. Further, though gold is sold to registered goldsmiths by the Bank of Ghana and now, the Ghana Goldbod, the price is higher than it pertains in the open market.

The 1986 price for 8 grams of gold at the Bank of Ghana was twenty-two thousand cedis (₵22,000) whiles it was sixteen thousand five hundred cedis (₵16,500) in the market. To avert this problem of scarcity of gold, the following measures are recommended. Firstly, all gold in use plating solutions should be recovered. To do this, all gold containing solutions are first evaporated until their colour become deep red-brown. It is then treated with potash lye. Then the metallic gold is separated by means of a freshly prepared iron sulphate solution. The deposits are then added to existing gold residues. The whole mass is then treated with nitric acid and filtered. Common salt is then used to recover the silver as silver chloride. What is left is heated with hydrochloric and nitric acid until all the gold dissolves as indicated by Vorobyova (2004).

It is then diluted with plenty of water and rinsed well for all silver chloride to be separated. All excess nitric acid remaining in the solution is removed by repeated evaporation. The solution now contains gold chloride which is deposited as metallic gold. The deposit is repeatedly washed with diluted hydrochloric acid to remove the iron, and then rinsed well with water. It is then burnt and melted in a crucible. Secondly, all illegal gold diggers (galamsey) should be registered so that they become recognised in selling gold. If this is done they will work without fear and the market will be flooded with gold with a reduction in price. Thirdly, all goldsmiths and jewellers should come together under the federation of Ghana goldsmiths so that they can have a common and formidable front in agitating for price decreases from the Government.

This stems from a survey the researchers conducted which showed most of the goldsmiths to be illiterates making it difficult for them to make worthwhile and viable suggestions and contributions. It is also of interest to note that they use a local dialect (twi) at their meetings. Such an association will virtually and undoubtedly yield to government policies which might not help them. On the other hand, most of the jewellers are educated (theoretically and practically). The strengthening of the federation will thus give them a strong and unified front which will go a long way to help in the pricing of gold.

The effect of a reduction in gold prices will:

- Make gold plating/plating solution cheaper thereby inducing the workers to produce their best at comparatively low prices.
- Motivate the workers to produce quality articles as there will be competition in the market in which situation only the best sells.

Again, times have changed and things which were considered sacred and utilised by a few for their selfish interests are over. Seminars should therefore be organised occasionally for goldsmiths. At such meetings, renowned and older goldsmiths will disseminate information on plating methods and new ideas to other up and coming and ignorant ones. Such symposia will keep them abreast with time using much more effective techniques and cheaper methods. It will further eradicate attitudes like lies and delays which have permeated the fabric of the goldsmithing trade. If confidence is restored, customers will willingly patronise those workshops. This will rejuvenate industry necessitating the employment of more working hands which will reduce the unemployment rate in the economy and other social vices.

Moreover, it has been seen that the porosity of coloured items is due to the leaching effect of some of the chemicals used in some of the gold plating solutions which is due to the easy dissolution of some of the base metals by these more potent chemicals. It is also known that the higher the gold contents in an alloy, the lesser the reaction of chemicals on it. From this, it is suggested that to lengthen the usage of gold coloured articles, the alloys should contain enough gold which will make them resist the leaching effect of these chemicals.

The need for the right quality should also be ensured so that a 9Kt item will not be labelled as 18Kt .

Medically, gold plating workers should submit themselves for regular check-ups due to the poisonous nature of some of the fumes they inhale. As an alternative solution, the following could be adopted.

- The work places should be adequately ventilated. Where ventilation is poor, gold plating could be done outdoors.
- The workers must not face the oncoming fumes. Where possible, transparent glasses could be used as barriers especially in mercury gilding where carbon monoxide which asphyxiates, is produced.
- As much as possible, fume cupboards should be used. When cyanide which is extremely poisonous is used, the hands must be thoroughly washed preferably with soap and ammonia to remove all traces of it before food is touched. When cyanide poisoning occurs, a doctor should be called immediately but until a doctor arrives, drinking of large quantities of milk, red oil, breathing in of ammonia, pouring of cold water over the poisoned person or induced vomiting may help. External wounds are dabbed with a solution of salt, washed with clean water and again rinsed with salty water. Now, if traditional gold plating is to stay on, efforts should be made to educate users on the differences between the different types and the qualities each possesses. Finally, if the solutions are well followed the problems inherent in traditional gold plating will be reduced completely and people will start patronising its usage.

Conclusion

Gold plating is not necessarily a complicated procedure, but precautions must be followed to guarantee high-quality output. Gold plating traditionally has been a tedious trade, through generations, but it was more of a craft than a science and focused more on authenticity and craftsmanship. Nonetheless, the modern ways have changed and provided different alternatives of imitation jewellery that resembles the look of genuine gold. Such imitations have become prevalent as they are guaranteed to last up to ten years and have been very affordable as compared to the original gold items. The use and appreciation of locally coloured real gold items have since diminished and the future of the traditional gold plating process is doubtful due to this shift.

Frequently, a consumer is misguided into buying fake gold at a high price and confusing it with real karat gold; this is a misrepresentation of authentic gold jewellery and cultural values. Also there are modern ways like electroplating that have been prominent in plating of gold particularly to objects that have more karats. Electroplating has been appreciated as swift, simple to work with and produces reliable outcomes and thus is a major preferred option in modern jewellery manufacturing. Nevertheless, it is still difficult to retain the traditional methods of plating gold and to better inform consumers of the differences between natural and artificial gold, because the sustainability of this valuable cultural art should be ensured.

References

1. Arrowsmith DJ, Brown G. The colour of gold and gold alloy electrodeposits. Trans IMF. 1983;61(1):1-8.
2. Baah OPK, Adom D, Samuel A, Peggy AF, Tetteh NA. Preserving the Asante cultural craft of traditional goldplating: lessons from Asante goldsmiths. J Afr Art Educ. 2023;3(2). Available from: https://www.jaae.atagonline.org
3. Bernstein PL. The power of gold: the history of an obsession. Hoboken, NJ: John Wiley & Sons; 2012.
4. Blair A. Gold plating. Plat Surf Finish. 1999;86:52-3.
5. Boyle RW. Gold during the pre-classical (primitive) period (5000 BC–600 BC). In: Gold: history and genesis of deposits. Boston, MA: Springer US; 1987. p. 23-8.
6. Creswell JW. Research design: qualitative and mixed methods approaches. 4th ed. Thousand Oaks, CA: Sage Publications; 2014.
7. Daitey W, Panin KBO, Daitey ST, Adjacodjoe AE. Environmental impact awareness in sustainable product design and production of Adinkra symbol jewellery. J Innov Art Cult Nat Conserv Environ Sustain. 2024;2(1).
8. Göttler C. Yellow, vermilion, and gold: colour in Karel van Mander's Schilder-Boeck. In: Materialized identities in early modern culture, 1450-1750. Amsterdam: Amsterdam University Press; 2021.
9. Hochschild AR. Love and gold. S&F Online. 2009;8(1).
10. Panin KBO, Tetteh FO. The fluidity of life in the art piece 'Let it go': capturing the essence through movement and texture. Jozac Acad Voice. 2025;5(1):1-5.
11. Pyykkö P. Theoretical chemistry of gold. Angew Chem Int Ed. 2004;43(34):4412-56.

12. Terry G, Hayfield N, Clarke V, Braun V. Thematic analysis. In: The SAGE handbook of qualitative research in psychology. 2nd ed. London: SAGE Publications; 2017. p. 17-37.
13. Underwood S, Mulvaney P. Effect of the solution refractive index on the color of gold colloids. Langmuir. 1994;10(10):3427-30.
14. Vorobyova TN, Poznyak SK, Rimskaya AA, Vrublevskaya ON. Electroless gold plating from a hypophosphite-dicyanoaurate bath. Surf Coat Technol. 2004;176(3):327-36.
15. Zahavi D. Phenomenology: the basics. London: Routledge; 2018. Available from: https://doi.org/10.4324/9781315441603