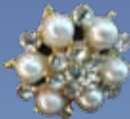
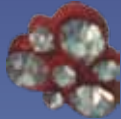


Toxic Jewelry

An Investigation of **Lead** in
Imitation Jewelry in Nepal



Ram Charitra Sah



CEPHED



SSNC

Imitation (Artificial) Jewelry Samples tested for Lead Content



Publisher: Center for Public Health and Environmental Development (CEPHED)

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Citation: Sah, Ram Charitra. 2012. *Toxic Jewelry, An Investigation of Lead in Imitation Jewelry in Nepal*, x+13. Kathmandu: CEPHED.

Design by: Krishna Prasad Subedi

Printed at: Sigma General Offset Press
Sanepa, Lalitpur-2, Nepal
Tel.: ++977-1-5554029

Available from: CEPHED
Nayabasti, Imadol-5, Lalitpur
Kathmandu, Nepal
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CEPHED would like to acknowledge the financial and technical support of Swedish Society for Nature Conservation (SSNC), Sweden for this research, implementation of heavy metals and chemical safety programs in Nepal.

The opinions expressed herein are those of the writer and may not necessarily reflect the official view of Swedish Society for Nature Conservation (SSNC), Sweden.



About CEPHED

Center for Public Health and Environmental Development (CEPHED) is an environmental NGO established in the year 2004, by and through the contribution, coordination from a group of activist and experienced people from medical, environment and public health sectors. CEPHED's focus is to serve Nepalese people and communities in the field of public health and environment. CEPHED has adopted the vision of bridging people with the science and technology for healthy living and environmental safety and taken a mission to act as bridging forum between people with science and technology to make access new scientific knowledge, technology and safety measures of environment and public health sector through research, coordination, capacity building and policy dialogue, etc. CEPHED is working with and also willing to work with group and organizations around the country with an understanding that this will help to bring the experience from the ground to the concerned authorities' notice that leads to more meaningful and sustainable solutions. From past eight years CEPHED has been engaged mainly on research, awareness raising, capacity building, policy influence especially in the area of chemical management, pesticide, obsolete pesticide, healthcare waste, POPs, heavy metals like mercury, lead, cadmium and electronic waste.

Additionally, CEPHED has been actively engaged in research, production of Information, Education and Communication (IEC) materials both in printed and electronic format widely disseminating all over the country.

The research results and findings have been shared with all stakeholders especially government, business communities and general public at large scale through all possible means such as meeting, interaction, presentation, newspaper, radio and television programme and also through organizing series of district, regional and national level awareness and capacity building training programmes on these issues. With its growing interest and engagement with various environmental issues of national and international importance, it became an active participating organization of several global networks working in the area of public health, environment and toxic free future. CEPHED is member organization of Toxic Link, International POPs Elimination Network (IPEN), Global Alliance for Incinerator Alternatives (GAIA), Health Care Without Harm (HCWH), Collaborative on Health and the Environment (CHE) and Zero Mercury Working Group (ZMWG)/EEB.



CEPHED has been doing research, raising awareness and at the same time setting pilot model projects. CEPHED has recently completed the feasibility study and strategy development for mercury free health care services from there pilot projects. The second intervention made by CEPHED towards curbing the release of POPs (Dioxins, Furans) is the development of environmentally sound management of health care waste and promotion of the use of dry welding machine for metal fabricating as model programme.

CEPHED has been awarded with “2011 Stockholm Convention’s PEN Award” in the ceremony hosted by POPs Convention Secretariat because of organization’s outstanding work on raising awareness on PCBs, their health effects and ways to prevent their release.

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Acknowledgement

Center for Public Health and Environment Development (CEPHED) is highly thankful to Swedish Society for Nature Conservation (SSNC), Sweden and Toxic Link, India for financial and technical support throughout the research work and implementation of the heavy metals as well as chemical safety programs in Nepal.

We would sincerely like to thanks the Laboratories: Nepal Environmental and Scientific Services (P) Ltd. (NESS) for helping us to test lead in jewelry samples which helped us to bring the real scenario of cosmetic products in Nepalese market.

CEPHED highly acknowledge the hard effort made by Ms Archana Sah, Ms Sabina Silwal and Ms Juna Giri, Er. Manish Thapa program officers of CEPHED to initially work on sampling and reporting of its own kind first ever publication based on primary level of indicative research carried out by CEPHED. Our gratitude extended to all those who have contributed to this report directly and indirectly.

We would also like to thank Mr. Krishna Prasad Subedi for computer layout and designing of this publication.

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Executive Summary

Jewelries have been a part of the daily wear from the ancient history. Jewelry is a personal adornment that people used from the early time to compliment themselves. The forms and design of the jewelries have been changed according to security situation, time and taste of the people. The literature shows that the history of jewelry begins from Africa. Even Asian countries also have long history of using jewelry.

With the time the materials from which jewelry are made have also changed. There is evidence that jewelry used to be made from animals bones, shells etc. to the precious metals like gold, silver, copper and now even from the non precious materials like plastic, clay etc. This imitation jewelry is also equally popular among consumer. But the harmful side of these kinds of jewelries is that they are heavily contaminated with lead. Lead is the toxic heavy metal that causes severe health problems and even causes death on long term exposure.

The study is carried out by Center for Public Health and Environment Development (CEPHED) in Nepal to know the existing scenario of lead contamination in imitation/artificial jewelry. During the study, the imitation jewelry from the market was collected, coded and sent for test at Nepal Environmental and Scientific Services (P) Ltd. (NESS) for the lead content in imitation jewelry with the help of Atomic Absorption Spectroscopy (AAS) method.

The result shows that in total sample, 53.33% (8 out of 15 samples) of samples exceed the lead level of US permissible limit in children's jewelry of 300 ppm. Lead content in the tested artificial jewelry ranges minimum from 28 ppm to maximum of 775500 ppm which is 2585 times higher than US standard for lead in children jewelry. The average lead content of all Jewelry is 198729.6 ppm which is about 662 times more than the US standard for lead in children of 300 ppm. Shocking thing is that more than 26.67% (4 out of 15) of the tested jewelries have more than 50% of their weight made up by lead composition. The bangle contain least lead, neck chain contain high lead, finger rings contain higher lead and ear rings contain highest lead content.

The reason behind this uncontrolled and alarming level of lead content in such products in Nepal is mainly due to the lack of standard, guidelines and regulation. So, it is recommended that there should be separate monitoring body to develop the standard and enact it. At the same time, the laboratory with facility to check the heavy metal contamination in various products should also be established.



Acronyms

AAS	:	Atomic Absorption Spectroscopy
CEPHED	:	Center for Public Health and Environmental Development
EU	:	European Union
mL	:	milli Litre
NESS	:	Nepal Environmental and Scientific Service (P) Ltd.
NIST	:	National Institute for Standards and Technology
NS	:	Nepal Standard
PMC	:	Precious Metal Clay
ppm	:	Parts Per Million
UK	:	United Kingdom
USA	:	United State of America
WHO	:	World Health Organization

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1. Introduction

Jewelry is a personal ornament such as necklace, ring or bracelet made from gemstones precious metals or other materials. The word jewelry is derived from the word jewel which was anglicized from the old French “joule” circa the 13th century. Further tracing leads back to the Latin word “jocale” meaning plaything^[1]. Earlier, jewelry was often used to denote the status. In ancient Rome, for instance only certain ranks could wear the rings ^[2].

The history of jewelry is long one with many different uses with different cultures. The first sign of jewelry came from the people of Africa. Perforated beads made from snail shells have been found dating to 75,000 years ago ^[3]. These evidence shows that the jewelry was even wore by a people when it was not made by a precious metal or gemstones but animal bones and shells etc. The first sign of the copper jewelry was seen around 7000 years ago ^[4].

The Modern jewelry moments began in the late 1940's at the end of the World War II with a renewed interest in artistic and leisurely pursuits. The movement is most noted with works by Georg Jensen and other jewelry designers who advanced the concept of wearable art. The advent of new materials, such as plastics, Precious Metal Clay (PMC), and colouring techniques, has led to increased variety in styles. Other advances, such as the development of improved pearl harvesting by people such as [Mikimoto Kokichi](#) and the development of improved quality artificial gemstones such as [moissanite \(a diamond simulant\)](#), has placed jewelry within the economic grasp of a much larger segment of the population.^[5]

According to a recent study in India, the largest jewelry market is the United States with a market share of 30.8%, Japan, India, China, and the Middle East each with 8–9%, and Italy with 5%. The authors of the study predict a dramatic change in market shares by 2015, where the market share of the United States will have dropped to around 25%, and China and India will increase theirs to over 13%. The Middle East will remain more or less constant at 9%, whereas Europe's and Japan's market share will be halved and become less than 4% for Japan, and less than 3% for the biggest individual European countries, Italy and the UK.^[5]

- 1 [www. http://alsayeghj.com/index.php?option=com_content&view=article&id=1:what-is-jewelry&catid=1:latest-news&Itemid=65](http://alsayeghj.com/index.php?option=com_content&view=article&id=1:what-is-jewelry&catid=1:latest-news&Itemid=65)
- 2 Pliny the Elder. *The Natural History*. ed. John Bostock, H.T. Riley, Book XXXIII *The Natural History of Metals Online at the Perseus Project* Chapter 4. Accessed July 2006.
- 3 http://en.wikipedia.org/wiki/Jewelry#cite_ref-Pliny33_15-0
- 4 Holland, J. 1999. *The Kingfisher History Encyclopedia*. *Kingfisher books*.
- 5 KPMG India (2007). “Global Jewelry Consumption”. *Gems and Gemology* (GIA) XLIII (Summer 2007): 180.



2. Jewelry in Nepal

Making of jewelry is like art in Nepal. The jewelries in Nepal are most commonly made by the hands and still the same trend is followed. The skill of making jewelry is handed over to the new generations now and then. The jewelry represents different culture, tradition and history that are being carried out from the time immemorial in Nepal, as the country has large range of ethnic diversity^[6].

Nepalese people living in different geographical areas and belonging to different communities wear a variety of jewelry made up of different metal like gold, silver, copper etc. Some people typically wear the ornaments made up of silver according to their culture while many people like to wear pure gold ornaments in Nepal. The culture of jewelry making has been around for centuries, and has a long and rich history among the people of Nepal.

Jewelry is always considered to add a beauty to the women and now days even men. So, no wonder it has been an important part of the dress and every day life. It is understood as the symbol of spirituality. Mostly in Buddhist community in Nepal, wearing jewelry is a way to draw close to the gods. It is also believed that it has the properties of amulet, bringing protection from evil spirits to the wearer.

Jewelry in Nepal is not only carved in fascinating design but sometimes even they are the representation of Sanskrit words. These words carry particular meaning for the people who wear the jewelry. For example the symbol of “Om” is often incorporated in jewelry. “Om” is a sound universe makes as the planets travel through the space. This sound has relaxing and healing properties. Wearing this symbol reminds the people who wear the peace that can be found by keeping harmony with Om ^[7].

3. Imitation Jewelry

Imitation jewelry also called artificial jewelry, fake jewelry, junk jewelry, fashion jewelry or trinkets is a jewelry manufactured as an ornamentation to compliment a particular fashionable custom or garments ^[8]. Imitation jewelry were made of less valuable materials including base metals, glass, plastic, and synthetic stones; in place of more valuable materials such as precious metals and gems. But at

6 www.nepal.com/blog/spectacular-art-of-jewelry-making-in-nepal

7 <http://www.omtibetanjewelry.com/hiandsyofnej.html>

8 Baker, Lillian. Fifty Years of Collectable Fashion Jewelry. Paducah: Collector Books, 1986.

present, high end crystals, cubic zirconia simulated diamonds, and some semi-precious stones are even used to make imitation jewelry ^[9].

Imitation jewelry is created in the same styles and designs as costly jewelry. There are bangles and rings, earrings, belly-rings and nose rings made from materials other than gold or silver ^[10]. Imitation jewelry has been part of culture for almost 300 years. During the 18th century cheap jewelry made with glass started getting made. After almost a century, in the 19th century, Imitation jewelry made of semi precious material came into the market. The use of semi precious material made the jewelry available in the hands of the common people ^[11].



Figure 1: Gold Plated Jewelries

Few years back the jewelry market was the busiest market, but due to the increasing price of gold, silver and other precious metal the business has dropped down. For this reason, consumers attracted towards imitation jewelry which is cheaper and the imitation of real jewelry. The use of this kind of jewelry is common among teenagers before but now even the other age group of women seems to be interested in it. The imitation jewelry is available in attractive design and styles like the real one.

In case of Nepal, the rush of people can be found in shops and market of imitation jewelry than the real jewelry shop. The high price of real jewelry items has made it beyond the imagination of normal people as well as the news that shows theft and robbery of jewelry in home or in market places has increased the interest of consumers towards the imitation jewelry. At the same time, imitation jewelry even at low cost and eye-catching design is fulfilling the demand of real gold and silver jewelry.

9 http://en.wikipedia.org/wiki/Costume_jewelry#cite_ref-Baker_1-1

10 http://www.ehow.com/about_6729179_history-imitation-jewelry-india.html#ixzz3qB86Jrec

11 Schiffer, Nancy. *The Best of Costume Jewelry*. Atglen: Schiffer Publishing, 1999.

4. Problem Statement

Imitation jewelry is cheaper and easy replace of precious metal jewelry and therefore people are more concentrated to such type of jewelry. But the thought has not yet gone to its dark side which has been shadowed by its high demand and use. The most dangerous part of such imitation jewelry is a lead content on it. Lead is the highly toxic heavy metal that does not break down in environment and causes a serious health problem.



Figure 2: Silver Plated Jewelleries

5. Use of Lead in Imitation Jewelry

Lead is used in jewelry-making for several reasons. First, it makes the base metal easier to shape and form. Second, it makes jewelry heavier, so it seems more substantial. Lastly, lead is cheaper to use than other metals, such as zinc. Lead is also sometimes used as a stabilizer in some plastic, such as polyvinyl chloride (PVC), which is often incorporated into children's jewelry items.¹²

Lead has often been used in jewelry, to make the article heavier, brighten colors, and to stabilize or soften plastic. However, lead can be dangerous, even deadly when used in jewelry. Scientists are increasingly concerned that there is no safe level of lead exposure, especially for pregnant women and young children. **In 2006, a 4-year old boy died after swallowing a pendant from jewelry that was over 90 percent lead.** Lead is a toxic metal and is persistent- meaning, it doesn't break down once it gets inside of our bodies. High levels of lead, have been found in jewelry, especially inexpensive children's jewelry. Exposures to lead can cause: behavioral problems; learning disabilities; organ failure and even death.



Figure 3: Color Coated Bengals

12 www.dtsc.ca.gov/HazardousWaste/Jewelry/.../LeadInJewelry_FAQ1...

Children 6 years old and under are most at risk because their bodies are growing quickly. Jewelry containing lead poses a particular concern because children are prone to placing jewelry in their mouths. This can result in absorption of dangerous levels of lead.



Figure 4: Gold, Silver, and Color Plated Ear Rings

6. Impact of Lead in Jewelry

Excessive exposure to lead can cause many health effects, ranging from behavioral problems and learning disabilities to organ failure, and even death. Children six years old and younger are more susceptible to adverse health effects because their bodies are growing quickly and their brains are still developing. Lead-containing jewelry poses a particular concern because children often place jewelry in their mouths, which can result in lead absorption at dangerous levels or very serious health effects if the jewelry is accidentally swallowed. As a consequences, they suffer from reduce intelligence, gastric problem, kidney damage etc. ^[12] Furthermore, pregnant women are at high risk to lead exposure in jewelry. Lead can affect the development of unborn baby's brain and nervous system. Child can then have learning and behavior problems. Lead also cause high blood pressure and complications during pregnancy such as premature birth or have a low birth weight such babies are at higher risks for illness. Lead can also cause pregnancy to end in a miscarriage or a still birth.¹³

6.1 Lead and Health Problem^{14 15}

People are generally exposed to lead by three major ways: inhalation, ingestion and absorption. Routes of exposure to lead include contaminated air, water, soil, food, and consumer products.

13 <http://nmhealth.org/eheb/documents/Lead/Lead%20and%20Pregnancy%20for%20web.pdf>

14 Gilbert SG. and Weiss B. "A Rationale for Lowering the Blood Lead Action Level From 10 to 2 µg/dL." *Neurotoxicology*. 27(5), September 2006, pp 693-701.

15 UNEP 2008a, *Interim review of scientific information on lead*, Taken 2008-05-18 from http://www.chem.unep.ch/Pb_and_Cd/SR/Files/2008/UNEP_Lead_review_Interim-mar102008.doc

The more toxicologists and other researchers investigated the health effects of lead, the more they realized that even very low levels of lead exposure were hazardous [16]. Lead may cause neuro developmental effects in children. [17] Other effects include cardiovascular, renal, gastrointestinal, hematological and reproductive effects. Children of six years old and below that are more at the risk. [18]

When the person is exposed to the lead, the blood lead level of the person raise up that leads to the lead poisoning. [19] Adults that are exposed to a dangerous

amount of lead can experience anemia, nervous system dysfunction, weakness, hypertension, kidney problems, decreased fertility and increased level of miscarriages, and low birth weight and premature deliveries. [20] Children exposed to high levels of lead show similar symptoms, including anemia, kidney damage, colic, neurological impairment, and impaired vitamin D metabolism. According to World Health Organization, no blood lead level is safe.

Lead poisoning causes a wide range of problems from low IQ and slowed grown in children to memory loss, mood disorders, and miscarriage in adults [21]. Exposure to lead can cause a range of deleterious health effect from behavioral problem and learning disabilities to seizures and death. Children 6 year old under are most at risk because children are growing at a very fast rate - growing bones, developing stronger muscles and creating many connections in their brain. When lead instead of essential nutrients is “available” to the body to make bones, muscle, and brain connections, permanent harm to health can occur. [22] In a child’s developing brain, lead interferes with synapse (junction for communication) formation in

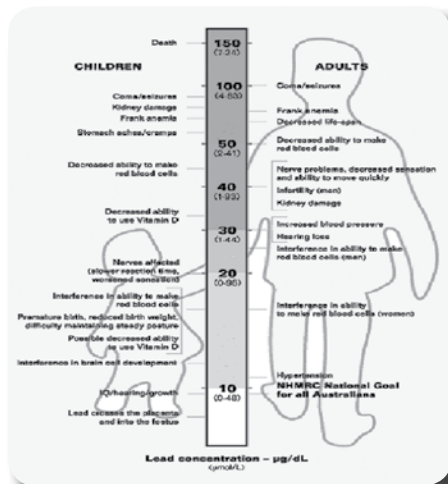


Figure 5: Impact of Lead on Health

16 <http://www.epa.gov/lead>

17 Stellman, Jeanne Mager (1998). Encyclopaedia of Occupational Health and Safety. International Labour Organization. pp. 81.2–81.4.

18 <http://www.atsdr.cdc.gov/toxprofiles/tp13.pdf> ATSDR Toxicological Profile for Lead

19 www.forbes.com/.../is-that-lead-in-your-lipstick-fda-tests-reveal-raise.

20 <http://www.kingcounty.gov/healthservices/health/ehs/toxic/Leadgeneral.aspx>

21 <http://www.leadsafeillinois.org/family-safety/pregnancy.asp>

22 http://safecosmetics.org/downloads/A_Poison_Kiss_report.pdf

the cerebral cortex, neurochemical development (including that of neurotransmitters), and organization of ion channels. It causes loss of neurons' myelin sheaths, reduces numbers of neurons, interferes with neurotransmission, and decreases neuronal growth.

6.2 Effects of lead exposure during pregnancy

A pregnant woman's past or present exposure to lead puts her unborn baby at risk. When she breathes in or swallows lead, it goes into her blood. Once the lead is in the bloodstream, it passes through the placenta into the baby and into the baby's developing bones and other organs. If a pregnant woman has had past exposure to lead, her body may store the lead in her bones and teeth. If the pregnant woman's diet does not contain enough calcium, the body may substitute lead in the bones for the calcium that the baby needs. Lead exposure can affect the unborn child's brain, causing developmental problems later in life. Fetuses exposed to lead before birth may be born early or underweight.

Lead is a proven neurotoxin that can cause learning, language and behavioral problems such as lowered IQ, reduced school performance and increased aggression. Pregnant women and young children are particularly vulnerable to lead exposure because lead easily crosses the placenta and may enter the fetal brain, where it interferes with normal development. Lead has also been linked to miscarriage, reduced fertility in both men and women, hormonal changes, menstrual irregularities and delays in the onset of puberty. The most recent studies conclude that there is no safe level of lead. No amount of exposure is without harm. Miscarriage, reduced fertility in both men and women, hormonal changes, menstrual irregularities and delays in when puberty begins for girls have all been linked to lead exposure. At puberty, boys' developing testes appear to be especially vulnerable to lead's impact.

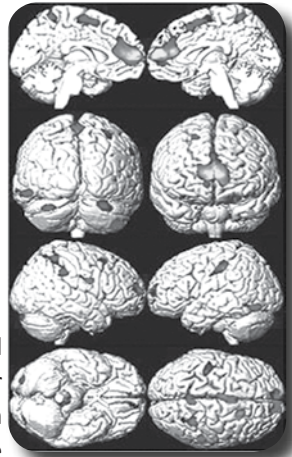


Figure 6: Brain damage caused by lead



Figure 7: Effects of lead during pregnancy

7. International Guidelines for Lead in Imitation Jewelry ^[23]

The countries like Canada, USA and EU already have national legislation in a place imposing a specific restriction on lead in children's jewelry. According to the WHO, metal tops the list of hazardous toxins. The USA Children jewelry regulation restricts the content of lead in product. According to the regulation, the children's jewelry must not contain more than 300 ppm of lead. The USA standard for lead in paint is only 90 ppm. California has taken enforcement action against a wide variety of discount stores, department stores, gift shops and vending machine operators.

California's Metal Containing jewelry Law:

- Forbids a person to manufacture, ship, sell, or offer for retail sale or offer for promotional purposes jewelry in California unless it is made entirely from one or more of the materials specified in the law,
- Mandates lead restrictions for certain of the specified materials allowed in manufacturing jewelry, and
- Establishes separate provisions for children's jewelry, body-piercing jewelry, and all other jewelry.

The Canadian regulation restricts the content and migration of lead. The limits are 600 ppm for the total lead and 90 ppm for the leachable lead. It incorporates both the US Children jewelry regulation and European Safety of Toys regulation. EU while only allows only 100 ppm of lead contain in children products.



Figure 8: Sample tested rings

8. Laws and standard for lead in products in Nepal

Different international studies show that heavy metal like lead, mercury, cadmium and many more are used in various products that are often used in daily life. And people all over the world are being exposed to such toxic substances that may be very harmful to health and environment once they are released. This is a reason that countries in world have developed some guidelines, policies and standards regarding their content in the products.

In case of Nepal, despite of several indicative studies carried out by CEPHEP (2011, Study of Lead in Decorative Paints: 2012, Lead in Lipstick: and Mercury in Skin Whitening Creams) no governing bodies or private institution has developed any standards or guidelines to check the content of heavy metals in the product including lead. Imitation jewelries that are mostly used by the consumer now days in Nepal are freely exported, distributed, sold and there is no market monitoring of such products as well. The qualities of imitation jewelry are not monitored and tested.

9. Materials and Methods

The use of imitation jewelry is increasing in Nepal day by day. And therefore, its market is also expanding. Kathmandu is a center for the different design and variety of such imitation jewelry. The samples for the lead in imitation jewelry were collected from different markets in Kathmandu. Samples collected include variety of imitation jewelry such as: gold plated guaranteed jewelry, gold plated non-guaranteed jewelry, silver coated jewelry and color coated jewelry. The collected samples were then coded and sent for testing the lead content to NESS Laboratory (NS Accreditation No. Pra. 01/2053-54).

9.1 Methods of Laboratory Analysis

9.1.1 Method Used

Atomic Absorption Spectroscopy (AAS).



9.1.2 Test Procedure ^[24]

The representative parts from the jewelry were selected for the sample analysis. Focus was given to incorporate the major jointed parts (where suspected lead has been used) selection. The identified parts were cut into small pieces and weighed accurately in clean and dry beaker. The sample was digested with calculated amount of nitric acid on controlled hot plate. The aliquot was cooled and filtered into 25mL volumetric flask and final volume was adjusted with distilled water. The content of lead in the aliquot was calculated by aspirating through AAS. The working lead standard solutions that had already prepared from NIST lead stock solution were used for the AAS calibration curve generation.

10. Key Findings

- All the collected samples contained lead in variable quantity.
- The highest lead content in tested jewelry was found to be 775500 ppm, minimum lead content was 28 ppm. The average lead content was 198729.6 ppm which was about 662 times more than the US standard for lead in children of 300 ppm.
- Highest concentration of lead was found in ear rings samples of all varieties. Maximum up to 775500 ppm was determined which was 2585 times higher than US standard for lead in children jewelry.
- The second highest concentration was found in a finger ring sample that was 612500 ppm which was 2041 times higher than US standard for lead in children jewelry.
- Bangle samples had a lowest concentration of lead on it. However, still 60% of it has more than 90 ppm of lead content.
- In neck chain sample 321900 ppm highest concentrations (1073 times higher than 300 ppm) and 460 ppm lowest content (1.53 times higher than 300 ppm) was determined.



Figure 9: Collected Samples for Laboratory Test

- In total sample, 53.33% of samples exceed the lead level of US permissible limit in children's jewelry of 300 ppm.
- Shocking thing is that more than 26.67 % (4 out of 15) of the tested jewelries have more than 50 % of their weight made up by lead composition and that is even more serious.

Table 1: Test results of lead in Imitation Jewelry

S.N.	Item Code	Sample	Types				Amount of Lead in ppm	% of lead by mass
			Gold plated (Guarantee)	Gold Plated (Non-Guarantee)	Silver Plated	Colour Coated		
1	NPB1	Bangles	*				136	0.0136
2	NPER1	Ear ring	*				33600	3.36
3	NPFR1	Finger ring	*				180	0.018
4	NPNC1	Neck Chain	*				460	0.046
5	NPB2	Bangles		*			28	0.0028
6	NPER2	Ear rings		*			558600	55.86
7	NPFR2	Finger Ring		*			49300	4.93
8	NPB3	Bangle			*		48	0.0048
9	NPER3	Earring			*		628300	62.83
10	NPFR3	Finger ring			*		612500	61.25
11	NPNC3	Neck chain			*		321900	32.19
12	NPBYC4	Bangle				*	145	0.0145
13	NPBBC4	Bangle				*	147	0.0147
14	NPERT4	Earring				*	775500	77.55
15	NPERR4	Earring				*	100	0.001
Average Lead Content							198729.6	19.872
Maximum Lead Content							775500	77.55

Source: NESS Private Limited, Laboratory Test Result, 2012.

Table 2: Percentage of samples with lead contain of more than 90 ppm, 300 ppm and 1000 ppm.

Samples	Above 90 ppm	Above 300 ppm	Above 1000 ppm
Bangles	60	0	0
Earring	100	80	80
Finger Ring	33.33	66.66	66.66
Neck Chain	100	50	50

Figure 10: Percentage wise lead content in different imitation jewelry, which is more than 90 ppm, 300 ppm and 1000 ppm

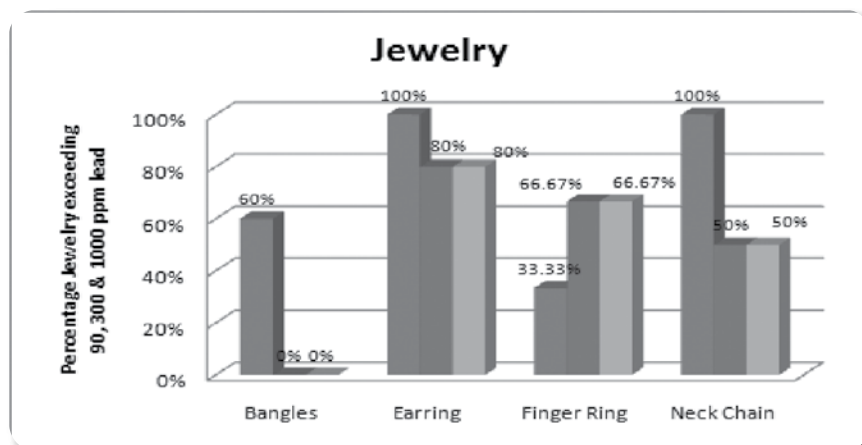


Table 3: Mean values of lead contain in different imitation Jewelry

Samples	Result by ppm and percentage	Mean	Min	Max	SD
Bangle	Result ppm	100.8	28	147	54.459205
	Result % by mass	0.01008	0.0028	0.0147	0.0057911
Earring	Result ppm	399220	100	775500	357924.93
	Result % by mass	39.922	0.01	77.55	35.792493
Finger ring	Result ppm	220660	180	612500	340231
	Result % by mass	33.09	4.93	61.25	39.824254
Neck chain	Result ppm	161180	460	321900	227292.4
	Result % by mass	16.118	0.046	32.19	22.72924

From above table it is inferred that the bangle contain least lead , neck chain contain high lead, finger rings contain higher lead and ear rings contain highest lead content.

11. Conclusion

Imitation jewelry is being widely used by consumer and is getting popularity in Nepalese market. Varieties of jewelry was tested which shows variable quantity of lead content. The lead content ranges from 28 ppm to 775500 ppm. All the ear rings samples contain higher concentration of lead. Maximum up to 775500 ppm lead was determined which was 2585 times higher than US standard for lead in children jewelry. The average lead content is 198729.6 ppm which was about 662 times more than the US standard for lead in children of 300 ppm. Shocking thing was that more than 26.67% (4 out of 15) of the tested jewelries have more than 50% of their weight made up by lead composition and that is even more serious issues with respect of causing deadly impact to the exposed population and users. The bangle contain least lead , neck chain contain high lead, finger rings contain higher lead and ear rings contain highest lead content. Exposure to lead in jewelry possesses several health problem but the consumers are unaware about the hazardous effect of lead. On the other hand, neither there are any legal frameworks nor any authorized government agencies to monitor this sector. Children, pregnant and breast feeding women are the major affected groups of lead exposure from such jewelry. Therefore our study recommends the followings.

12. Recommendations

- The demand of imitation jewelry is increasing but consequently the quality of such products is seemed to be very serious health concern. So, there should be a regular monitory about the quality of such products from concern sector.
- The imitation jewelry available in market of Nepal has been found heavily contaminated with lead. The government of Nepal should make a standard, Act and Regulation to control the lead content in jewelry and make it mandatory to follow it while producing, importing, sale, distribute and promoting such products.
- The laboratory should be set up to check the contamination of heavy metals in imitation jewelry and other products.
- Mass awareness campaign should be carried in order to provide information to consumer about what they are using in their daily life could cause serious health hazards.
- Warning lebel should be put on the package of all imitation jewelries.