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RESEARCH ARTICLE

DETERMINATION OF HEAVY METALS (NI, CD, CO, CR, PB) USING ATOMIC ABSORPTION SPECTROPHOTOMETRY (AAS) IN NAIL POLISH SAMPLES

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Abstract: Nail shines has been advancing observably somewhat recently, some nail clean brands adding names revealing the rejection of specific poisonous fixing, for example, lead, cadmium, chromium, nickel which are added as fixings can be found in follow sum. Ingesting high levels of heavy metals can result in behavioral problems, stomach irritation, reproductive and immune toxicity and cancer. The point of this study is to analyze the degree of weighty metals in various brands of nail clean sold in market and evaluate the potential dangers related with their utilization. In this work corrosive absorption process was utilized for test arrangement and assurance of Number of weighty metals including Disc, Co, Cr, Ni, and Pb. To know the concentration of metals calibration curve was prepared practicing AAS (Atomic Absorption Spectroscopy), by which the concentrations of branded and local nail enamels inspected and gauge its potential health threat.

KEYWORDS: Metals, nail polish and enamels, toxic substance, AAS, forensic chemistry

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INTRODUCTION:

The merchandise for beauty products, dermas is emerging rapidly, has been developing recognizably, labels marking and publicizing the debarment of some toxic ingredients in essence lead, cadmium, chromium, nickel can be found in trace amount ingesting outturn in problems.[1]Nail polishes can be effective to procure some dominant information about perpetrator and victim and also help in Crime scene reconstruction by chemically analyzed. In these times every individuals especially women wants to enhance their beauty to look more attractive this way enamels are one of them which is in plentiful use. Chemicals that are cloaked in some beautiful colours in enamels are one of the majorproblem and health at risk as it accommodates toxic and poisonous substances that are graduallydamaging individuals' health as well as that who works in nail salons [2,3]. Despite of the harmful effects of nail polishes its demand increasing massively which is largely unrestricted by government authorities due to which most of companies brands specially locals are just barely tested for safety precautions [4,5]. All over some of the magnificence items in India comes under Drugs and Cosmetics Acts, and its manufacturing of nail polishes subject to the Drugs and Cosmetics rules that are issued by the government of India, and made amendments by time emerging rapidly with different brand and with its highly demanding products, different types of nail polishes are available in market which has their own property claims to be identical in polishes that divulge in product[6,7]. Mica also used in polishes as finishes that provides metallic touch, still there are no regulations as toxic metals still uses in polish but it is not present on the labels as it is not disclosed as one of the ingredient in product that contains information regarding descriptions that poses in nail polishes which led researchers in concern[8,9].There are many contaminants that are threat to individual health which can be detected by its concentration that are present in the body. In today's time research shows that there are toxic and poisonous metals consist in human body system as a major source which are related with the harmful effect on human which lead to severe diseases major as well as minors[10]. Those metals can route administered in body by eating or biting nails or can be swallow, metals can get through the pores that are on skin which are absorbed in digestive system depends on the status of the humans. Submission of various metals administered in body could cause adverse problem namely damage to kidney, mental retardations, hormones imbalance and so forth psychological effects and so forth[11-12].For handling these concern US government issues some directives on metals constitute in nail polish[13].acceptable limits as it becomes completely avoidable as metals somehow present in human bodies as it can present in not only in water but also in food, air, and can come in contact in every single day of individual life, there are insufficient data concerns the concentrations of heavy metals in nail polish[14] within India and the health issues to peoples have not been investigated, the usage and popularity of nail polish have witnessed a magnificent urge in India [15]. As trace evidence it can create a linkage between a suspect and victims provides essential fact and details about crime due to the presence of alloys in products that can cause trouble, Hereupon the purpose of this project was to examine the level of heavy minerals in dissimilar label of enamels advertise in local merchandise as it is important to have notable focus on the safety of products, as well as its potential risks associated with the exposure of metals.

METHODOLOGY:

Reagents and Chemicals

Nitric acid and HCL (1:3), Hydrogen Peroxide (30%), AAS standard solution, Metal free water.

Equipments

Atomic Absorption Spectrometer, (AAS 4141 from ECIL, India), Digital Balance from Hanna, India.

Sample Collection

Twenty Nail Polish samples (10 branded & 10 local/unknown brand samples) were purchased from local market, India.

PROCEDURE:

Digestion of sample

In this work, wet acidic digestion method employed, 1 g of each Nail polish was taken and weighed on electronic equilibrium followed by 5 mL of a concentrated $HClO_4$:HNO_3 (1:3), which was then warmed for 2 hours on a hot plate at 100 °C, at that point 3 mL of the concentrated solution is added and warmed again for two hours. The sample digested were cooled for three hour in room temperature and diluted to 25mL with deionized water and was filtered through filter paper (Whatman No. 40) to remove unwanted components.

Figure 1: Sample prepared using acid digestion method

Standard Solution preparation

2ml of 1000 parts per million(ppm) chromium, cadmium, nickel, lead and copper stock solution was taken and dilute to 10mlwas prepared by taking 0.4 ml, 0.6 ml 0.8 and 1 ml of 200 ppm metals solutions and diluted it to 100 ml. The absorbance for 0.2 ppm, 0.4 ppm, 0.6 ppm, 0.8 ppm and 1 ppm solutions were recorded and calibration curve was prepared.

Sample analysis

Prepared sample analyzed by atomic absorption spectrometer optimized with hollow cathode lamp for which air- acetylene fuel was used.The absorbance for 0.2 ppm, 0.4 ppm, 0.6 ppm, 0.8 ppm and 1 ppm arrangements were recorded and calibration curve was prepared. The solution of different concentration of each 5 metals was calibrated to get standard curve, readings and values. All samples were analyzed and the absorbance of solutions was recorded.

The calculation formula for AAS is the content of micronutrient in sample(mg/ppm) = Concentration µg/ml × 25 ml (dilution factor).

Figure 2: Sample analysis at AAS 4141

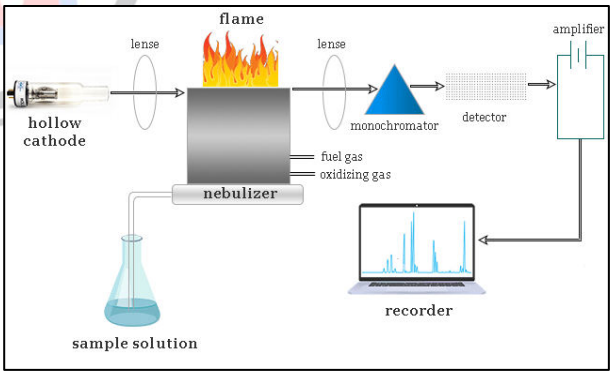

Figure 3: Atomic Absorption Spectrometer-Instrumentation [16]

A widely used method for determining the concentration of metal atoms or ions in a sample is atomic absorption spectroscopy (AAS). This instrument is utilized to decide the specific metal components (the analyte) in a specimen.

This absorbs in time atom absorbs the UV lights or visible lights. Along with this action the atoms comes out in excited state that were in ground state before and it discharges radiations of the metals as

they goes again in their ground state. The nebulizer systems metamorphose the sample solution into a aerosols atoms.It consists of a component called optical system and detector and a monochromator used to separate out the lines as, and to exclude out the other wavelengths. The light is administered into the detector that is a photomultiplier tube, change the light signals into electrical signal amplifier is used. The signals expose to view in monitor for readings readout or to get the absorbance reading to prepare the calibration curve.

RESULTS & DISCUSSIONS

Total of twenty samples were taken and analyzed using Atomic Absorption Spectrophotometer (AAS 41410).

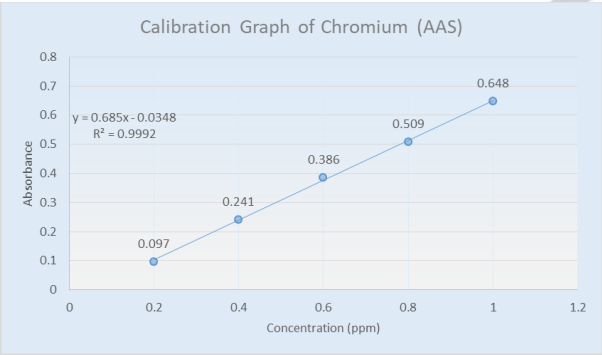

Figure 4: Calibration Graph of Chromium

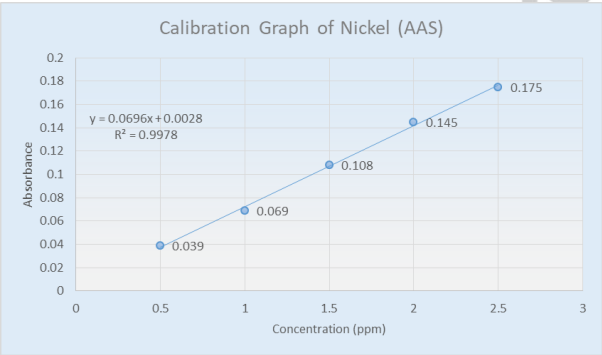

Figure 5: Calibration Graph of Nickel

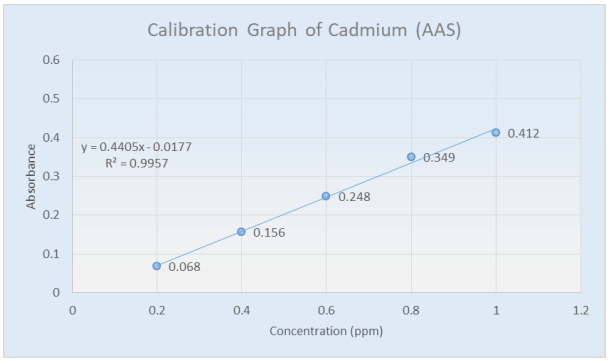

Figure 6: Calibration Graph of Cadmium

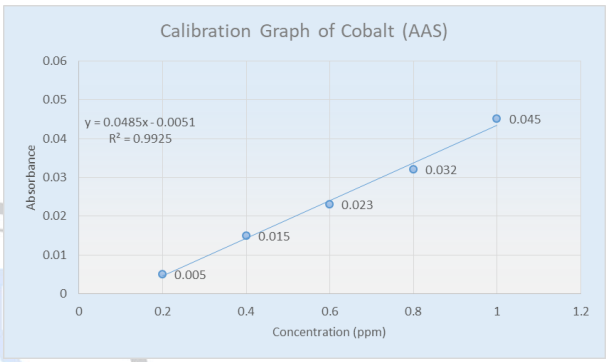

Figure7: Calibration Graph of Cobalt

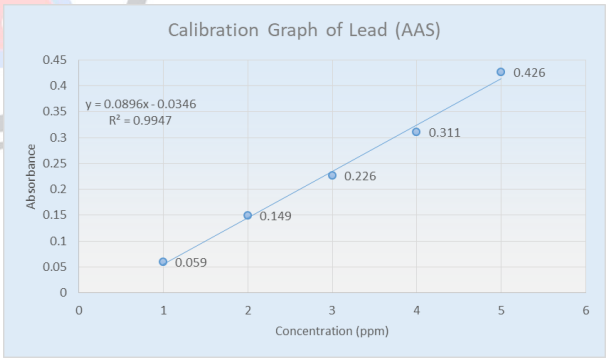

Figure 8: Calibration Graph of Lead

The alignment bends for Pb, Co, Ni, Cr, Co showed great linearity over the predefined focus range where relationship coefficients more noteworthy than 0.99.

Table 1: The average centralization of Chromium (Cr), Cadmium (Album), Cobalt (Co), Nickel (Ni) and Lead (Pb) in Nail polishes.

S.No.	Sample	Chromium Concentration in sample(ppm)	Cadmium Concentration in sample(ppm)	Cobalt Concentration in sample(ppm)	Lead Concentration in sample(ppm)	Nickle Concentration in sample(ppm)
1.	Premium Nail polish (n=10)	0	0.00409	0.0068	0.03093	0.00403
2.	Local Nail polish (n=10)	0.00068	0.00517	0.04568	0.40597	0.01572

This study was conducted to estimate the concentration of metals in a selected nail polish, The concentrations in both (premium and local) nail polish samples did not exceed the prescribed permissible limit set for chromium, cadmium, cobalt, lead, and nickel in Nail polish formulations are 3 ppm, 16ppm, 8 ppm, 22ppm, and 8 ppm given by respectively. Lead, in particular, was identified as the heavy metal with the highest concentration 0.40597 among all the samples which assent with the cutoff points set by the US Food and Medication Organization and Wellbeing Canada. Chromium level was 0.00 ppm. The alignment bends for Pb, Co, Ni, Cd, Co showed great linearity over the predefined focus range where relationship coefficients (R^2) more noteworthy than 0.99. So it concludes that all the samples qualify the limit criteria.

CONCLUSION:

This study concludes that Atomic Absorption Spectroscopy is the most dependable technique use for analyzing the quantity of metals.Nail polish is a popular cosmetic product that is used by millions of people around the world.In general, the convergences of these heavy metals in the nail polish did not surpass the acceptable limit sets for heavy metals in beauty products. The utilization of nail polish didn't represent a critical constant non-cancer-causing wellbeing risk associated with exposure to these heavy metals. Lead, in particular was identified as the heavy metal with the highest concentration among all the samples. The concentration of metals in the assessed nail polish brands, both premium and local, were viewed as under 3 ppm, which consents as far as possible given that is 3 ppm, 16ppm, 8 ppm, 22ppm, and 8 ppm given bythe US Food and Medication Organization and Wellbeing Canada.

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