

Article on undesirable effects of different chemicals used in tattoo inks

Abstract

A fashion trend and growing interest of youth towards tattooing has become an important issue to discuss and concerns are therefore exist to find out the hazardous effects of different chemical used in formulation of tattoo inks. Allergic hypersensitivity and severe dermatological reaction are common with irritation, redness, and swelling. Eczematous skin reactions, also reported in many cases. Commercially available different colours of tattoo inks contains different chemicals like ferric oxide (red and black), chromium oxide (green), cobalt blue (blue), manganese violet and lead white. Almost all metallic salts are found to cause undesirable effects on health.

Keywords: tattoo ink, health effects, metal salts and young population

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Mohammad Athar,¹ Sameena Farrukh²
¹Assistant Professor, Department of Forensic Science, India

²Department of Education and Research, National Institute of Technical Teachers Training & Research, India

Correspondence: Sameena Farrukh, Department of Education and Research, National Institute of Technical Teachers Training & Research, Bhopal, India, Email sameenafarrukh04@gmail.com

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Introduction

Tattooing has been a common practice from historic civilization and prevailed among almost all cultures. In Europe and American culture it was previously fringe fashion. But in present scenario it is becoming a part of pioneer personalities and mostly common among the young group of 16-30 years. Now it is also getting common among Indian youths and they are adapting it as newer fashion trend. In this paradigm of growing interest of youth towards tattooing it has become an important issue to discuss and find out the hazardous effects of different chemical used in formulation of tattoo inks. The present study is the part of survey conducted about the local brands of tattoo ink available in Indian markets and the main concern was to emphasize the chemical composition of tattoo ink of different colors and to search out the possible toxic effects of those chemicals. Tattoo ink are broadly classify as Temporary, which last for one week, while Permanent tattoos can be medical therapeutic, decorative or traumatic in nature.¹ Cosmetic tattoo is the most commonly used as decorative arts, many salon and professional artist used it for tattooing. Many individual get their first tattoos at the age of 16-18 years and

unfortunately no safety standard or safety regulation has been defined by the government or medical association in this regards.

Some Common clinical manifestations have been reported through different studies. Allergic hypersensitivity and severe dermatological reaction are common. B.M. Shashi kumar et al.,² in their study reported hypersensitivity, lichenoid reaction and cutaneous allergic reaction among 39 patient of mean age 22 years and mean duration before the appearance of lesion 7 months. Similarly, swapnil et al.,³ reported two cases of tattooing reactions on skin. The tissue taken from affected parts were examined and biopsies were done and lichenoid reaction was diagnosed.

Chemical composition of tattoo inks

A very rare data is available about the detail chemical composition of tattoo ink. As chromophore in tattoo inks consist of organic colorants and a wide range of metal salts. There are different colours of tattoo inks with different chemical composition of which the few have described below (Table 1).

Table 1 Composition of tattoo pigments

Composition of Tattoo Pigments			
Color	Material	Comment	Adverse Effects
Black	Iron Oxide (FeO) Carbon	Natural black pigment is made from magnetite crystals, powdered jet, wustite, bone black, and amorphous carbon from combustion (soot). Black pigment is commonly made into India ink	discoloration of the eyes, siderosis, and pneumoconiosis
Brown	Ochre	Ochre is composed of iron (ferric) oxides mixed with clay. Raw ochre is yellowish. When dehydrated through heating, ochre changes to a reddish color.	risk of lung cancer
Red	Cadmium Red (CdSe) Iron Oxide (Fe ₂ O ₃) Naphthol-AS pigment	Iron oxide is also known as common rust. cadmium pigments are highly toxic. Naphthol reds are synthesized from Naptha. Fewer reactions have been reported with naphthol red than the other pigments, but all reds carry risks of allergic or other reactions.	kidney and liver afflictions, respiratory problems
Yellow	Cadmium Yellow (CdS, CdZnS) Curcuma Yellow Chrome Yellow (PbCrO ₄ , often mixed with PbS)	Curcuma is derived from plants of the ginger family; aka tumeric or curcumin. Reactions are commonly associated with yellow pigments, in part because more pigment is needed to achieve a bright color.	Risk of skin cancer, irritation, redness, and swelling

Table Continued...

Composition of Tattoo Pigments			
Color	Material	Comment	Adverse Effects
Green	Chromium Oxide (Cr ₂ O ₃), called Casalis Green or Anadomis Green	The greens often include admixtures, such as potassium ferrocyanide (yellow or red) and ferric ferrocyanide (Prussian Blue)	blisters and deep ulcers. allergic and eczematous skin reactions,
	Malachite [Cu ₂ (CO ₃)(OH) ₂] Ferrocyanides and Ferricyanides Lead chromate Monoazo pigment		
Blue	Azure Blue	Blue pigments from minerals include copper (II) carbonate (azurite), sodium aluminum silicate (lapis lazuli), calcium copper silicate (Egyptian Blue), other cobalt aluminum oxides and chromium oxides. The safest blues and greens are copper salts, such as copper phthalocyanine. Copper phthalocyanine pigments have FDA approval for use in infant furniture and toys and contact lenses. The copper-based pigments are considerably safer or more stable than cobalt or ultramarine pigments.	Allergic and eczematous skin reactions,
	Cobalt Blue Cu-phthalocyanine		
Violet	Manganese Violet (manganese ammonium pyrophosphate) Dioxazine/carbazole	Some of the purples, especially the bright magentas, are photoreactive and lose their color after prolonged exposure to light. Dioxazine and carbazole result in the most stable purple pigments.	respiratory problems, irritation to the skin.
White	Lead White (Lead Carbonate) Titanium dioxide (TiO ₂) Barium Sulfate (BaSO ₄) Zinc Oxide	Some white pigments are derived from anatase or rutile. White pigment may be used alone or to dilute the intensity of other pigments. Titanium oxides are one of the least reactive white pigments.	

Discussion

With the growing interest of tattooing the cases of adverse effects is also increasing with mild effects to severe dermatological complications, as already been quoted in this article with reference to the findings of Shashi Kumar et al.,² and Swapnil et al.³ As described in the table different colors of tattoo inks have different formulations with number of chemical substances which have potential adverse effects. The most common adverse health outcomes induced by iron oxide include permanent discoloration of the eyes, siderosis, and pneumoconiosis.^{4,5} The exact mechanisms underlying iron oxide particulate-induced adverse outcomes are poorly understood, but most research suggests they are related to the physicochemical properties of the iron or iron oxide metal compounds, and are largely due to iron oxide-induced or catalyzed oxidative stress.^{6,7} Cinnabar (an inorganic mercurial compound) contains more than 95% mercury sulfide (HgS) and has been used for many thousands of years in traditional Chinese medicine and in Asian and Middle Eastern countries as a sedative and hypnotic.^{8,9} Various reports have reported that cinnabar can be absorbed following oral administration at high doses and accumulated in the brain and other tissues, causing mercury intoxication.¹¹ Exposure to cadmium is known to be toxic,¹² and is linked to an increased risk for cancer as well as a number of kidney and liver afflictions; inhalation can also cause a host of respiratory problems and a flulike condition known as the “cadmium blues. While these risks are associated with working with large quantities of cadmium in industrial settings; it’s

unclear how the small amounts of cadmium in paint affect the human body. According to a report published by health department of New Jersey, lead chromate is toxic substance and prolonged contact with skin can cause blisters and deep ulcers.

Conclusion

There is a need to assess and find out proper toxicological effects of tattoo inks and their possible health effects. Almost all type of tattoo inks contains metal salts but their particular effects on health need to be study. Because these chemicals enter in body through dermal absorption and many of them get accumulated and cause irritations after months of getting tattoos. Hence proper findings and research in this concern will help to set safety regulations and safety measures for following this fashion trend in a safe way.

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None.

Conflicts of interest

The author declares that there is no conflict of interests regarding the publication of this paper.

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