

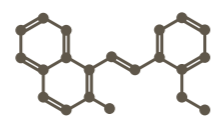
# Tattoo chemistry: Colourants and concerns



## What's in tattoo ink?



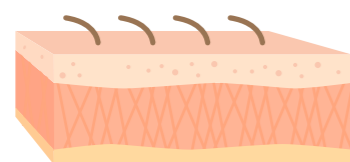
Carrier



Colourant

Tattoo ink has two key components: carriers and colourants. The carrier acts as a solvent for the colourant and transports it to the dermis. Usually, the carrier is ethanol or distilled water, though other substances including isopropyl alcohol and glycerin can also be used.

Skin

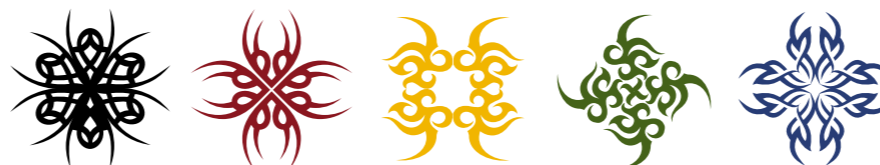


Epidermis

Dermis

## What pigments are used?

Historically, various ground up minerals were used as tattoo pigments to achieve different colours.



Carbon Black

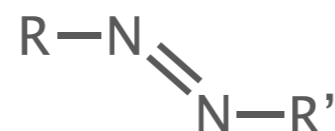
Mercury(II) sulfide

Cadmium sulfide

Chromium oxide

Cobalt(II) aluminate

In the present day, over 80% of tattoo colourants are organic (carbon-based) compounds. Of these, 60% are from a family of compounds known as azo dyes.



Azo dye - general structure

R and R' represent varying parts of the molecule

Other families of organic dyes are also used, giving varying ranges of colours. A selection are shown below. It is common for tattoo inks to contain multiple colourants.

### Azo dyes



Red, orange, yellow

### Phthalocyanine dyes



Blue to green

### Anthraquinone dyes



Red to blue

### Xanthene dyes



Yellow to violet

### Diketopyrrolopyrrole dyes



Red to orange

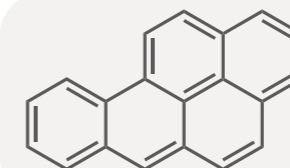
### Quinocridone dyes



Red to violet

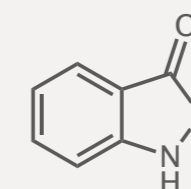
## What are the health concerns?

The majority of health complications arising from tattoos relate to infection or allergic reaction when getting one. However, tattoo inks are largely unregulated, and there are also concerns surrounding some compounds in them.



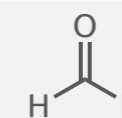
### Benzo-[a]-pyrene

A polycyclic aromatic hydrocarbon (PAH) and carcinogen which is found in some black tattoo inks.



### Benzoisothiazolinone

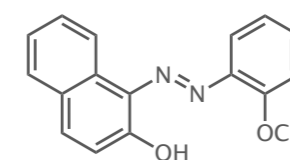
An antiseptic in some ink formulations which can cause skin irritation.



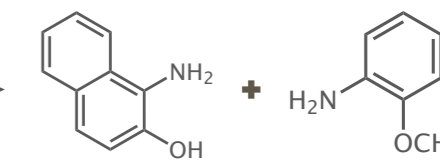
### Formaldehyde

A preservative found in some tattoo inks which is classified as a carcinogen.

Some pigments used in tattoos break down into compounds with known health concerns. For example, some azo dye pigments can be broken down by bacteria or UV light to form potentially cancer-causing primary aromatic amines.



Azo dye



Primary aromatic amine

In spite of the health concerns, a causative link between tattoos and cancer has not been established.