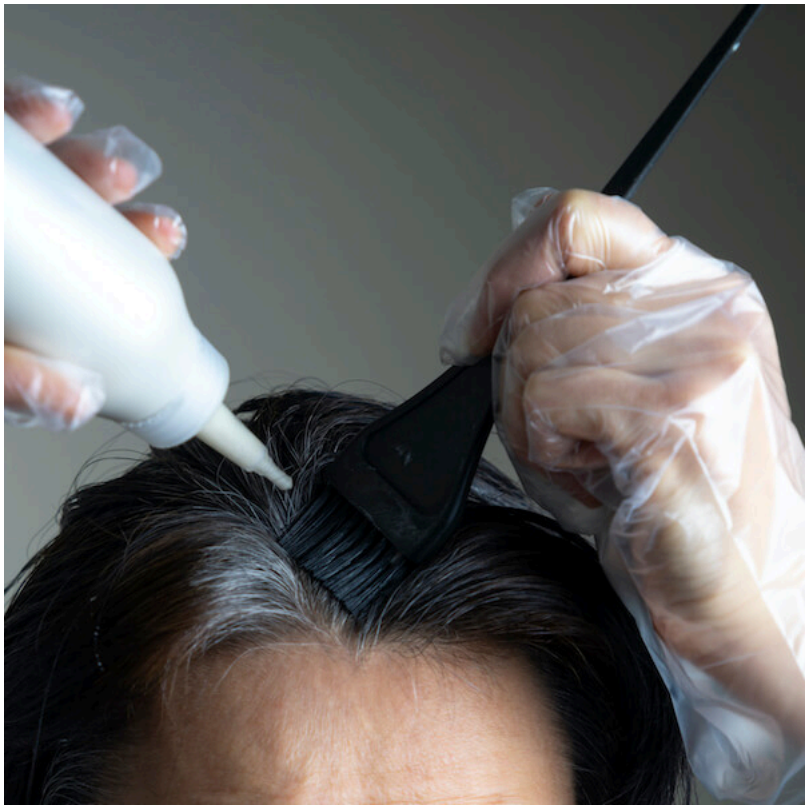
P-Phenylenediamine

Consumers encounter p-phenylenediamine in many forms of permanent hair dyes called oxidative dyes. As a known skin sensitizer, it leads to allergic reactions. P-phenylenediamine, as well as the products of its reactions with hydrogen, can alter the genetic material of cells.



WHAT IS P-PHENYLENEDIAMINE?

Consumers are primarily exposed to p-phenylenediamine (PPD) through its use in permanent hair dyes that rely on chemical reactions (called oxidation) to fix the color[1],[2] where it is found in concentrations of about 4 percent.

PPD reacts with hydrogen peroxide to bind the color to the hair permanently.[3],[4] It is also often mixed with other chemicals, such as resorcinol, to achieve a particular color of dye.[5]

P-phenylenediamine is part of a class of chemicals called aromatic amines, which are found in the plastic and chemical industries as byproducts of manufacturing. In addition to hair dyes, this chemical is used in the manufacturing of rubber and certain polymers, such as Kevlar. It also acts as developing agent in photography.[6]

Found In

- Hair dyes

What to look for on the label

- P-phenylenediamine
- Para-phenylenediamine
- 4-aminoaniline
- 1,4-benzenediamine
- p-diaminobenzene
- 1,4-diaminobenzene
- 1,4-phenylene diamine

Health Concerns

Skin sensitization: Evidence confirms p-phenylenediamine is a strong potential skin sensitizer.[7],[8] A German study showed that it was the 5th most common skin allergen and that it had about a 5% sensitization rate.[9]

Cancer: Aromatic amines found in hair dyes, such as p-phenylenediamine, have long been suspected of being carcinogenic. For example, they are linked to increased incidence of bladder cancers.[10] However, studies looking at the risk of cancer

associated with the use of hair dyes have returned conflicting results and the International Agency for Research on Cancer (IARC) states that it is unable to classify the carcinogenicity of p-phenylenediamine.[11]

Mutagenicity: When P-phenylenediamine reacts with hydrogen peroxide, as it does in the preparation of hair dyes, it can form a mutagenic, or DNA-altering, substance called Bandrowski's base. Bandrowski's base has been shown to be strongly mutagenic and possibly carcinogenic.[12],[13],[14],[15] It is clear that there is a high potential for consumer exposure to mutagenic substances when using oxidative hair dyes.

Organ system toxicity: When ingested, p-phenylenediamine is highly toxic. Often referred to as hair dye poisoning, p-phenylenediamine can cause respiratory distress and renal failure. It causes swelling in the upper respiratory tract and larynx which causes respiratory distress. If the poisoning is severe it enough it can also cause renal failure and can ultimately be fatal.[16],[17],[18]

Vulnerable Populations

Teenagers (https://www.safecosmetics.org/population/teenagers/), Workers (https://www.safecosmetics.org/population/workers/)

Regulations

The European Union limits maximum concentrations and requires warning labels. Use is restricted in Canadian cosmetics.

How to Avoid?

Avoid dying your hair. Read labels and look for products that include p-phenylenediamine, para-phenylenediamine, 4-aminoaniline; 1,4-benzenediamine; p-diaminobenzene;1,4-diaminobenzene; 1,4-phenylene diamine. Salon workers who are frequently exposed to oxidative hair dyes should wear protective gear, including gloves and protective wear on the face.

Explore other Chemicals

Octinoxate (https://www.safecosmetics.org/chemicals/octinoxate/)

PABA (https://www.safecosmetics.org/chemicals/paba/)

Resorcinol (https://www.safecosmetics.org/chemicals/resorcinol/)

Carcinogens in Cosmetics (https://www.safecosmetics.org/chemicals/known-carcinogens/)

Toluene (https://www.safecosmetics.org/chemicals/toluene/)

Nanomaterials (https://www.safecosmetics.org/chemicals/nanomaterials/)

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