

Cosmetics and Hair Dye

Millions of women and men around the world use cosmetics to enhance or change their appearance. The common term makeup refers to cosmetics such as foundation, eye shadow, eye liner, mascara, blush, and lipstick. Other cosmetics may include nail polish, body wash and moisturizers, perfumes, and hair coloring or styling products.

Hair dyes and straighteners involve a series of chemical reactions. For example, permanent hair color is mixed with colorless dye precursors and a stabilizer, and applied to the scalp and hair. The mix of chemicals process together to make the final color, which bonds to the hair.

Can these products affect health?

Some chemicals in cosmetics are considered endocrine disrupting, which means they can interfere with the body's hormones. They may alter bodily processes such as the timing of puberty, and may cause other health problems for adults.¹

Consumers may choose from hundreds of hair dye products that contain combinations of more than 5,000 different chemicals. In the late 1970s, some hair dye chemicals were linked with cancer in laboratory animals, so many manufacturers removed these chemicals from their products. However, some hair dyes on the market today contain substances that are in the same chemical class as those removed.²

What is NIEHS doing?

Cosmetics and hair dye products contain a mix of chemicals. NIEHS is working to better understand if any of these compounds are harmful.

The National Toxicology Program (NTP), housed at NIEHS, conducts research on chemicals used in cosmetics and related products, including:

- **Antimicrobials**, such as triclosan, are used in some body washes and other products to kill or stop the growth of microorganisms, such as bacteria.
- Engineered **nanomaterials**, like zinc oxide and titanium dioxide, are commonly used in cosmetics and sunscreens to protect skin from harmful ultraviolet rays. Engineered nanomaterials are measured in nanometers. A nanometer is one millionth of a millimeter, or approximately 100,000 times smaller than the diameter of a human hair.



- **Parabens** are used to preserve the shelf life of many cosmetic and scented products.
- **Phthalates** are found in cosmetics, such as nail polish and hair spray, and plastic packaging.

NIEHS-funded research found women working as cosmetologists and manicurists had an increased chance of developing gestational diabetes during pregnancy. They also found a higher risk for placenta previa, a condition where the placenta partially or totally covers the cervix — the opening to the uterus — which can cause severe bleeding during pregnancy and delivery.³

NIEHS-supported research also found that Latina adolescent girls, who reported daily use of certain makeup and other cosmetic products, had higher levels of endocrine-disrupting chemicals in their urine, which may affect reproductive development.⁴

A subsequent study found daughters of women whose urine was found to have phthalates and other endocrine-disrupting chemicals may start puberty earlier.⁵

Children born to mothers with high levels of phthalates in their urine were up to 30% more likely to have language delays compared with children born to mothers with lower levels.⁶

Is there a link between hair dye and cancer?

A study conducted by the International Agency for Research on Cancer, part of the World Health Organization, concluded that occupational exposure to hair dye, such as by a hairdresser or barber, showed limited evidence in humans for carcinogenicity.⁷

Some studies found an increased risk of bladder cancer in hairdressers.⁸ However, study results are mixed for people who dye their own hair, and the link to bladder and other cancers is uncertain.

In the NIEHS Sister Study, women who regularly used hair dye were 9% more likely than women who didn't use hair dye to develop breast cancer. Among African American women, using permanent dyes every five to eight weeks or more was associated with a 60% increased chance of developing breast cancer as compared with an 8% increased risk for white women.⁹

How does NIEHS work with other federal agencies?

At NIEHS, NTP collaborates with the U.S. Environmental Protection Agency, the National Center for Advancing Translational Sciences, and the U.S. Food and Drug Administration (FDA), to conduct toxicity testing with robotics of 10,000 chemical compounds, including those found in cosmetic products. Called Toxicology in the 21st Century, or Tox21, the program's goal is to develop ways to rapidly test whether substances are associated with health problems.

Are cosmetics and hair dye regulated?

The Federal Food, Drug, and Cosmetic Act regulates the cosmetics and personal care industry in the United States. The law mandates that manufacturers report the safety of cosmetic products to the FDA. But, cosmetics do not undergo the same stringent premarket approval as drugs, except for color additives.¹⁰ Makeup products with sunscreen are treated as both cosmetics and drugs.¹¹

Most hair dyes on the market belong to a class called coal-tar. The term coal-tar colors dates to the time when coloring materials were byproducts of the coal industry, though most are now made from petroleum. Unlike color additives in cosmetics, coal-tar hair dyes do not need FDA approval if the label includes a special caution statement and the product has clear directions for conducting a skin test before using the dye.



Further Reading

- **American Cancer Society: Cosmetics**
<https://www.cancer.org/cancer/cancer-causes/cosmetics.html>
- **FDA: Cosmetics Safety Q&A: Personal Care Products**
<https://www.fda.gov/Cosmetics/ResourcesForYou/Consumers/ucm136560.htm>
- **FDA: Hair Dyes**
<https://www.fda.gov/Cosmetics/ProductsIngredients/Products/ucm143066.htm>
- **GirlsHealth.gov: Makeup**
<https://www.girlshealth.gov/body/grooming/makeup.html>

For more information on the National Institute of Environmental Health Sciences, go to www.niehs.nih.gov.

- ¹ Ferguson KK, Colacino JA, Lewis RC, Meeker JD. 2017. Personal care product use among adults in NHANES: associations between urinary phthalate metabolites and phenols and use of mouthwash and sunscreen. *J Expo Sci Environ Epidemiol* 27(3):326-332.
- ² NCI (National Cancer Institute). 2016. Hair Dyes and Cancer Risk. Available: www.cancer.gov/about-cancer/causes-prevention/risk/myths/hair-dyes-fact-sheet [accessed August 22, 2018].
- ³ Quach T, Von Behren J, Goldberg D, Layefsky M, and Reynolds P. 2015. Adverse birth outcomes and maternal complications in licensed cosmetologists and manicurists in California. *Int Arch Occup Environ Health* 88(7):823-833.
- ⁴ Berger KP, Kogut KR, Bradman A, She J, Gavin Q, Zahedi R, Parra KL, Harley KG. 2018. Personal care product use as a predictor of urinary concentrations of certain phthalates, parabens, and phenols in the HERMOSA study. *J Expo Sci Environ Epidemiol*; doi.org/10.1038/s41370-017-0003-z [online 09 January 2018].
- ⁵ Harley KG, et al. 2019. Association of phthalates, parabens and phenols found in personal care products with pubertal timing in girls and boys. *Hum Reprod* 34(1):109-117.
- ⁶ Bornehag CG, et al. 2018. Association of prenatal phthalate exposure with language development in early childhood. *JAMA Pediatr* 172(12):1169-1176.
- ⁷ IARC (International Agency for Research on Cancer). 2010. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Volume 99, Some Aromatic Amines, Organic Dyes, and Related Exposures: Occupational Exposures of Hairdressers and Barbers, and Personal Use of Hair Colourants. Available: <https://monographs.iarc.fr/wp-content/uploads/2018/06/mono99-17.pdf> [accessed September 6, 2018].
- ⁸ Harling M, Schablon A, Schedlbauer G, Dulon M, Nienhaus A. 2010. Bladder cancer among hairdressers: a meta-analysis. *Occupational and Environmental Medicine* 67(5):351-358.
- ⁹ Eberle CE, et al. Hair dye and chemical straightener use and breast cancer risk in a large U.S. population of black and white women. *Int J Cancer*; doi: 10.1002/ijc.32738
- ¹⁰ FDA (U.S. Food and Drug Administration). 2016. Does FDA approve cosmetics before they go on the market? Available: www.fda.gov/ForIndustry/FDABasicsforIndustry/ucm238793.htm [accessed September 26, 2018].
- ¹¹ FDA (U.S. Food and Drug Administration). 2017. Makeup. Available: <https://www.fda.gov/Cosmetics/ProductsIngredients/Products/ucm134054.htm> [accessed October 3, 2018].