



## GENTIAN VIOLET, LEUCOGENTIAN VIOLET, MALACHITE GREEN, LEUCOMALACHITE GREEN, AND CI DIRECT BLUE 218

VOLUME 129

IARC MONOGRAPHS  
ON THE IDENTIFICATION  
OF CARCINOGENIC HAZARDS  
TO HUMANS



IARC MONOGRAPHS



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LEUCOMALACHITE GREEN,  
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This publication represents the views and expert opinions of an IARC Working Group on the Identification of Carcinogenic Hazards to Humans, which met remotely, 22 February to 5 March 2021

LYON, FRANCE - 2022

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## IARC MONOGRAPHS

In 1969, the International Agency for Research on Cancer (IARC) initiated a programme on the evaluation of the carcinogenic hazard of chemicals to humans, involving the production of critically evaluated monographs on individual chemicals. The programme was subsequently expanded to include evaluations of carcinogenic hazards associated with exposures to complex mixtures, lifestyle factors and biological and physical agents, as well as those in specific occupations. The objective of the programme is to elaborate and publish in the form of monographs critical reviews of data on carcinogenicity for agents to which humans are known to be exposed and on specific exposure situations; to evaluate these data in terms of cancer hazard to humans with the help of international working groups of experts in carcinogenesis and related fields; and to identify gaps in evidence. The lists of IARC evaluations are regularly updated and are available on the internet at <https://monographs.iarc.who.int/>.

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About the cover: Gentian violet, malachite green, and CI Direct Blue 218 are widely used as textile dyes.

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This volume of the *IARC Monographs* provides evaluations of the carcinogenicity of three dyes and their two leucometabolites: gentian violet, leucogentian violet, malachite green, leucomalachite green, and CI Direct Blue 218.

Gentian violet and malachite green are cationic triphenylmethane dyes widely used for textiles, paper, and acrylic products, as biological stains, and in some hair dyes and other cosmetics. Because of their antibacterial and antifungal properties, they have had various medical, veterinary, and aquaculture applications, including the treatment of livestock, animal feed, ornamental fish, and farmed fish and shellfish.

Leucogentian violet and leucomalachite green are used as precursors in the production of their parent compounds and have direct applications as chromogenic reagents in analytical chemistry and as radiochromic indicators in dosimeters.

CI Direct Blue 218 is a copper-chelated dimethoxybenzidine-based azo dye used for cellulose, acetate, nylon, silk, wool, tissue, fine papers, and textile goods.

For all agents, data were sparse regarding exposure levels, but indicated that exposures can occur in occupational settings and in the general population.

An *IARC Monographs Working Group* reviewed evidence from cancer bioassays in experimental animals and mechanistic studies to assess the carcinogenic hazard to humans of exposure to these agents and concluded that:

- Gentian violet, leucomalachite green, and CI Direct Blue 218 are *possibly carcinogenic to humans (Group 2B)*
- Leucogentian violet and malachite green are *not classifiable as to their carcinogenicity to humans (Group 3)*.

