PHOTOTOXICITY OF PHENYLENEDIAMINE-ASSOCIATED HAIR DYE CHEMICALS IN SALMONELLA TYPHIMURIUM TA102 AND HACAT KERATINOCYTES

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Abstract: Phenylenediamines (PD) are dye precursors used to manufacture hair dyes. The three PDs, 1,2-, 1,3-, and 1,4-PD and three chlorinated PDs, 4-chloro-1,2-PD, 4-chloro-1,3-PD, and 4,5-dichloro-1,2-PD were studied for their mutagenic effect in Salmonella typhimurium TA 102, cytotoxicity in human skin keratinocyte cells, and for DNA cleavage assay. The results show that all six compounds are not toxic/mutagenic in TA 102 bacteria or skin cells, and do not cause DNA cleavage in ΦX 174 phage DNA. If the same tests are carried out by exposing them to light irradiation concurrently, all three chlorinated PDs cause mutation in TA 102 bacteria and DNA single strand cleavage in ΦX 174 phage DNA. This indicates that chlorination of the PDs makes these compounds more photochemically active and produces reactive species that cause DNA damage and mutation. For the photo-cytotoxicity test in skin cells, it appears there is no such structure-activity relationship, two chlorinated PDs and two non-chlorinated PDs are cytotoxic at a fairly high concentration (1000 µM) upon exposure to light irradiation.

Keywords: Phenylenediamines; phototoxicity; photomutagenicity; HaCaT keratinocytes; ΦX174 DNA cleavage

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