Impacts of COVID-19 Pandemic: Phthalate Esters Released from Face Masks and its Associated Exposure Risk

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ABSTRACT

Introduction: The COVID-19 pandemic has altered our daily routines and made face masks a standard shield against the virus. However, emerging concerns focus on the phthalate esters (PAEs) in these essential preservatives. The presence of masks has raised concerns among health experts and environmentalists due to the known health risks. Long-term exposure to PAEs through masks can lead to respiratory irritation, allergies, and more severe issues such as endocrine disruption. Disposing of masks contaminated with PAEs also raises environmental concerns due to the potential harm these chemicals can cause to ecosystems and wildlife. This study highlights the neglected aspect of the epidemic by emphasizing the importance of understanding and addressing the possible health and environmental impacts of PAEs in face masks.

Search Strategy: The PubMed, Web of Science, Scopus, and Google Scholar databases were systematically reviewed using the keywords "Phthalate esters," "Face mask," and "COVID-19".

Results: The results showed that PAEs such as dibutyl phthalate (DBP), Di-iso-butyl phthalate (DiBP), di(2-ethylhexyl) phthalate (DEHP), Diisodecyl phthalate (DiDP), Benzyl butyl phthalate (BBP), Diethyl phthalate (DEP), Dimethyl phthalate (DMP), and Diisononyl phthalate (DNP) are detected in medical, surgical, FFP2, non-surgical, and N95 masks at concentrations ranging from 168.18 to 10516.84 ng/g. DEHP is present in all mask samples, while DMP, DEP, DiBP, DBP, and DNP are prevalent in more than 50% of samples. Notably, DEHP and DiBP were consistently found in N95/P1/P2 masks; however, it was less in 3-ply surgical masks. Exposure to PAEs ranging from 6.43×10^{-5} to 1.43×10^{-2} mg/kg body weight daily with DEHP contributed significantly (96.5%) to the total PAE exposure level.

Conclusion and Discussion: This review study focused on the presence of PAEs in face masks and reveals significant environmental and health risks associated with their presence. Common PAEs such as DIBP, DBP, BBP, and DEHP are commonly found in synthetic fabrics like PE and PP masks. These chemicals, known for disrupting the endocrine system, can impact human health by interfering with hormones, potentially leading to reproductive and growth issues. The study highlights the sensitivity of amphibians, mollusks, and crustaceans to PAEs, showcasing genetic deviations and weaknesses in organ growth. Despite the crucial role of masks in the pandemic, they introduce risks of PAE exposure that need to be addressed to ensure effective protective measures during this global health crisis.

Keywords: COVID-19, Ecosystem, Pandemics

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