

Effect of face mask inks and dyes on human health during the COVID-19 pandemic

Abderrahim Lakhout¹

¹Affiliation not available

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Dear editor,

COVID-19 is a multi-system illness that develops from the novel SARS-CoV-2 virus. The first outbreak of the disease occurred in Wuhan, China, in late 2019. In March 2020, the World Health Organization (WHO) declared COVID-19 a pandemic and many governments around the world introduced a number of restrictions on their populations to control the spread of the virus. These restrictions included business and school closures, lockdowns, social distancing, and the wearing of masks and other personal protective equipment (PPE). Meanwhile, many commercial and industrial sectors have been significantly impacted by government-imposed directives to halt COVID-19's spread. Hospital wastes and municipal solid wastes are included in the affected sectors, as the amount of solid wastes being generated as a result of pandemic-related measures has increased astronomically, with hospitals in particular contributing to the large boost in solid waste generation. Pandemic-related wastes include discarded PPE items such as masks, gloves, gowns, eye protectors and face shields, as well as items used in the testing and treatment of the disease, such as surgical instruments, needles, and medications^{1, 2}. In response to the pandemic, many countries and districts have imposed various rules on the general public to reduce the spread of the virus without taking into account the increase in medical waste that these directives will cause. The most common of the "new normal" rules includes wearing face masks and visors in closed areas such as public transportation and shops. More recently, wearing non-surgical masks has become mandatory in a number of cities and countries around the world as a way to limit the spread of COVID-19. Masks are presented to the public as an excellent tool to protect human health and reduce disease transmission among the population. Although different types of face masks offer different levels of protection, all of them eventually contribute to landfill waste and are uncomfortable to wear for long periods of time.

The main aim of this letter is to study the impact on human health of the various inks used in masks. Because most authorities have imposed the wearing of face masks without any norms, the choice of masks depends on the person. Individuals are free to choose any method to make their masks and to write on them whatever slogan they wish. In the market, many masks with different colors and slogans have appeared for sale. For masks as for any other fabric, color is applied for the main purpose of making the mask more aesthetically appealing. However, many dyes present varying degrees of environmental hazards, despite their continued use in inks, textiles, printing, and other applications. Most commercially available masks are made from layers of plastics, whose negative impact on both human health and the environment is well-known. In addition to the toxic content of plastics, textile dyeing is a major source of pollution and is not only toxic but also persistent³⁻⁶. Furthermore, the impact of different paints and inks on human health is rarely, if ever, taken in account when choosing a mask⁴⁻⁷. As is known, different paints and inks are composed of a range of chemical compounds, including volatile organic compounds (VOCs) as chemical elements. The effect of VOCs on human health has been extensively documented in the literature^{8, 9}. Another consideration is that aerodynamic parameters can affect the emission of VOCs, as certain VOCs are emitted at ambient air temperature. The number of studies focusing on the reduction of VOC content produced by inks has increased

lately due to heightened environmental awareness¹⁰. Benzene toluene, ethyl-benzene and xylene (BTEX), which is one of the most prevalent chemical compounds emitted by landfills, is also a VOC. According to several researchers¹¹⁻¹⁷, BTEX is considered a carcinogenic substance that is well-known for its ability to deteriorate human health^{16, 17}. Individually, both benzene and ethyl-benzene are carcinogens as well, affecting the nervous system, while toluene and xylene can damage the nervous and reproductive systems. The main organs affected by these carcinogenic compounds are the lungs, liver, and kidneys. According to a recent scientific study, people working in printing and inking occupations are considered at high risk for developing illnesses. Workers in these industries typically suffer from chronic ailments such as headaches, dizziness, skin damage, and respiratory failure. The inks causing the health issues are composed of numerous organic solvents, such as toluene, ethyl acetate, isopropyl alcohol, and others. Even for the short-term, respiratory and skin exposure to these chemical elements (such as occurs during daily mask wearing) can lead to the development of skin, respiratory, cardiovascular and eye diseases and may even cause cancer.

As a recommendation to lessen the negative effects of mask wearing, the mask should not have any written slogans on its surface. In fact, writing on face masks should be forbidden. Further, dyes should be selected according to internationally accepted industry standards to protect human health and the environment. An international consensus concerning face mask colors based on their impact on human health should be investigated and determined. Certain dyes are toxic and persistent and have both short- and long-term negative impacts on human health, fauna, and flora. Finally, governments and authorities should encourage people to use their masks one time only and then properly dispose of them as medical waste.

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