Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Letter to the Editor

The role of the environment and its pollution in the prevalence of COVID-19

Coronaviruses are a large group of viruses that can infect animals and humans and cause severe respiratory disease. In December 2019, for the first time in Wuhan, Hubei Province, China, Coronavirus was detected in humans. As of May 12, the new coronavirus has infected more than 4256,076 people worldwide.[1] COVID-19 is a virus with a high transmission rate that can be transmitted through direct contact (person to person) and indirect contact (contact with virus-infected surfaces).[2] Because to date, many efforts have been made to reduce direct contacts (person to person) and personal hygiene, unfortunately, we are still seeing the prevalence of this disease worldwide. Now this question arises, why still in some regions the COVID-19transfer speed is greater despite the implementation of a social distance plan? Thus, this hypothesis is formed that indirect exposure may also play a significant role in the transmission of COVID-19.The environment around us is fraught with contaminants and surfaces that can unintentionally expose the human to the virus. Therefore, to investigate the prevalence of coronavirus, it should be more attentive to environmental pollutants. Environmental pollutants that may play a significant role in the COVID-19 spread include air pollutants, sewage, polluted water, and waste, which their role in the indirect expansion of the virus should be considered. The air is the main environment we deal with and inhale it every day with all its pollutants. The most important pollutants are NO_x, SO_x, O_3, $PM_{2.5}$ and CO, which are mainly due to traffic and vehicles.[3] Studies have proven that these pollutants are able to reduce the level of immune system and therefore make the body weak against various viruses and pathogens.[4] With knowledge of this subject, this hypothesis formed that air pollution can have a synergistic effect on coronavirus performance. Conticini et al. 2020 reported a significant association between coronavirus transmission and air pollution in some parts of Italy.[5] Travaglio et al. 2020 reported that in regions of Britain with high NO_x levels, the deaths associated with the COVID-19 were higher.[3] A study in the United States found a significant link between air pollution and coronavirus mortality, so with the increase of 1 μg/m^3 of PM, the COVID-19-related mortality rises to 15%.[4] Air pollutants can cause coronavirus in many different ways. Some studies stated that the body in normal condition produces a small amount of nitrogen oxide that is able to prevent the process of duplicating the RVS in the lungs. In contrast, during air pollution, when NOx rises in the environment and inhaled by the individual, it suppresses the production of endogenous nitric oxide and increases RVS production. Nitrogen is also a free radical in the body, which can act as a lung stimulant. Then NO_x can reduce lung activity and increase infection in the airway.[6] Ozone, another air pollutant, can also stimulate the respiratory system and decrease the lung function by producing other oxidant products.[7] Since O_3 and SO_x have significant impacts on TNF,[1] IL[2]1 b, IL-6, IL-8, IL-17 and IL-18, they have a prominent role in inflammation of the respiratory and systemic systems, thus increasing the risk of developing coronavirus.[8,9] PM_{10} and $PM_{2.5}$ are of other air pollutants. There is a hypothesis that these particles can act as a carrier to transmit and disperse coronavirus in the air. Researchers demonstrated that coronavirus can survive on PM about 3 h.[10] On the other hand, $PM_{10/2.5}$ by penetrating the depth of lung not only can paralyzes the ciliums airway, but also lead to chronic respiratory tract inflammation.Therefore, the chances of contracting the coronavirus increase in air containing high particulate matter concentrations.[11] $PM_{10/2.5,}$due to their very small size, easily penetrate to the lower respiratory tract, and as a result, they can carry the coronavirus directly into the alveo and tracheobrochial region.[12] Another possible way to transmit the virus may be to sewer systems. The urine and stool of the patient can enter the virus into the sewer network and cause it to release. Weber et al. 2016 explained that the Severe Acute Respiratory Syndrome-CoV could stay viable for about 4 h in the stool.[13] Tang et al. 2020 reported that the coronavirus could survive 9 days in the fecal and sewer.[14] Thus, with knowledge of this issue, during the toilet flushing, urinary and fecal aerosols can carry the virus and infect the ambient air. If personal hygiene is not good, the situation will get worse.[15] The best idea is for patients with positive COVID-19 to use a separate toilet. Due to the survival of the virus in the wastewater, untreated wastewater spray is not recommended for irrigation. Another suspicious source of virus transmission is water resources. Fortunately, to date, there is no evidence that the COVID-19 could survive in surface or groundwater for a long time. Also, the COVID-19 has also not been found in drinking water, because it is rapidly inactivated into chlorinated water.[2] Other studies have shown that the virus can survive in chlorinated waters for two days, while in water contaminated with feces and urine, its survival has been reported for several weeks.[2] Relying on this object, protecting the water distribution systems and by and ensuring don't breakage of water distribution pipes can prevent the outbreak of COVID-19. To date, there is no evidence that waste transmits the COVID-19 to human. But people who come in contact with hospital waste should use personal protective equipment.

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[1] tumor necrosis factor
[2] interleukin

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