Monitoring Wastewater: A Novel Environmental Infrastructure for Preventing Disease Outbreak in Urban Areas

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Abstract

Pathogenic microorganisms infect people in direct or indirect ways; they grow in humans and are often excreted with feces. Norovirus, Salmonella, and the new coronavirus are examples of such pathogens. The emergence of a highly pathogenic new coronavirus (COVID-19) that infects the respiratory systems has sparked around the world, and it is also transmitted in the intestinal tract and excreted together with feces. Feces collected in a sewer system are directed to a wastewater treatment plant and treated properly including disinfection. However, in developing countries, they are collected with rainwater and discharged into rivers or oceans without proper treatment. Such sewage contains high concentrations of pathogenic microorganisms originated from people in the city. In other words, measuring pathogenic microorganisms in wastewater would provide valuable information to illustrate the epidemic of infectious diseases in cities. Information obtained from wastewater could be much faster than reports from the medical information system managed by health authorities. Early discovery of signs of outbreaks is extremely useful in preventing the spread of infection in the city. Mechanisms to identify and disclose information from sewage epidemiology surveys can be used to monitor and control the infections. Moreover, it is imperative to form an active system that allows departments to cooperate and associate directly with administrative sewer management, public health, and infectious disease control. The COVID-19 pandemic occurred predominantly in larger cities with a higher population density and complexity of human migration, indicating the high probability of infections. Monitoring individual human infections is challenging for several reasons, for instance, lack of advanced disease surveillance systems, inadequate diagnostic tools, and timely reporting, to name a few. In the case of COVID-19, many infected people do not show any symptoms; they are called asymptomatic infected persons. Asymptomatic infections cannot be detected by the medical test but sewage examination. Further, the fear about the new coronavirus leads to discrimination against infected persons; likewise, there were significant problems such as unreliable news and hoaxes via Social Network Services (SNS). Conclusively, the detection of pathogenic microorganisms in sewage has many advantages, including accurate and early detection (avoiding inaccuracy caused by asymptomatic infections and information delay caused by virus incubation period in humans), privacy protection of infected people, and the easiness of testing the sample from the government-controlled infrastructure. A microbial monitoring system placed online within the wastewater treatment system shall be considered in the future, which could lead to better understanding of the behaviours and ecology of viruses in water environment, supporting strategy development for the prevention of infectious disease outbreaks.

Keywords: wastewater, infection, pathogen, disease, monitoring, prevention