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BRIEF REPORT – OPEN ACCESS

The Fate of SARS-CoV-2 in the Marine Environments: Are Marine Environments Safe from COVID-19?

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ABSTRACT

SARS-CoV-2 is a novel coronavirus and the agent of the COVID-19, which was first detected in Wuhan, China, in December 2019. In this period, scientists have been working intensively to disambiguate unclear parts about this novel coronavirus and the related disease. The aim of this report is to evaluate the stability of SARS-CoV-2 in marine environments, which is one of the issues of very serious concern. Here, we reviewed the literature about the marine environment survival of human coronaviruses, some of the human respiratory viruses, and especially SARS-CoV-2. Salinity and the pH of the marine environment were the major key factors influencing the survival of SARS-CoV-2. The survival period of the coronaviruses was reported being decreased by the increase of the ocean's salinity and pH levels. In conclusion, due to the high salt concentration, pH levels and dilution capacity, marine environments are not likely to be a risk factor for the transmission of SARS-CoV-2.

Keywords: SARS-CoV-2, marine environment, COVID-19, seawater, salinity, pH

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INTRODUCTION

The COVID-19 pandemic, an international public health concern emerging since December 2019, has reached more than 56,000,000 confirmed cases worldwide on November 19, 2020, and the number of cases is increasing dramatically (1).

Coronaviruses are enveloped viruses; thus, generally, they are accepted to have a short survival period in the environment, like any other enveloped viruses (2). However, some of the enveloped viruses may not be as fragile as expected, and their persistence can be nearly similar to the non-enveloped viruses (2, 3). Although it's enveloped structure, SARS-CoV-2 can be stable in supportive environmental conditions; three hours on printing or tissue paper, two days on wood and cloths, and up to seven days on stainless steel, plastic surfaces, and the outside surface of surgical masks' (4). On the other side, the infectivity of SARS-CoV-2 can be degraded by environmental conditions. Thus, viral infectivity can be shorter than the SARS-CoV-2 genome presence (5).

The transmission of SARS-CoV-2 may occur via aerosols or contaminated fomites (1), and the COVID-19 infective dose is estimated to be approximately 300 (6). Besides respiratory tract secretions, the SARS-CoV-2 genome was also detected in saliva, urine, and stool samples, stating other possible transmission ways, such as faecal-oral or faecal-respiratory transmission (7). Therefore, risk assessment principles should include and evaluate multiple factors that play a role in the virus-human and virus-environment interactions. Viruses can be significant contaminants of marine environments (2). Thus, seawater survival of this novel coronavirus is one of the most critical concerns in this field.

The marine environment may get contaminated by the flow of treated or untreated sewage or via swimmers' body fluids (2). In several studies, the SARS-CoV-2 genome has been detected in the marine environment or wastewaters, but this does not mean that the detected virus is infective (2, 7). Thus, when alternative transmission ways are mentioned, the factors affecting the infectivity of the virus in the marine environment should be scrutinised.

Salinity and pH are the significant factors affecting the survival and infectivity of viruses in the marine environment (2). High salt (especially NaCl) concentrations of water may inactivate many viruses significantly; thus, removing salts from the solutions results in the increased survival time of viruses (8).

The marine environment pH may affect the viral survival rate directly or indirectly. The direct effect of pH is on viral capsid protein's conformation and can affect viral survival. Studies conducted on HCoV 229E, the MHV

(Murine hepatitis virus) and TGEV (Transmissible gastroenteritis virus) reported significantly faster inactivation at alkaline conditions (pH>8) and longer viral persistence at slightly acidic conditions (pH=6–6.5) (3).

The ocean's average salinity level is usually around 35 parts per thousand (ppt) (9) and the average pH is 8.1 (10). Salinity-induced pH relationship shows that seawater pH increases with the increase in salinity. Based on the salinity-induced pH relationship, in the Mediterranean sea, salinity increases above 38 ppt, while the salinity-induced pH increases to 8.5 (11).

In conclusion, due to ocean and seawater's vast dilution capacity, the viral inactivation capacity of high salinity and pH, and the estimated infective dose of COVID-19 (~300), the marine environments are not likely to be a risk factor for the transmission of SARS-CoV-2.

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REFERENCES

1. World Health Organization. Coronavirus Disease (COVID-19) Dashboard. Geneva: 2020. Available from: URL: https://covid19.who.int/. Accessed November 19, 2020.
2. Bosch A., Abad FX., Pinto RM. Human pathogenic viruses in the marine environment. In: Belkin S, Colwell RR, editors. Oceans and health: Pathogens in the marine environment. Chapter 5. New York: Springer: 2005; p. 109–31. [CrossRef]
3. Geller C, Varbanov M, Duval RE. Human coronaviruses: insights into environmental resistance and its influence on the development of new antiseptic strategies. Viruses 2012; 4(11): 3044–68. [CrossRef]
4. Chin AWH, Chu JTS, Perera MRA, Hui KPY, Yen HL, Chan MCW, et al. Stability of SARS-CoV-2 in different environmental conditions. Lancet Microbe 2020; 1(1): e10. [CrossRef]
5. Bar-On YM, Flamholz A, Phillips R, Milo R. SARS-CoV-2 (COVID-19) by the numbers. Elife 2020; 9: e57309. [CrossRef]
6. Basu S. Exposure to a COVID-19 carrier: transmission trends in respiratory tract and estimation of infectious dose. medRxiv preprint. July 29, 2020. doi: https://doi.org/10.1101/2020.07.27.20162362 [Epub ahead-of-print]. [CrossRef]
7. Jeong HW, Kim SM, Kim HS, Kim YI, Kim JH, Cho JY, et al. Viable SARS-CoV-2 in various specimens from COVID-19 patients. Clin Microbiol Infect 2020; 26(11): 1520–4. [CrossRef]
8. Sobsey M, Meschke JS. Virus survival in the environment with special attention to survival in sewage droplets and other environmental media of fecal or respiratory origin. Corpus 2003;1–70.
9. U.S: National Oceanic and Atmospheric Administration. Why is the ocean salty? 2020. Available from: URL: https://oceanservice.noaa.gov/facts/whysalty. Accessed August 28,2020.
10. U.S: National Oceanic and Atmospheric Administration. Ocean acidification. 2020. Available from: URL: https://www.noaa.gov/education/resource-collections/ocean-coasts/ocean-acidification. Accessed August 28, 2020.
11. Saraswat R, Kouthanker M, Kurtarkar S, Nigam R, Linshy VN. Effect of salinity induced pH changes on benthic foraminifera: a laboratory culture experiment. Biogeosciences Discuss 2011; 8 (4): 8423–50. [CrossRef]