

## **Covid-19: monitoring of SARS-Cov-2 traffic in wastewater, simple indicator for monitoring the Covid-19 pandemic**

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A major challenge to follow the Covid-19 pandemic is monitoring the circulation of the virus in the population to prevent possible resurgence as soon as possible. This can be achieved through systematic population-based qRT-PCR testing to identify and isolate healthy carriers of SARS-Cov-2. This can also be done by sero-epidemiological studies based on the detection of specific antibodies against the coronavirus, which allows the rate of collective immunity to be estimated today at 5 to 10% of the French population.

In addition to these tests of difficult implementation, the microbiological analysis of wastewater can play a strategic role in the prospective and regular monitoring of the virus circulation. It has been established that SARS-Cov-2 can multiply in enterocytes [1] and that about 10% of Covid-19 cases present gastrointestinal disorders, including diarrhea [2]. In addition, potentially contagious asymptomatic or pauci-symptomatic carriers momentarily eliminate the virus in their stool (up to 30-50%). SARS-Cov-2 has a poor stability in the environment and is very sensitive to oxidative agents such as hypochlorite. It is rapidly inactivated in water, unlike non-enveloped enteroviruses.

Like surveillance of polio viruses in wastewater, inactivated nucleic acids of SARS-Cov-2 can be detected and quantified by qRT-PCR in wastewater samples from water treatment plants serving hundreds of thousands of households. This has been successfully carried out in agglomerations of several countries (France, United States, Spain, Netherlands, Luxembourg, Italy [3]. The qRT-PCR tests show that the amount of nucleic acids is correlated with the epidemic curve, preceding the arrival of the wave, following its ascent and decreasing sharply with its regression [4]. This direct time relationship with the epidemic wave, and especially even before its outbreak, can make this indicator a valuable tool for predicting a possible resurgence, by testing for the presence of the virus on hundreds of thousands of people.

### **Faced with these findings, the National Academy of Medicine recommends:**

- 1- to monitor the circulation of SARS-Cov-2 in the population by microbiological analysis of wastewater from treatment plants;

- 2- to make this virological surveillance systematic by quantitative tests using a rigorous methodology, as long as the virus circulates in the population.
- 3- to extend this systematic surveillance to other viruses (myxovirus, rotavirus, respiratory syncytial virus...).
- 4- to set up a bank of samples allowing to retrospectively detect any new virus or pathogen appearing in the population, thus fixing the time of the beginning of the epidemic.

[1] Lamers M.M., *et al.*, SARS-Cov-2 productively infects human gut enterocytes, *Science* 10.1126/science.abc1669 (2020).

[2] N. Zhu, *et al.*, « A novel coronavirus from patients with pneumonia in China », 2019, *New England Journal of Medicine*, 382, 2020, p. 727-733

[3] Peccia J., *et al.*, SARS-CoV-2 RNA concentrations in primary municipal sewage sludge as a leading indicator of COVID-19 outbreak dynamics, <https://doi.org/10.1101/2020.05.19.20105999>; Ahmed W., *et al.*, First confirmed detection of SARS-CoV-2 in untreated wastewater in Australia: A proof of concept for the wastewater surveillance of COVID-19 in the community. *Science of the Total Environment* 2020, 728, 138764 ; Medema G., *et al.*, Presence of SARSCoronavirus-2 in sewage. *medRxiv* 2020, 2020.03.29.20045880 ; Wu F., *et al.*, SARS-CoV-2 titers in wastewater are higher than expected from clinically confirmed cases. *medRxiv* 2020, 2020.04.05.20051540 ; Randazzo W., *et al.*, SARS-CoV-2 RNA titers in wastewater 1 anticipated COVID-19 occurrence in a low prevalence area, *medRxiv* doi.org/10.1101/2020.04.22.20075200 ; La Rosa G., *et al.*, First detection of sars-cov-2 in untreated wastewaters in Italy, *medRxiv*, doi.org/10.1101/2020.04.25.20079830

[4] Wurtzer S., *et al.*, Evaluation of lockdown impact on SARS-CoV-2 dynamics through viral genome quantification in Paris wastewaters. *medRxiv*, 2020, 2020.04.12.20062679.