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Development of Magnetic Separation Technology for the COVID-19 Virus in Wastewater
- Significant contribution to wastewater-based epidemiological surveys –

JNC Corporation (Headquarters: Chiyoda-ku, Tokyo; CEO and President: Keizo Yamada) and Professor Eiji Haramoto of the Interdisciplinary Center for River Basin Environment, Graduate Faculty of Interdisciplinary Research, University of Yamanashi (Headquarters: Kofu, Yamanashi Prefecture; President: Shinji Shimada) jointly developed the world's fastest level of new coronavirus separation technology for wastewater using the Pegcision method (Figure 1), which is a patented technology developed by JNC Corporation.

As the COVID-19 infection rages on, the sensitivity of PCR tests has increased by several levels in Japan compared to other countries, and as a result, there are high expectations for the "wastewater-based epidemiological survey (see Note 1)," which will enable early detection of the spread of epidemics by regularly monitoring the COVID-19 viruses in wastewater.
However, unlike the cases for saliva and blood tests, there was no technology developed to efficiently separate and concentrate the COVID-19 virus from a large amount of wastewater, which was a major obstacle to the wider use of sewage epidemiological surveys.
In this study, use of the Pegcision method made it possible to separate the COVID-19 virus from waste water in about 30 minutes, and the recovery rate was confirmed to be equivalent to the polyethylene glycol (PEG) precipitation method (processing time: more than 9 hours) recommended in the "Manual for Detecting COVID-19 Genes in Wastewater" published by the COVID-19 Task Force of the Japan Society on Water Environment (see Note 2).
The Pegcision method also allows high throughputs as it uses magnetism to separate COVID-19 virus, enabling the processing of a large number of samples with commonly used magnetic separation devices.
Compared to conventional virus isolation techniques such as the PEG precipitation method, the Pegcision method is faster, simpler, higher-yield, and less expensive (no antibodies, etc. are needed) (Table 1).
We will continue developing the technology so that it will lead to the early dissemination of sewage epidemiological surveys of COVID-19 virus.

Note 1: The term describing the academic field "wastewater-based epidemiology" has been translated

into the Japanese term “gesui-ekigaku (下水疫学)” by a research group led by Professor Haramoto of the University of Yamanashi and Associate Professor Kitajima of Hokkaido University and is now widely used outside of academia in Japan.

Note 2: “Manual for Detecting the COVID-19 Genes in Sewage” was written and edited by the COVID-19 Task Force of the Japan Society on Water Environment and published on March 30, 2021.

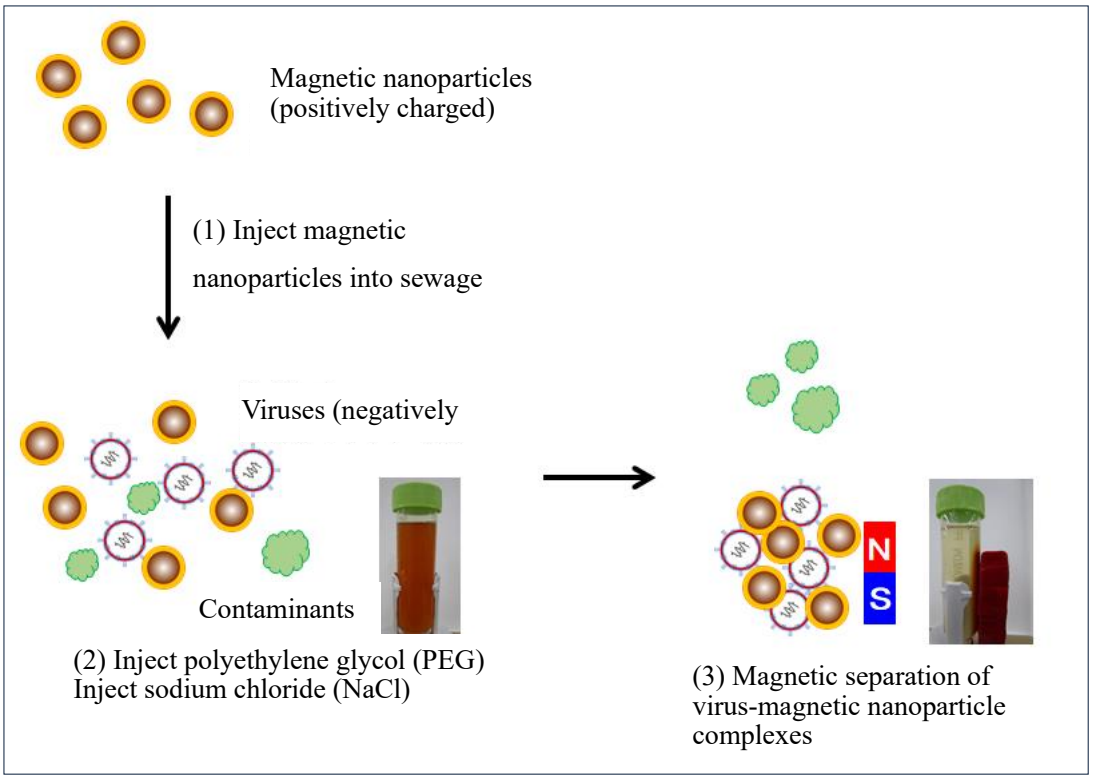

Figure 1. Concentration principle of the Pegcision method

Table 1. Comparison of the Pegcision method with other concentration methods

	Pegcision method	**PEG precipitation method**	**Electronegative membrane-vortex method**	**Ultrafiltration membrane method**
Processing time	Good (< 1 hour)	Not good (> 9 hours)	OK	Good
Separation method	Good (Magnetic separation)	Not good (Centrifugal separation)	OK	OK
Throughput	Good (High)	Not good (Low)	Not good	Not good
Virus recovery rate	Good (Equivalent to conventional methods)	Good (High)	Good	Good
Cost	OK (Inexpensive)	Good (Very inexpensive)	OK	Not good

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