

Title	Water Environmental Research Study in Hue City : A test of general bacteria and coliform group of ground water and Huong River
Author(s)	Utosawa, Kohken; Tachibana, Harukuni; Kunimasa, Akihiro et al.
Citation	Annual Report of FY 2007, The Core University Program between Japan Society for the Promotion of Science (JSPS) and Vietnamese Academy of Science and Technology (VAST). p.107-p.110
Issue Date	2008
oaire:version	VoR
URL	<a href="https://hdl.handle.net/11094/12937">https://hdl.handle.net/11094/12937</a>
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## Water Environmental Research Study in Hue City

—— A test of general bacteria and coliform group of ground water and Huong River ——

Kohken Uotosawa\*, Harukuni Tachibana\*\*, Akihiro Kunimasa\*\*, Sonoko Ouchi\*\*

\* *Department of Environmental Design, Hokkaido Institute of Technology, Sapporo, 006-8585, Japan*

\*\* *Department of Environmental Eng., Hokkaido University, Sapporo, 060-8628, Japan*

### ABSTRACT

Groundwater in Hue and water of Huong River were examined in terms of general bacteria and coliform group. Bacteria pollution was detected on the investigated spots. Especially, a lot of pollution was detected from villages and areas which have many residents along the river. The same kind of pollution was found in groundwater, but less than the river water.

### KEYWORDS

Coli form group, General bacteria, Ground water, River water, Simple test

### INTRODUCTION

Hue is an ancient capital city and also a world heritage. Because of that, the city has a lot of visitors from other countries.

Water works are well-equipped in some areas, but sewage works has not been completed yet. People on the water side let sewage flow into the water. Therefore, water pollution in Huong River has become worse. We have examined the river and the groundwater with support from Hokkaido University and Hue University since 2005.

### MATERIALS AND METHODS

5 examinations, such as for general bacteria, coli form group, E. coli(X-Type), staphylococcus and staphylococcus aureus(X-Type) were done using simple test paper. Sampling water was diluted adequately with physiological salt solution. After the test paper was soaked shortly in the water, the container putted the test papers was shut tightly. It was cultured around 35°C for 20 – 24 hours. Then number of colonies were counted keeping the container warm by holding it between an examiner's body and his shirt (Uotosawa Method).

Coli form group(X-Type) shows E. coli by the emission of light when it was irradiated with infrared rays. Staphylococcus (X-Type) shows colony of staphylococcus aureus by the same way.

Investigations into groundwater (well water) were done on the four spots across the river (see G-point ● in Figure 2). Such well water was not used for drinking, but for washing, gardening and

farming. The depth of wells from the ground to bottom were uncertain, but the free water surface was about 1 – 7 meters depth from the ground. It was 30 cm high from the ground to the top of the well equipment. It means that the structure of the wells do not allow rain water nor sewage to flow into them.

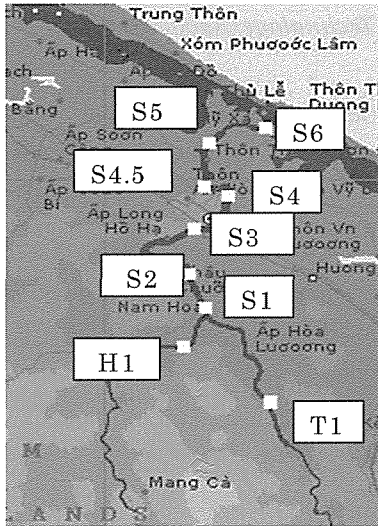


Fig. 1 Sampling points of Huong River

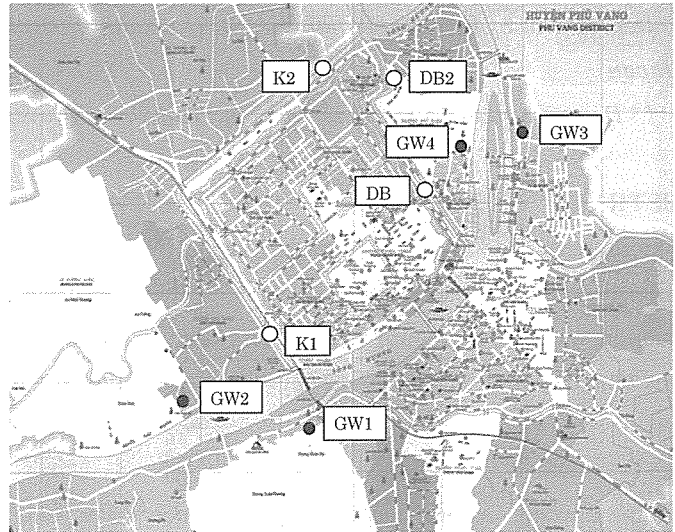


Fig. 2 Sampling points of Hue old city

## RESULT

General bacteria were detected in groundwater from all 4 examined spots. We found it serious that groundwater could be polluted with *E. coli*(X-Type) even though the water was not used for drinking purposes (see Fig. 3). The result of EC and TOC also show its tendency (see Fig. 4).

On the other hand, on GW2 spot which has a small population, the number of bacteria was smaller and the level of EC, Cl<sup>-</sup> and bacteria was lower than other spots. The number of bacteria and the level of EC, Cl<sup>-</sup> and TOC are correlated (see Fig. 3,4).

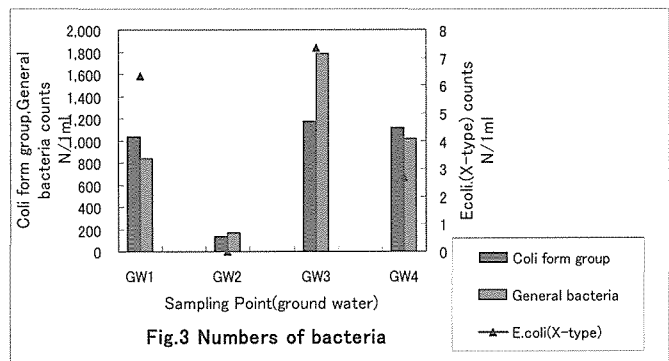


Fig.3 Numbers of bacteria

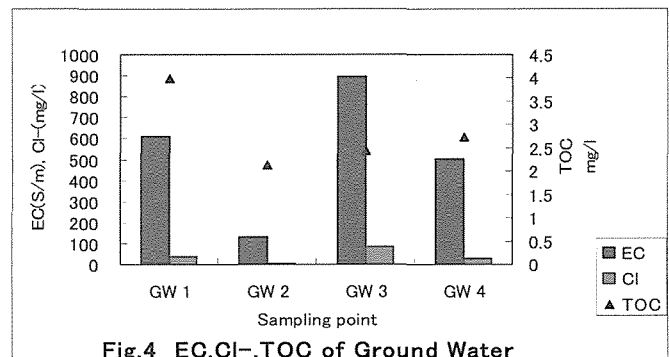


Fig.4 EC,Cl<sup>-</sup>,TOC of Ground Water

Along Huong River, it seems that there are fewer bacteria at the upper reaches and dilution and natural purification work well. The number of bacteria surprisingly increases as the stream comes closer to the center of Hue. The fact that E. coli(X-Type) was detected from every investigated spot shows that excrement of people and domestic animals flows into the river

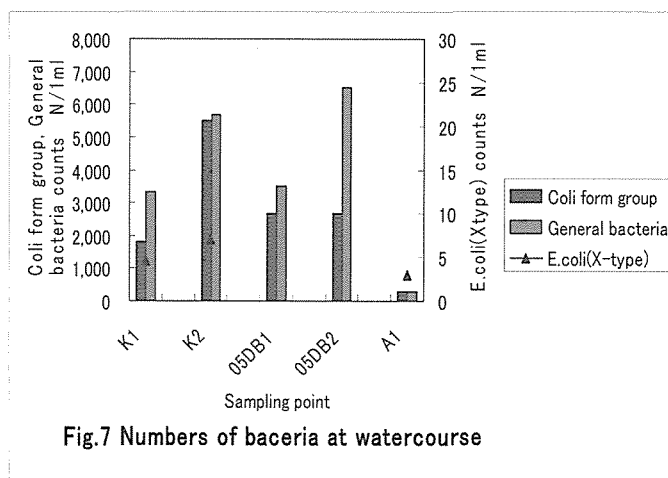
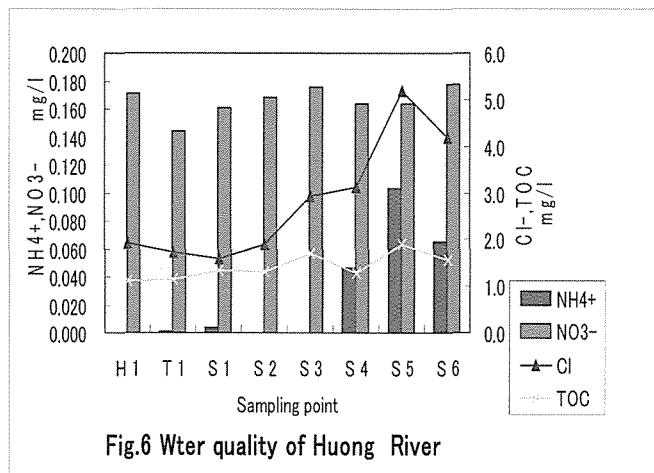
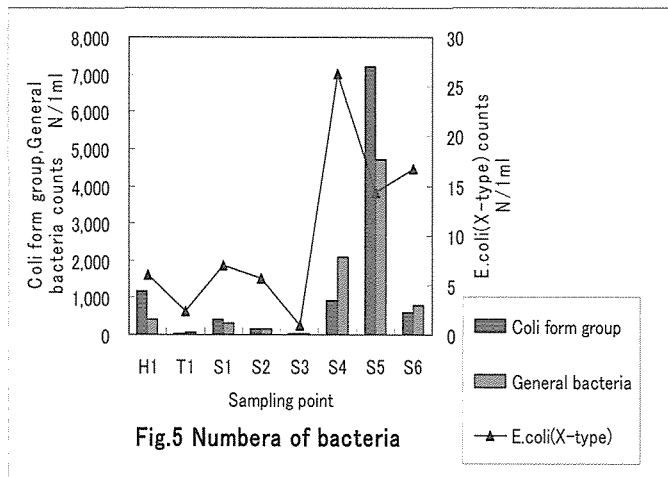
(see Fig. 5).

The same mentioned above was appeared in Fig. 6.

The area which has a lot of ammonia nitrogen(NH<sub>4</sub>-N) also holds a big number of bacteria.

There was a lot of bacteria in watercourses around old Hue city. This is because these watercourses did not have enough water to flow and residents on the riverside and people living on the water let the hose-hold effluents run into the river.

Detections of staphylococcus were limited to leachate treatment water from waste disposal site and around the mouth of Huong River. Staphylococcus aureus were not detected in all examined spots.



## CONCLUSION

It is seriously important to find out how to treat raw sewage in order to prevent groundwater and river from pollution.

## ACKNOWLEDGEMENT

We would like to thank people concerned in Osaka University and Hokkaido University. We are deeply grateful to Prof. Hop of Hue University and his laboratory members. This research was partially funded by JSPS.

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