Study on the water purification by using the functional and material of foamed waste glass with zeolite

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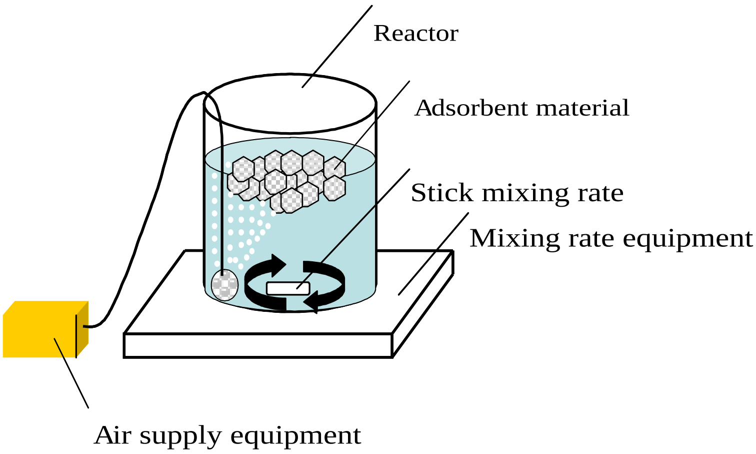
Introduction:

At present, the quality of water becomes worse due to many waste materials directly discharged into the water environment, so that the application of purification technologies which directly purify the water have been broadly employed in Japan.

In wastewater treatment technology, the adsorption is one of the techniques, which is comparatively more useful and economical for such removal of pollutants.

In this research, we used the new functional material of foamed waste glass (FWG) (a new material developed from waste glass) covered by zeolite (a material with high ability of absorption and cation) to evaluate water purification ability.



Materials and method ology:

Adsorbent materials: - Zeolite -FWG (grain size 10mm to 20mm)
- FWG (grain size 10mm to 20mm)
- Active carbon (grain size 5mm×3mm×3mm)

Adsorbate materials: - the domestic wastewater from the wastewater treatment plant of Saga City

Methodology: Experiment was performed in conditions: adsorption isotherm, mixing rate and contact oxidation.

Experimental process: A set of experiment was designed as described in Fig.1. Using 200 g Zeolite-FWG as an adsorbent material with a 3 reactor of sewage solution, the varying concentration of ions following times by was measured the spectrophotometer DR/2010 machine.

In order to compare the absorbability of COD, NH_4-N, PO_4-P, T-N, T-P on Zeolite-FGW, in this study we also performed a set of similar experiment with other adsorbents of FWG and active carbon.

Results and discussions

Initial concentration (c_i) and equilibrium concentration (c_e) of components in sewage after treatment on Zeolite- FWG were showed in Table 1.

NH_4-N (mg/l)		PO_4-P (mg/l)		COD (mg /l)		T-P (mg/l)		T-N (mg/l)	
c_i	c_e	c_i	c_e	c_i	c_e	c_i	c_e	c_i	c_e
58.0	42.0	13.5	11.5	78.0	32.0	15.4	12.4	65.0	45.0

The relation between concentration and time in removal of NH_4-N and T-N is showed in Fig 2. Among the investigated absorption materials, the removal effect of NH_4-N was in order of Zeolite-FWG material > in active carbon material > in FWG material.

The removal of NH_4-N was high in the initial 4 hours, but thereafter the rate of removal was decreased and eventually approached zero, when equilibrium was attained. These changes in the rate of removal might be due to that, initially, all adsorbent surfaces were vacant and the solute concentration gradient was high. After that, the ammonium removal rate by the Zeolite- FWG decreased significantly, due to decrease in adsorption surface.

The removal effect of NH_4-N ion on Zeolite-FWG was the highest because of not only the adsorption process on the surface of the Zeolite-FWG but also the exchange ion process between NH_4^+ in solution and Na^+ in structural framework of zeolite. Active carbon shows larger removal than FWG due to the large specific surface, while FWG can little absorb NH_4-N.

The variation of the amount of the adsorbed phosphate with respect to times was investigated. The results were showed in Fig. 3 in which the removal of the phosphate increased in the initial 4 hours, but attained equilibrium after 24 hours. In this case, the absorbability of active carbon material were higher than Zeolite-FWG material and in FWG material. It is possible because the adsorption of phosphate on the Zeolite-FWG principal occurred as physical interaction between the adsorbent surface and PO_4-P. This phenomenon also occurred similarly as in the COD removal process.

Conclusions:

The results of this study showed that using Zeolite-FWG material for wastewater treatment attained rather high efficiency, especial the removal of cation such as NH_4-N was higher than that of active carbon and FWG material. Not only cation but phosphate and organic matter can be also removed though high physical absorption by large surface of Zeollite-FWG and FWG itself which is the basic material of Zeolite-FWG. Therefore, the high application possibility of newly developed material (Zeolite-FWG) is confirmed.

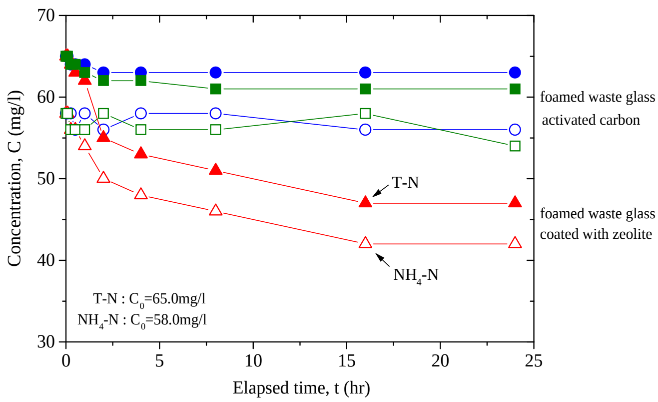
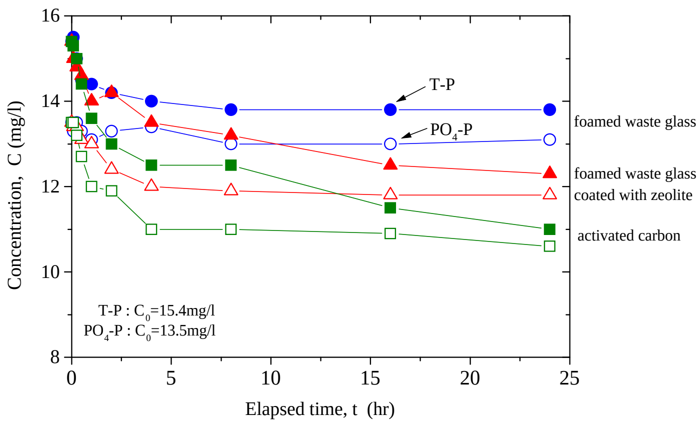


Fig 2. Time change of NH4-N and T-P



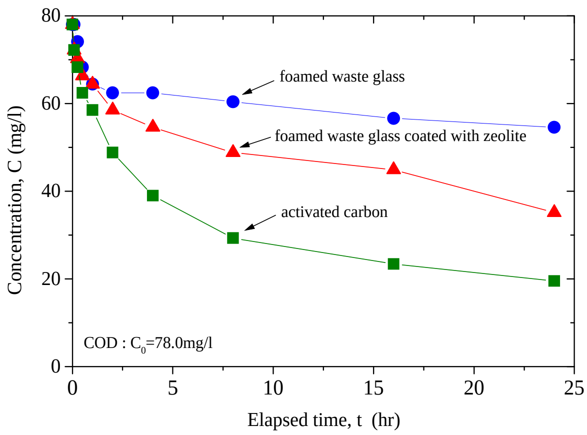


Fig.3. Time change of PO4-Pand T-P

Reference: Mogens Henze**.** 2000. Characterization of wastewater and biomass. In: Henze, Harremoes. La Cour Jansen Arvin, eds. *Wastewater Treatment.* Springer, pp.43-60

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