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種別(和文)	論文要旨
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（博士課程）
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論 文 要 旨

THESIS SUMMARY

専攻： Department of	土木工学	専攻	申請学位（専攻分野）： Academic Degree Requested	博士 Doctor of	(Engineering)
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要旨（英文 800 語程度）
Thesis Summary（approx.800 English Words ）

Background and purposes of this study

Nitrogen (N) is a major nutrient that affects productivity in freshwater systems. However, the existing knowledge on the interaction between suspended solids (SS) and N transformation in freshwater columns is still fragmentary. Thus, the overall purpose of this study is to elucidate the effects and mechanisms of inorganic and organic suspended particles on N transformation in freshwater column. Accordingly, there are two sub-topics in this study as following:

a. Effect of inorganic suspended particles on nitrification (ammonium and nitrite oxidation) in freshwater columns. The purpose of this study is to elucidate of detailed nitrification processes under the presence of SS
b. The role of organic suspended particles as nitrogen source in freshwater columns. The two hypotheses were tested in this study:
    - FPOM, having a relatively large surface area, plays a significant role as DN source in streams, despite being relatively refractory; and
    - DN release rates from CPOM and FPOM is significantly affected by their sources and generation processes.

Material and Methods

a. Effect of inorganic suspended particles on nitrification in freshwater columns

In the present study, the effect of SS on nitrification was investigated by using dominant mineral types as representatives. Batch experiments were set up in the laboratory to investigate the effect of ISS characteristics and their concentrations on nitrification. There dominant ISS types was montmorillonite, sericite, and kaolinite and concentration range is 0-1000 mg/L. Nitrogen species concentration (i.e., NO_2^-) was measured at several time steps to estimate nitrification rate.

b. The role of organic suspended particles as nitrogen source in freshwater columns:

We investigated total DN (TDN) and nitrate and nitrite (NO_3^-+ NO_2^-) releases from particulate organic matter (POM) by incubating POM of various sizes and chemical characteristics in stream water over a two-week period. Large- and medium-sized fine POM (L-FPOM, 250-500 μm, and M-FPOM, 100-250 μm) were prepared by feeding five types of coarse POM (CPOM) to shredding amphipods in laboratory aquaria.

Results

Effect of inorganic suspended particles on nitrification:

- In the concentration range from 200-1000 mg/L, the introduction of sericite significantly improve ammonium oxidation compared to control experiment (i.e., clear medium). There was no effect of sericite concentration on transformation rates (0.066-0.072 L mg^{-1} d^{-1}). Stimulation effect was also observed with the introduction of montmorillonite although the transformation rate (0.042-0.046 L mg^{-1} d^{-1}) was much lower than those in sericite system. The transformation in the system treated with kaolinite was negligible with kaolinite higher than 200 mg/L.
- For nitrite oxidation process, both of stimulation and inhibition effect of three clay minerals on nitrite oxidation was observed. Under pH= 8.2 and the introduction of sodium ion (i.e., clay particles was dispersed), the higher concentration of montmorillonite and sericite resulted in higher nitrite oxidation rate while kaolinite concentration did not significantly affect the oxidation rate.

The role of organic suspended particles as nitrogen source in freshwater columns:

Compared to CPOM chemical quality, FPOM fractions were more recalcitrant (i.e., higher linocellulose index) but they have larger surface area than CPOM (4-40 fold for L-FPOM and CPOM and 6-75 fold for F-POM and CPOM). The release of DN from L-FPOM was low during the first day but comparable or even higher than that of CPOM during the second week of the experiment. The contribution of L-FPOM on DN release on the first day and the second week were 17 and 52%, respectively. Although FPOM is relatively recalcitrant, it has high surface area and accounts for a dominant budget of stream POM. This study confirmed that DN release from FPOM especially L-POM was comparable with that from CPOM. Thus, FPOM should be considered as an important N source in stream.

In summary, this study provided deep understanding about the interaction between suspended particle and nitrogen transformation, which aimed to support water quality management in freshwater column. Nitrification is one of the key transformation and the first step in N removal process in river and one of component of water quality model. The estimation of nitrification rate is one of the crucial step in water quality calibration and validation steps. The overestimate or underestimate of transformation rate can result in poor performance of the model and affect decision making in water quality planning. The result from this study about the effect of clay mineral particles, which is very common with high concentration in many turbid rivers in Asia countries, on nitrification showed that transformation rate of both sub processes of nitrification was strongly affected by the appearance of clay characteristics and concentration. So the investigation of suspended sediment quality and concentration is necessary for the estimation of nitrification rate. Information about N source is also a critical part of N model. Hence the underestimation of FPOM as a nitrogen source can be a potential cause of eutrophication which resulted in water quality degradation and fish killed.

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