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Characteristics of DOC and Ammonia Removal In BAC Process

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1. Introduction

The biological activated carbon(BAC) process is defined as a simultaneous combination of granular activated carbon(GAC) adsorption and aerobic biological oxidation, normally installed after postfiltration in the water treatment process. Through this study the removal characteristics of DOC and ammonia in the BAC(ozone+GAC) process will be examined. The goals of this research are to derive adequate design parameters of BAC process and to understand the charateristics of DOC(especially BDOC) and ammonia removal in BAC process for Nakdong river.

2. Materials and Methods

The pilot plant system is installed at the Mulgeum intake station located on the lower Nakdong river in Korea and consists of coagulation, sand filtration, postozonation and GAC system. The raw water of this water treatment system was pumped from a site which is not treated by prechlorination. The ozone dosage of the postozonation system was 2~3㎎/ℓ at 10min. The BAC processes was packed to a wood-based activated carbon. DOC was measured with a Dohrmann DC-180 TOC analyser using ultra-violet promoted persulfate oxidation of organic carbon. BDOC was determined according to the bioassay procedure developed by Servais et al(1987, 1989). Dissolved ozone was measured by Indigo colorimetic method of standard methods. NH_3-N was measured by Nesslerization method of Standard Methods. UV absorption was measured by UV-1601PC(Shimadzu).

3. Results anf Discussions

3.1 Design parameter

Because water temperature in the winter drops below 5℃, the longer EBCT is required to remove BDOC and ammonia. Considering the winter, the 20min of EBCT as a design parameter to remove these matters is recommended. In order to obtain the longer EBCT(above 20min), the EBCT of BAC system can be controlled to above EBCT 25min according to diminishing water production for the system because of the reduction of water consumption in the winter

3.2 Removal of DOC and BDOC

The mean removal efficiencies of DOC after 200 days in the BAC process was 21% of the wood-based BAC process. The removal efficiency of BDOC concentration in the BAC process made distinct difference since about 200days of operation. Since 200 days, the mean removal efficiencies of BDOC for EBCT 15min in the BAC process was 68% for the BAC process.

3.3 Removal of ammonia in winter

The results present that the decreased pH per 1㎎ of NH_3-N is about 0.47. The alkalinity by ammonia removal is decreased to about 7.1㎎ per 1㎎ NH_3-N. Dissolved oxygen requirement per 1㎎ of BDOC and NH_3-N in the BAC system are 2.09㎎ and 4.05㎎, respectively. The total required time to attain above 1㎎/ℓ of ammonia removal efficiency was at least above 80days including adaptation time.

4. Conclusions

The removal quantities of DOC and NH_3-N by BAC filtration show mostly the maximum values with EBCT 15 minutes at above 10℃. Considering the winter, the 20min of EBCT as a design parameter to remove these matters is adequate. For operation condition of backwashing, the period of backwashing may well be adjusted to maintain below 80cm of headloss to obtain above 30% of removal efficiency. As operation time passes, the biomass on surface of granular activated carbon, as a rule, reached a constant level of bacterial colonization from after 60 days. Maximum biomass of carbon surface was mainly observed not at the top of each column but at 100cm of depth. The relation between NH_3-N and pH, alkalinity showed that decreased pH and alkalinity per 1㎎ NH_3-N were about 0.47 and 7.1㎎ respectively. And also the required dissolved oxygen per 1㎎ BDOC and NH_3-N in the BAC system was 2.09㎎ and 4.05㎎, respectively.

References

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