



Performance evaluation for the improved PCF filter to apply to the water treatment plant (WTP)

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Received 4 January 2021; Accepted 1 April 2021

ABSTRACT

The ultimate object of this study is the replacement of the precipitator plus the rapid sand filter (RSF) used in the conventional water treatment plant (WTP) with single filtration equipment. The pore controllable fiber (PCF) filter which was one of the depth filters using the pump pressure was studied from 2008 to apply to the portable water production. In this study, the PCF was improved by thickening the filter media depth more than 2 times and adjusting the backwash conditions. The feed used in the main study was supplied from the Hoedong catchment of which hydraulic retention time was about 14 d. So, its average turbidity was very low as much as about 5.76 NTU and its particle size was very fine as much as about 8 μm by weight average since it was naturally precipitated for 14 d. The purpose of this study is to discuss problems and to find solutions through performance tests of the improved PCF (let 150 mm PCF) for the WTP process. According to pilot test results, the filter showed more than 99% removal of the turbidity and so the turbidity of the filtrate was as low as 0.066 NTU after increasing the filter media depth to 150 mm even though the raw water's turbidity was as low as 8.97 NTU. Moreover, a similar pilot which was tested on the raw water of the Nacdong river for 2 months from June of 2020 showed that the filtrate turbidity was 0.065 NTU and 99.7% of the turbidity was removed from 24.9 NTU of the feed. These results hint that the PCF could be in a fair way to replace the conventional WTP in the near future. According to the performance data for nine equipment including the PCF and seven of UF membranes evaluated by BWQI that was the public organization of Busan city, Korea from to June 24 to September 17 of 2018, the PCF having 100 mm filter media depth (let 100 mm PCF) was lower than the UF by 0.3% in the turbidity removal but was higher than the UF by 11%, 22.7%, and 20% in dissolved organic carbon, Mn, and trihalomethane formation potential removal, respectively. On the other hand, results of SDI_{15} measurements that were the indirect indicator for colloidal showed 3.3 for the PCF and 2.3 for 6 of the UF by average which were satisfying the RO pre-treatment standard, 5.0 as the colloidal level. The colloidal removal of the 100 mm PCF was slightly worse than membranes through the comparison of the turbidity removal and the SDI_{15} between the 100 mm PCF and membrane. It was found that these problems were coming from the initial filtrate of the PCF. So, it was concluded that the circulation of the initial filtrate of the PCF to the feed is needed to obtain higher colloidal removal from the PCF, and it is expected that this work makes the colloidal removal of the PCF close to the membrane.

Keywords: Drinking water treatment; Potable water production; Fiber filter; PCF filter; Turbidity; Water treatment plant

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