

Applicability of precoat filtration for the drinking water treatment

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Abstract

The objective of this investigation was to evaluate applicability of precoat filtration for drinking water treatment. Precoat filter used in this experiment are candle filter. Element disk of candle used in this experiment are pore size $5\mu\text{m}$ (W), $10\mu\text{m}$ (R), $20\mu\text{m}$ (B) and $40\mu\text{m}$ (Y). And diatomaceous earth are cake pore size $3.5\mu\text{m}$ (A), $7\mu\text{m}$ (B) and $17\mu\text{m}$ (C). Filtrate of precoat filter during 30min are R-C 11.3, B-C 10.2, W-C 8.9, Y-C 8.6, Y-B 7.1, R-A $5.4(\text{m}^3/\text{m}^2)$. Turbidity of the effluent can be attained under 0.1NTU with the all combination.

Introduction

The Protozoa parasite *Cryptosporidium* has caused many documented outbreaks of intestinal disease associated with drinking water. Even a well-operated water treatment system can not ensure that drinking water will be completely free of this parasite. *Cryptosporidium* oocysts makes resistance to chlorine disinfection.

Pre.coat filtration bears comparison with high technology separation processes such as membrane microfiltration. Turbidities as low as 0.05NTU have been reported at low rate of $1.4\text{m}^3/\text{m}^2$ per hour with the precoat process. This makes DE filtration a highly efficient process for the removal of micro-organisms, such as cryptosporidia and giardia from drinking water. For this reason, water clarification using diatomite has been specified by the US. Environmental Protection Agency as an approved technology for compliance with the surface water treatment rule. It is recommended below 0.5 NTU turbidity for reducing risk of cryptosporidia and giardia .

It was investigated to evaluate applicability of precoat filtration for drinking water treatment in the D water treatment plant at Gwangju water treatment plant during 2002. sep.~oct. whose inlet water is supplied from Juam lake in Jeollanamdo.

Materials and Method

The precote filter system is shown in the Fig.1 and the shape of element disk and filter in Fig. 2 and Fig. 3.

These consist of the filter, the feed pump, tanks containing filter aid for precoating.. In the operation of a filtration, the filter is first precoated by circulating a slurry of diatomaceous earth (1~2kg/m³) and clear or filtered liquid from the precoat tank through the filter back to the precoat tank.

This is continued until all the filter aid is deposited on the filter septum. The filter is changed over, with minimum fluctuations in pressure, from precoating to filtering. Element disk of candle used in this experiment are pore size 5 μ m(W), 10 μ m(R), 20 μ m(B) and 40 μ m(Y). Diatomaceous earth are cake pore size 3.5 μ m(A), 7 μ m(B) and 17 μ m(C). Proxymate analysis of diatomaceous earth are shown in table 2.

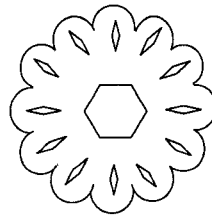
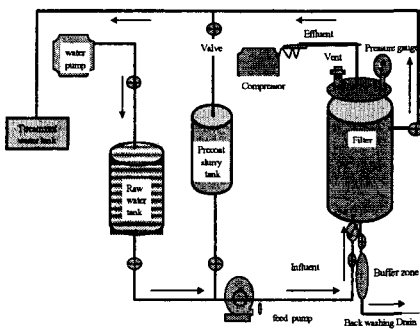


Fig. 1. Schematic diagram of precoat filter

Fig. 2. The shape of element disk

Fig. 3. The shape of candle filter

Items	Contents	Items	Contents
Raw water tank	SUS 304 (W400×600×600mm) Effect volume 60 ℓ	Feed pump	LG, water pump
Precoat tank	SUS 304 (W400×200×600mm) Effect volume 20 ℓ	Precoat filter	Body SUS 304, Acryle, D100mm × H500mm Effect volume 4 ℓ
Raw water pump	LG, 1HP water pump		Element disk Polypropylene, Pore size : 5, 10, 20, 40 μ m
Compressor	2HP, 10kgf/cm ²	Candle	Element Supporter SUS 304 Hexagon pillar L 500mm

Experimental Method

- The selection of diatomaceous earth usage for precoating
- Flux variation in each combinations
- Analysis of the effluent's water quality
(KMnO₄ Consumption, DOC, UV₂₅₄, Turbidity)

Results and Discussion

When 2kg/m² diatomaceous earth was used for precoating, candle was coated in 5~6mm thickness.

Filtrate of precoat filter during 30min are R-C 11.3(m³/m²), B-C 10.2(m³/m²), W-C 8.9(m³/m²), Y-C 8.6(m³/m²), Y-B 7.1(m³/m²), R-A 5.4(m³/m²).

Water quality of precoat filter effluent are thus.

Turbidity are below 0.1NTU with the all combination, removal rate are over 90%. KMnO₄ consumption are 2.41~5.42mg/ℓ, removal rate are 30.5~65.3%. DOC are 2.038~2.911mg/ℓ, removal rate 9~30.8%.

Classification	A	B	C
	STANDARD SUPER-CEL	Hyflo Super-CEL	CELITE 545RV
Product method	Calcined	Flux Calcined	Flux Calcined
Color	Pink/Buf	White	White
PH	7.0	10.0	10.0
Median cake pore size(μm)	3.5	7.0	17
wet density(g/cm ³)	0.314	0.314	0.34
Moisture(%)	0.5	0.1	0.1
Permeability, D'Arcy's	0.25	1.1	4
표면적(m ² /g)	12~40	20~45	30~55
Median paticle size (μm)	20.9	30.1	46.5
Particle Size Distribution (%)	합계	100	100
	2μm 이하	0	0
	2~6μm 이하	9	4
	7~12μm 이하	20	11
	13~24μm 이하	27	24
	25~48μm 이하	28	33
	48μm 이상	16	28

Conclusion

The optimum diatomaceous earth dosage for precoating are 2.0kg/m³.

R-A combination effluent's water quality are KMnO₄ Consumption 2.71(mg/ℓ), DOC 2.038 (mg/ℓ), UV254 0.0300(Abs/cm), Turbidity 0.1 (NTU).

R-A combination can be substituted for CWTS to remove micro-organisms, such as cryptosporidia and giardia from drinking water.

References

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