EVALUATION OF PILE CLOTH MEDIA
FILTRATION OF SECONDARY EFFLUENT FOR WATER REUSE

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ABSTRACT

The objectives of this evaluation were:

- To determine the operational characteristics of a pile cloth filtration media under highly variable loading conditions.

- To determine the media cleaning requirements and backwash intervals associated with variable suspended solids loadings.

- To determine the effects of variable operational conditions, cleaning frequency and adverse weather conditions on the service life of the pile cloth media.

Introduction

The use of cloth media for wastewater filtration was first introduced 30 years ago in Europe. This innovation was the result of considerable research conducted on a variety of media types and construction methods that were focused on finer filtration without rigorous cleaning requirements. The most recent development in cloth media is a *pile* type construction (Figure 1). One unique feature of the pile cloth is its filter media filaments are free to move in response to the backwash flow. This movement makes captured solids easier to remove. This new media concept was considered a significant development and it was decided that a field evaluation of the pile cloth media was essential.

The pile cloth evaluation was structured to compare its performance to our existing filtration technologies for tertiary filtration of secondary clarified effluent under variable operating conditions.

Evaluation

The evaluation of a pile cloth media was initiated in September 2000. A single-disk, full-scale production filter unit, mounted on a double dropdeck trailer was furnished and installed at the South Beloit Water Pollution Control Facility, located in South Beloit, Illinois (See Figures 2 and 3). The treatment facility is comprised of two (2), 1 MGD package treatment systems and one conventional 1 MGD treatment system. Effluent from package plants No. 2 and 3 served as the influent to the cloth media filter.

The evaluation period was from September 2000 to December 2001. A preliminary protocol (Table 1) was developed to guide the initial study efforts, however, a significant portion of the study was restricted to the daily operating conditions of the wastewater treatment facility.

Table 1: South Beloit Testing Protocol

Experiment	Duration (days)	Hydraulic Loading Rate ($gal/ft^2 * min$)	Influent Turbidity (NTU)
1	14	3	3-6
2	14	4.5	3-6
3	7	6	3-6
4	7	3	7-10
5	7	4.5	7-10
6	7	6	7-10

System Capabilities

The filtration system consisted of an influent pump, an influent flow meter, a single disk filter equipped with influent and effluent turbidity meters, a control system, a data logger, and a backwash system. Influent and filtrate turbidities and flows were continuously monitored and recorded (see Figures 4A and 4B) while backwash events were automatically totaled and manually recorded. Influent and effluent stream samples were collected and analyzed for TSS, pH, and temperature values. Liquid levels were measured and recorded manually.

The single disk filter has an effective filtration area of 53.8 ft^2. Surface loading rates ranging from 3 to 6 gpm/ft^2 were evaluated. A solids loading of 10 to over 200 mg/l with associated turbidity levels of 5 to 100 NTU was encountered. No attempt was made to enhance the filter cleaning apart from the normal backwash events that were initiated on the basis of differential liquid level or default time except for a one-time, two-hour offline cleaning. This one-time cleaning was performed as part of the study to determine the effects of a simple sodium hypochlorite soak and extended backwash.

The study was conducted with only one three-week interruption during the winter of 2000/2001. During the shutdown, the cloth was subjected to winter conditions without any special protection. Throughout the study, the cloth segments were inspected and photographed to observe any possible progressive fouling.

Results of the Evaluation

After 14 months of nearly continuous operation, the pile cloth media demonstrated reliable filtration performance under a wide range of influent conditions. No indications of irreversible fouling were observed, and the media did not show premature physical wear as a result of severe test conditions. The backwash requirements were typically less than 3% of the forward flow. It was concluded that the pile cloth filter has improved solids loading capability with lower backwash requirements compared to existing filtration methods (Table 2).

Table 2:
Solids Loading Capability and Backwash Requirements for Various Filtration Methods

Media Type	SS Loading (mg/l)	Backwash (% of Flow)	Filtrate SS (mg/l)*	Filtrate Turbidity (NTU)
Sand (ABF)	10 - 20	4 - 5	3 – 5	< 2
Needlefelt (ADF)	10 –25	3 – 4	3 – 5	< 2
Pile (ADF)	10 - 50	< 3	3 - 5	< 2

*** Filtrate TSS data achieved without the use of chemical filtration aids**

Figure 1: Magnified Cross Sectional View of Pile Cloth Media

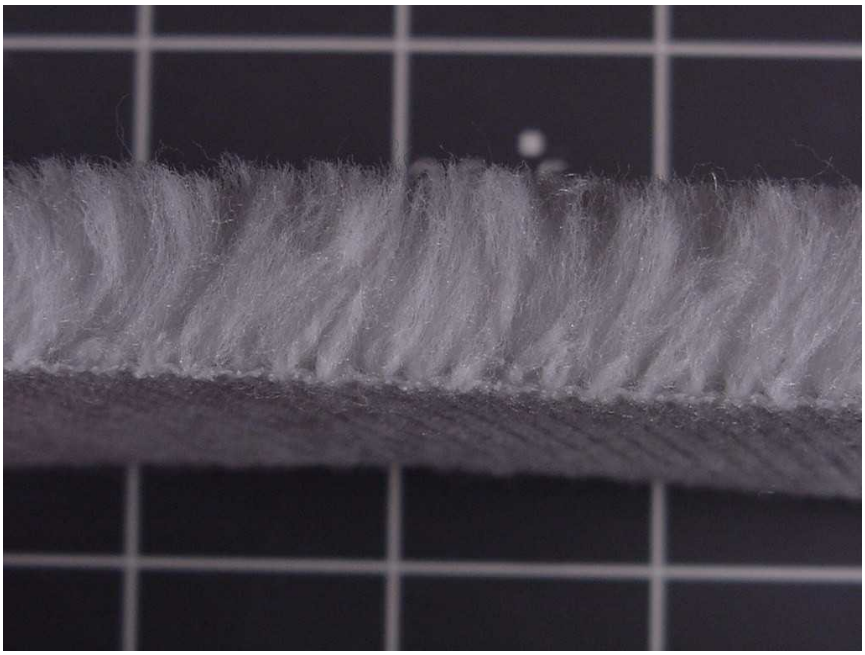

Figure 2: AquaDisk® Test Unit at South Beloit Water Pollution Control Facility

Figure 3: AquaDisk® Filter with Pile Cloth Media

Figure 4A: South Beloit Pollution Control Facility Pile Cloth Study
Influent and Effluent Turbidity Daily Averages

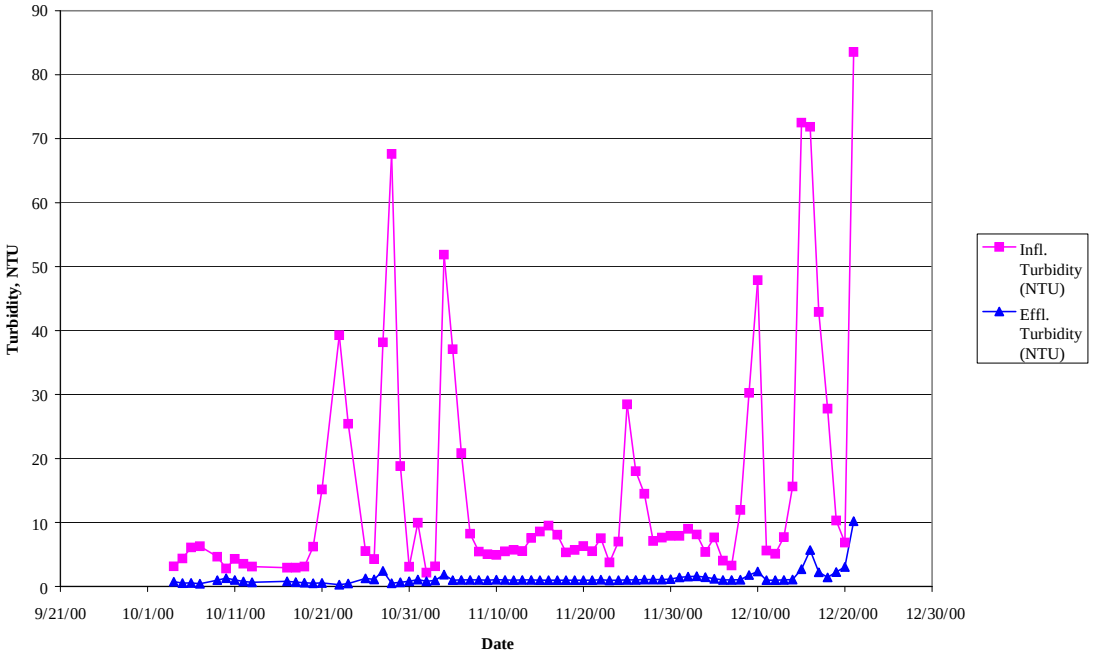

Figure 4B: South Beloit Pollution Control Facility Pile Cloth Study
Influent and Effluent Turbidity Daily Averages