Q&A

22Q6: What are the points to pay attention to when operating the water treatment system of rapid sand filtration method? （Mr. T.H. Sudan）

A: Rapid sand filtration method has four processes of mixing, flocculation, sedimentation and rapid sand filtration, and good results of treatment can be obtained by proper operation of each process. In order to keep the performance for many years, there are several points to pay attention to at the start of operation and thereafter. I will describe the key points at each process.

1. Mixing

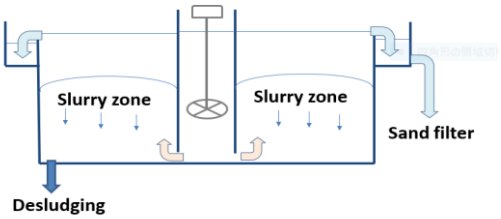
To obtain good coagulation, it is necessary to spread to the whole raw water of mixing basin immediately after the coagulant is dosed. And it also must be checked whether the amount of coagulant determined by jar test is dosed. If the diluter of coagulant is installed at the dosing point, it must be confirmed that enough dilution water is being supplied. The picture on the right is an example that diluted coagulant is dosed at multiple points.

2. Flocculation

The dosing rate determined by Jar test is not absolute. If the actual flocculation is poor, it needs to increase the dosing rate. If the mixing is electrically operated, proper mixing strength can be obtained, but in the case of a baffling mixing, the raw water amount must be kept within the design range to obtain the proper mixing strength.

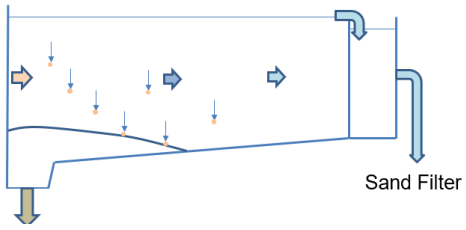
3. Sedimentation

There are two kinds of sedimentation, one is a horizontal flow type sedimentation and another is a clarifier (suspended solid contact clarifier). In the clarifier type, flocculation and sedimentation are carried out in the same basin. To keep performance of the clarifier, it is important to keep proper concentration of slurry zone (floc layer). So, the regularly (preferably daily) drainage of sludge is required.



Suspended solid contact clarifier

In the horizontal flow type, when the sludge accumulates a lot in the sedimentation basin, the performance will decrease due to increase the flow velocity. So, periodical drainage of sludge is required.



Horizontal flow sedimentation basin

Regarding drainage time, for both types, it is determined by observing the turbidity of the drained sludge water, which has become somewhat clean. It is required to empty the sedimentation basin and wash out sludge with pressure water several times a year as well.

4. Rapid sand Filtration

Floc not settled down in the sedimentation basin is trapped at the filter basin. To keep this function, proper backwash is important. Setting method of backwash procedure by demonstrative check is as follows.

a) Adjusting of backwash flow rate

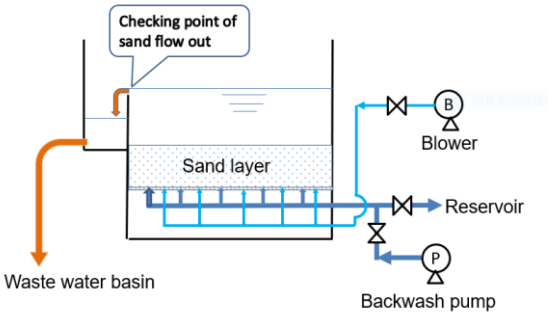
A backwash pump or a backwash tank is installed for the sand filter to ensure adequate backwash flow rate. However, there are many cases the filter sand is flowing out without adjusting the backwash flow rate. In order to avoid this, it is necessary to adjust the backwash water flow rate at the start of operation.

Since the diameter of the filter sand is usually 0.3 to 2.0 mm, a sieve with size of 0.3 mm mesh is used for checking the sand outflow. Receive the backwash effluent flowing into the drainage trough and check whether the filter sand is trapped. If trapped sand is observed, reduce the backwash flow rate until the sand is not trapped.

0.3mm mesh sieve

b) Backwash time

Since the purpose of backwash is to wash out adhered floc from sand layer, it is wasteful of water if backwash continues even after backwash effluent became clean. Measure the turbidity of the backwash effluent every minute and set the wash time when turbidity reduction stops.



General Backwash of filter

There is one more point to mind; keep the filter in good condition. Although the

backwash is proper, if there is a lot of substances which was not flocculated remain in the settled water, the sand grains stick these substances to the surface. These substances cannot be removed completely by ordinary backwash, and it causes deterioration of sand filter and filtered water. Therefore, it is important not only the proper backwash, but also proper coagulation-sedimentation, such as proper coagulant dosing, control of raw water flow rate not for exceeding the treatment capacity (designed capacity). Also, the sand layer thickness requiring to function fully is 1000 times of the sand effective size*1, so the sand layer with an effective size of 1.0mm*2 is required the depth of 1m or more. When the water treatment plant newly constructed, sand is usually filled about 1.15m with some excess. Measure the depth of the sand layer every year and check whether there is no decrease. If proper operation and maintenance as described above is carried out, the filter basin does not need to replace the sand and will keep its performance for many decades.

*1 Sand effective size: filter sand particle size with passed through weight percentage of 10% in filtering sand sieving test expressed in mm unit. The number of particles smaller than the effective size and the number of larger particles become almost same.

*2 Many developing counties use filter sand with an effective size of 1mm. But in Japan, sand effective size is set to 0.45~0.7mm in the Design Criteria for Waterworks Facilities.

(Answerer: Mr. KAGATA Katsutoshi, Kitakyushu City Water and Sewer Bureau, O.B., 2018)