

Indonesia

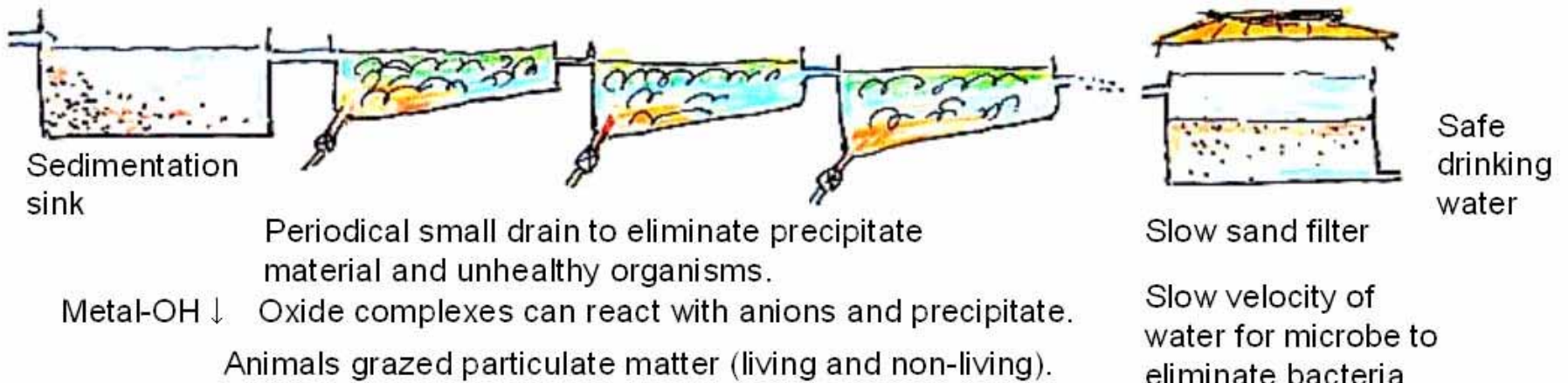


New biological pre-treatment for SSF

Active growth of algae : holding stick (code) for filamentous algae

$O_2 \uparrow \rightarrow$ bubbles \rightarrow keep aerobic condition

$pH \uparrow \rightarrow$ precipitate oxide and hydroxide complexes.



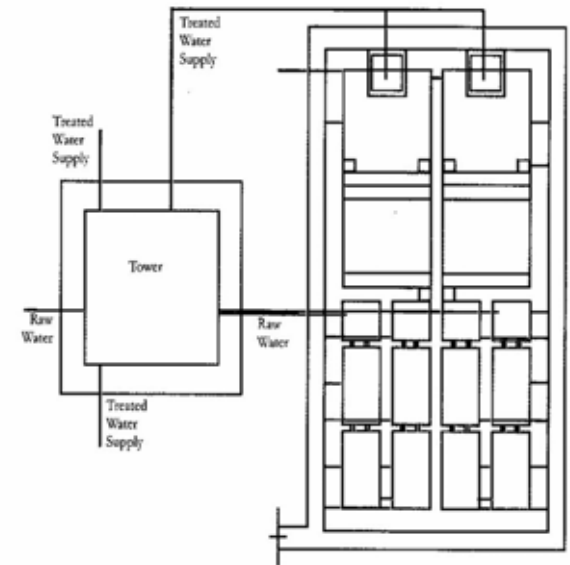
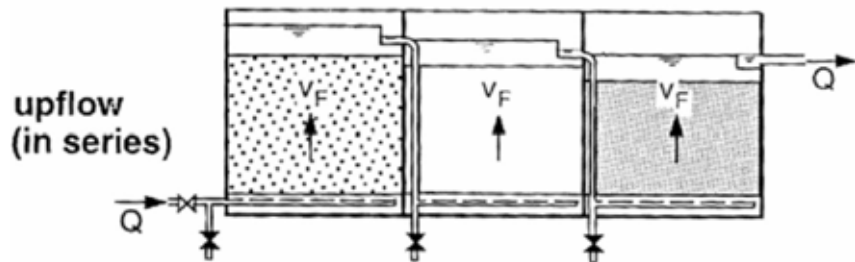
Metal-OH \downarrow Oxide complexes can react with anions and precipitate.

Animals grazed particulate matter (living and non-living).

Slow velocity of water for microbe to eliminate bacteria.



Two bottles of 20liters per 1 family. This water is used for drinking and cooking only. This water is not used for bath and washing hands. Diarrhea and eye sickness are disappeared. Health village sanitary sense and its level are distributed among the villagers. This acts to protect against sickness.



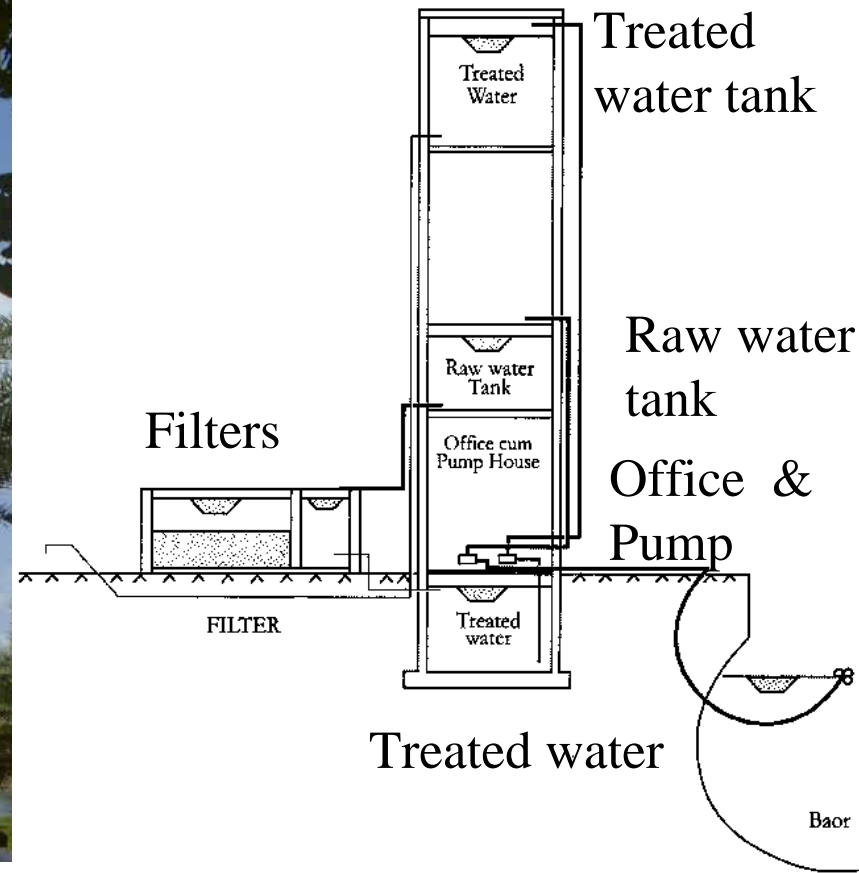
Upflow roughing filter is easy to maintenance to remove trapped particle among the gravel chamber.



Bangladesh: water source is surface water of an eutrophic oxbow lake



SSF treatment is completed in cold Europe. In the warm tropical region, the biological activity is more active than in cold environment. This point is important for the ecological purification system. Faster flow rate is necessary to keep aerobic condition.



Water tower of Pipeline Water Supply System in Sharsha Upazila of Jessore district, Bangladesh



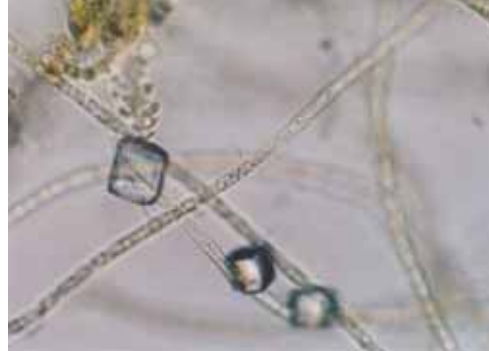
All of floating algal mat is collect by gill net. Nutrient absorber, oxygen supplier, remover of SS, and food supplier for animals.



Coral Island :Miyako Jima, Okinawa. Hardwater underground water is water source of SSF.



**Floating green algae is harvested by hand.
Algae grows using nutrient under sunshine.**



Calcium carbohydrate crystals are observed on algal filament.

10 years ago: Algal bloom in SSF was bad phenomenon. Treated chlorine to kill algae.

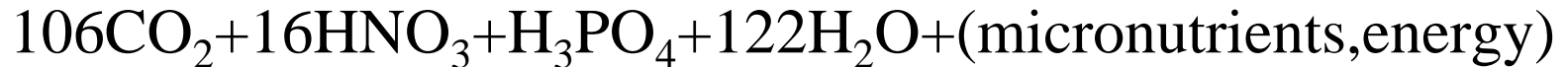
Water became better taste (soft water) by stopping addition of chlorine. However, heavy algal bloom happened.

Bio-mineralization is occurred by algal activity. Oxidized reduced substances under aerobic condition. Softening under high pH condition. Reduction of nutrient by algal growth is observed.

Biological Phenomena of Ecological Purification System(EPS)

Oxygen Production by Photosynthesis $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{CH}_2\text{O} + \text{O}_2$
Gives a better condition for heterotrophs. (Decomposer: bacteria, small animals)

Reduction of Nutrients in Water by Algal Growth



Photosynthesis respiration, decomposition

$(\text{CH}_2\text{O})_{106}(\text{NH}_3)_{16}\text{H}_3\text{PO}_4 + 134\text{O}_2 + \text{micronutrients}$
Oligo-trophication (opposite process of eutrophication: shift to less polluted water)

Production of Food and Energy Source for Heterotrophic Organisms
Algae is one of the best food for animals in EPS.

Shift to High pH and High DO Concentration by Photosynthesis
(Low CO_2 concentration shifts to high pH condition)

Metal ions are easily changed to hydro-oxide compounds.

Easily precipitate: ***bio-mineralization***

Reduction of metal ions: Reduction of toxic heavy metals



Muelheim, Germany. Bank filter: Artificial subsurface water is made in a flood plain in Ruhr river. In Germany, 60 % of water source of tap water is subsurface water or under ground water.

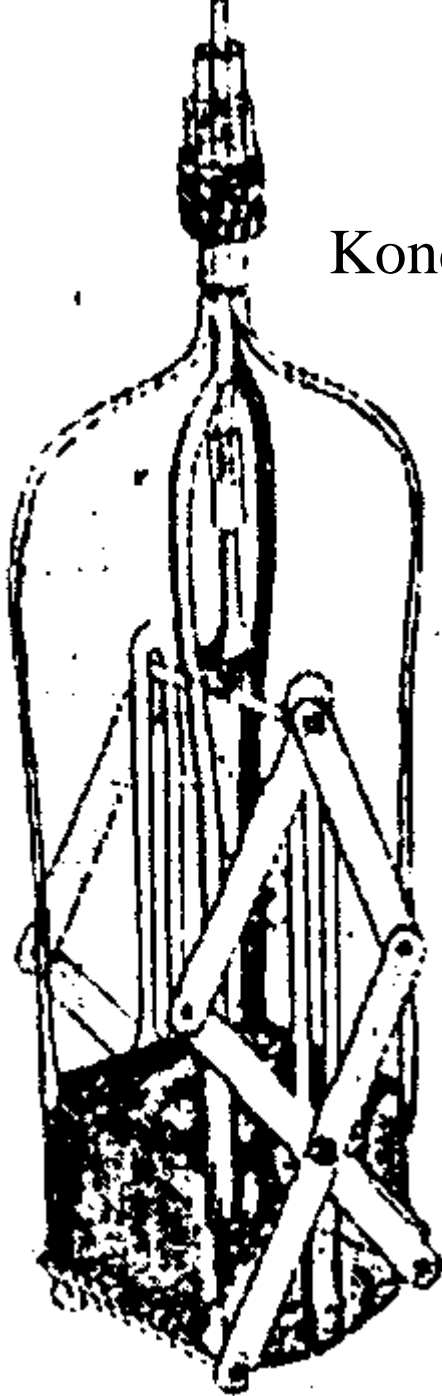


Scrapping of surface mud on the sand layer.

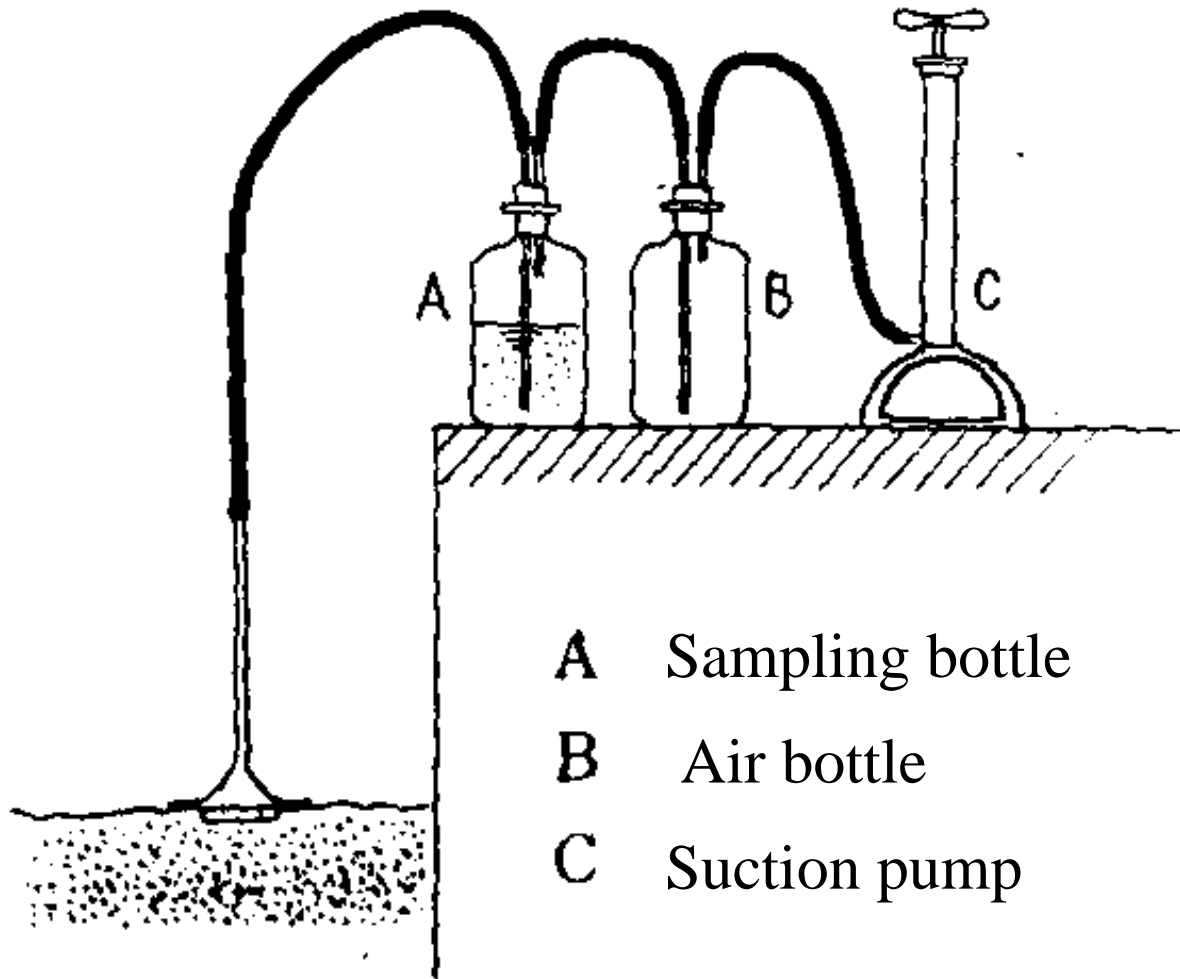


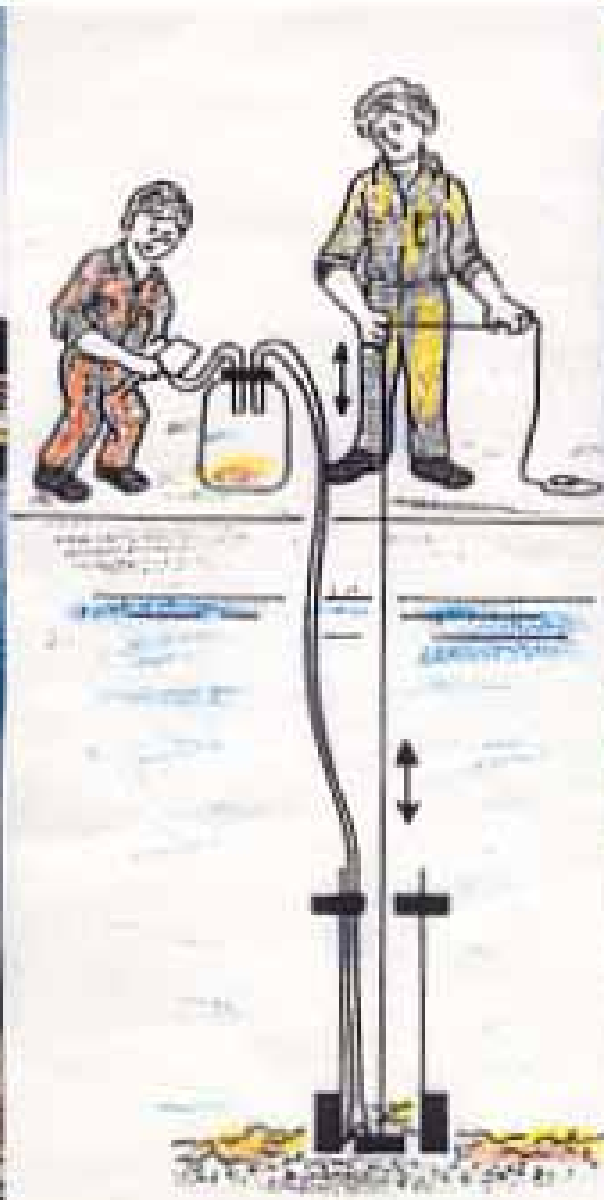
Sampler for surface mud.

Kondo 1935



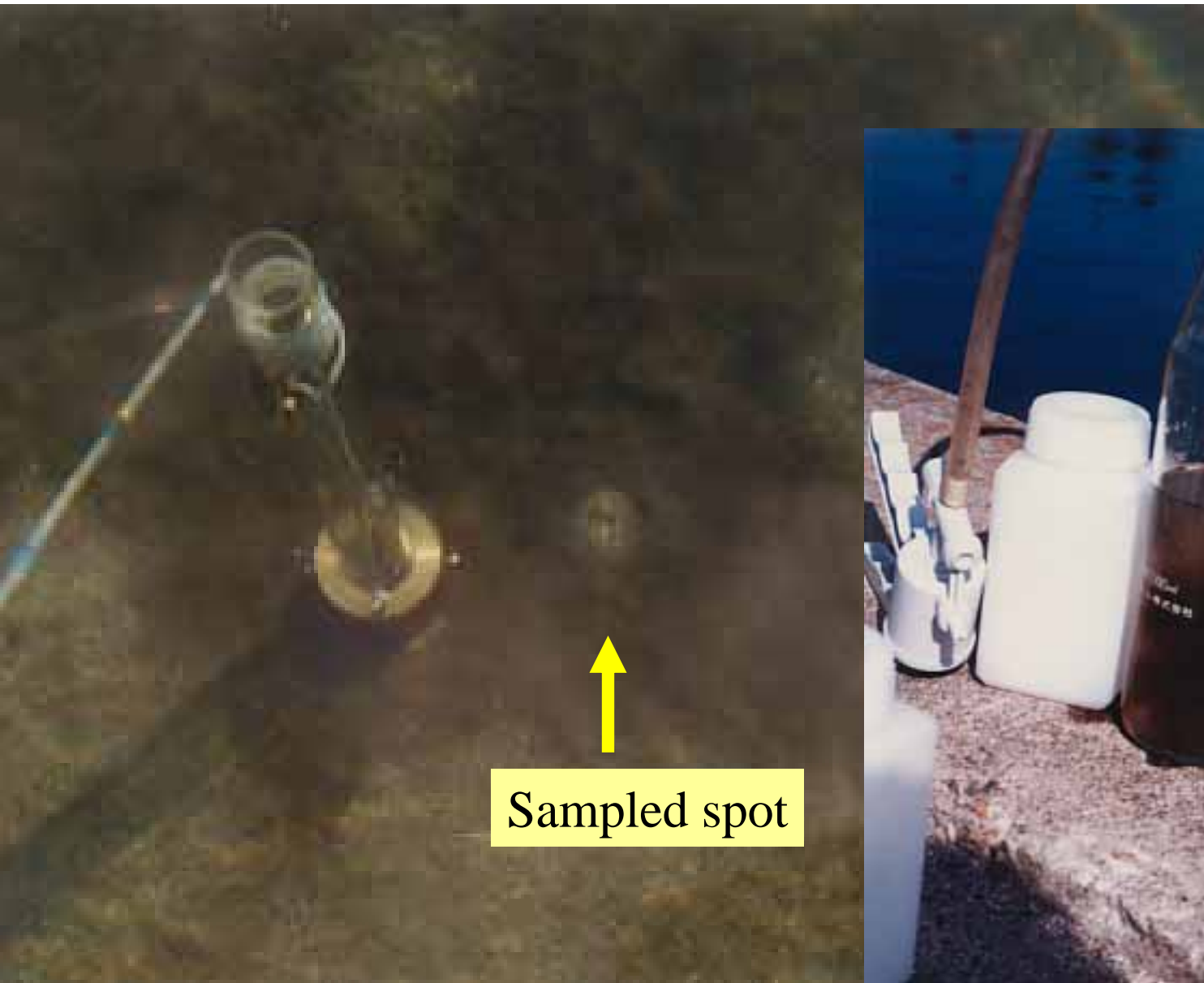
Kojima 1964

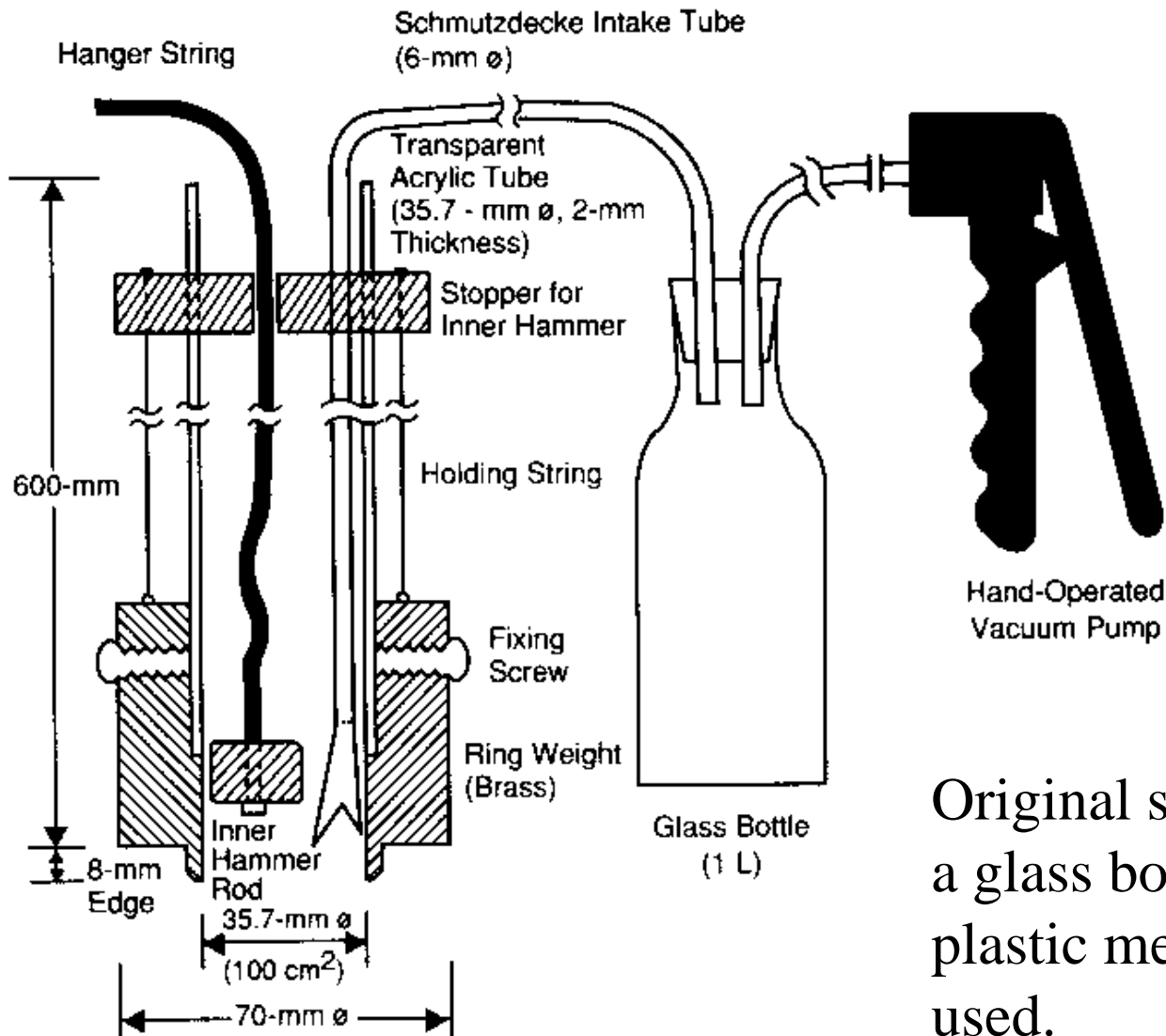




Sampling tool for algal mat

Algal mat can be taken quantitatively.





Original sampling vessel was a glass bottle. At present time, plastic measuring cylinder is used.

Figure 2 Schematic showing components of the schmutzdecke sampling tool

How to Use

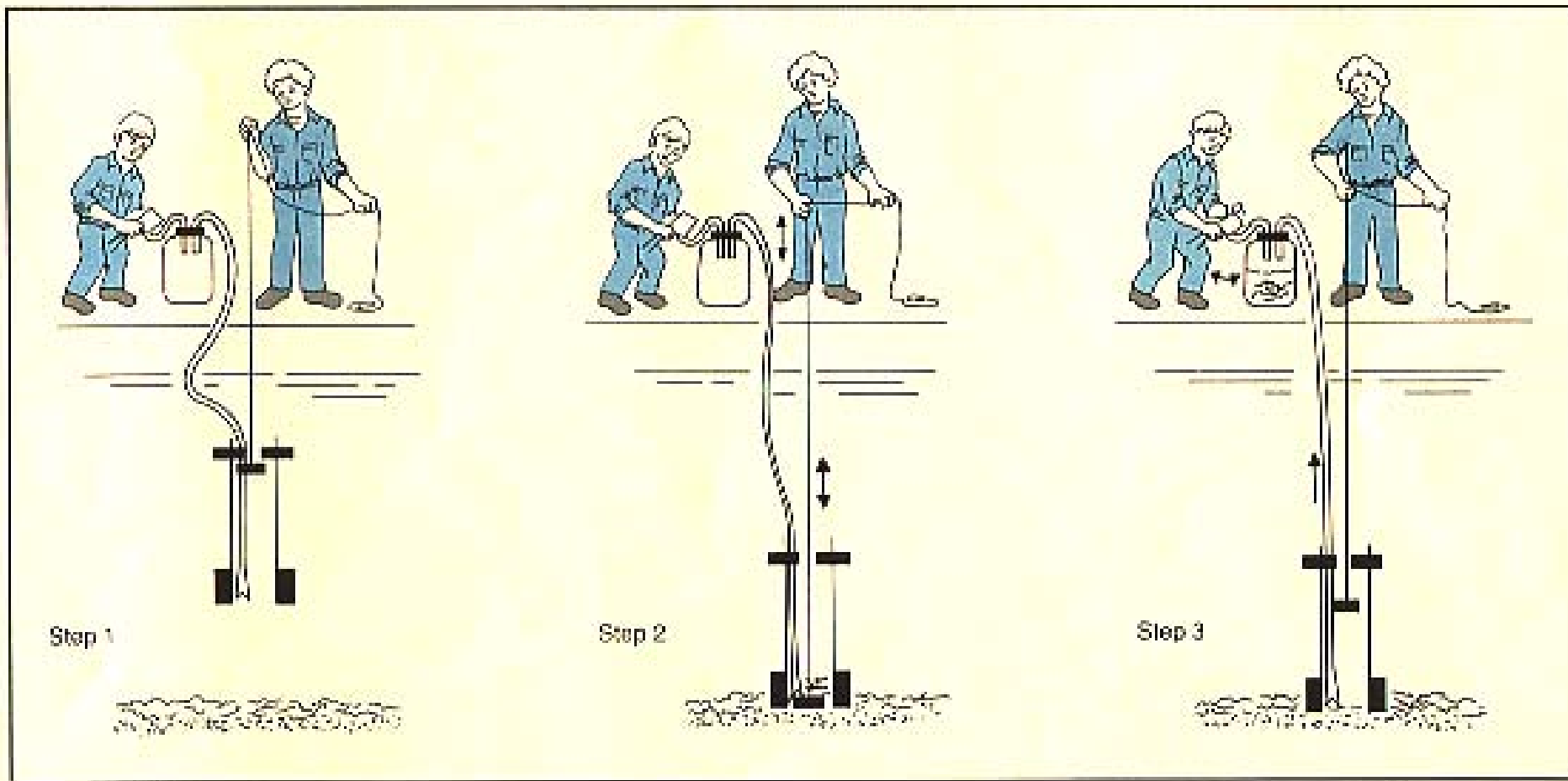
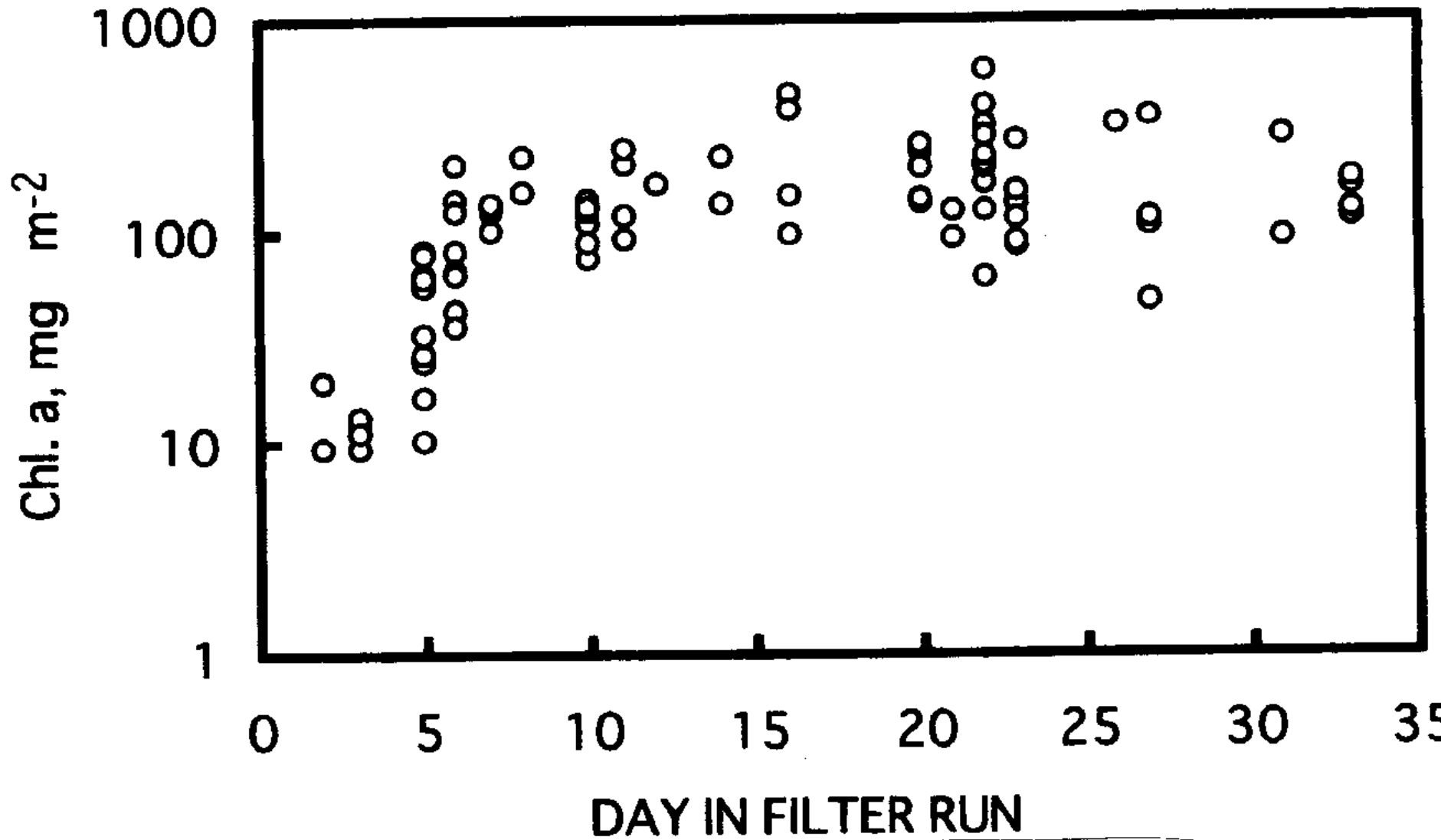
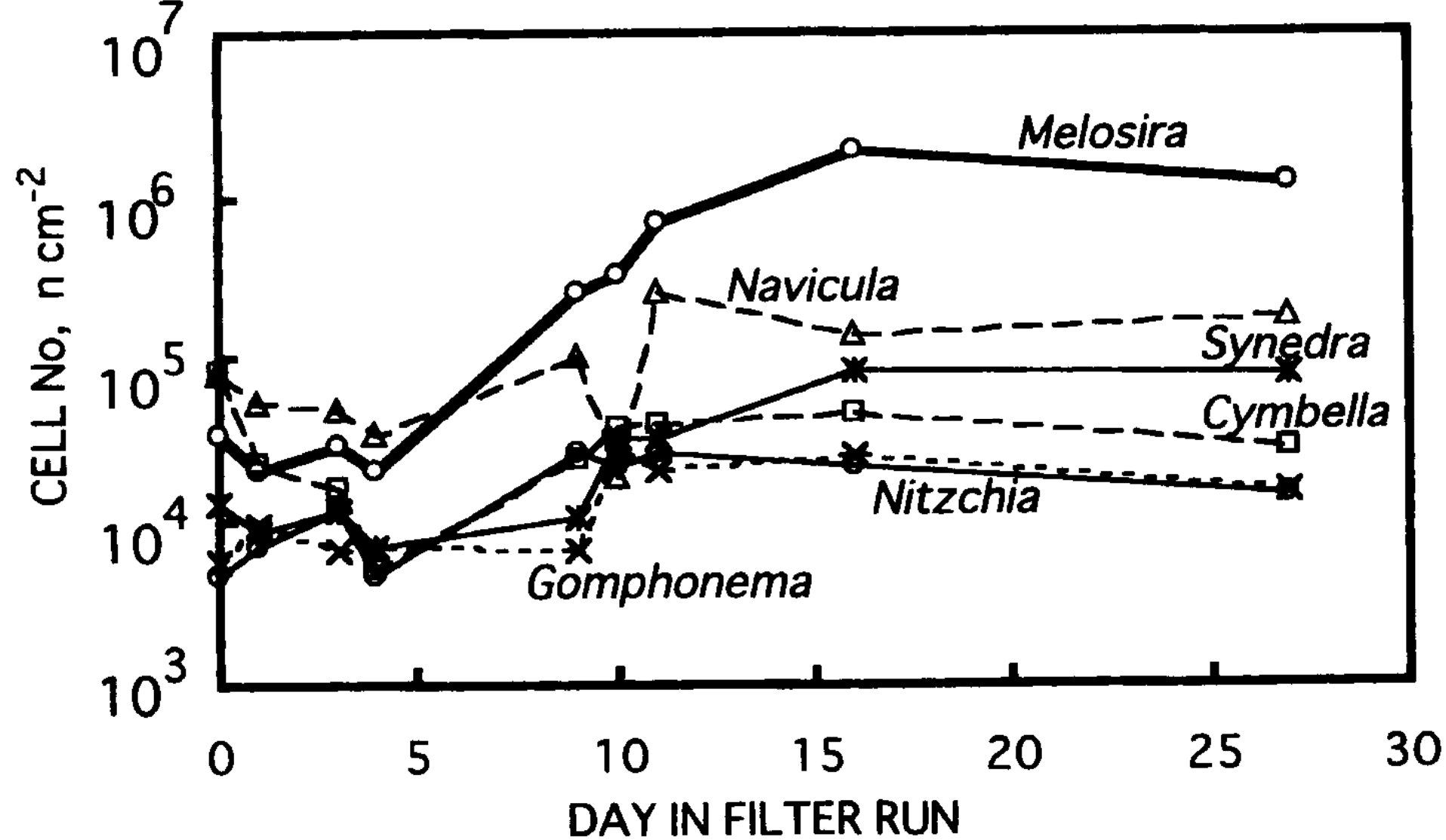


Figure 3 These three illustrations show how the schmutzdecke sampler is used

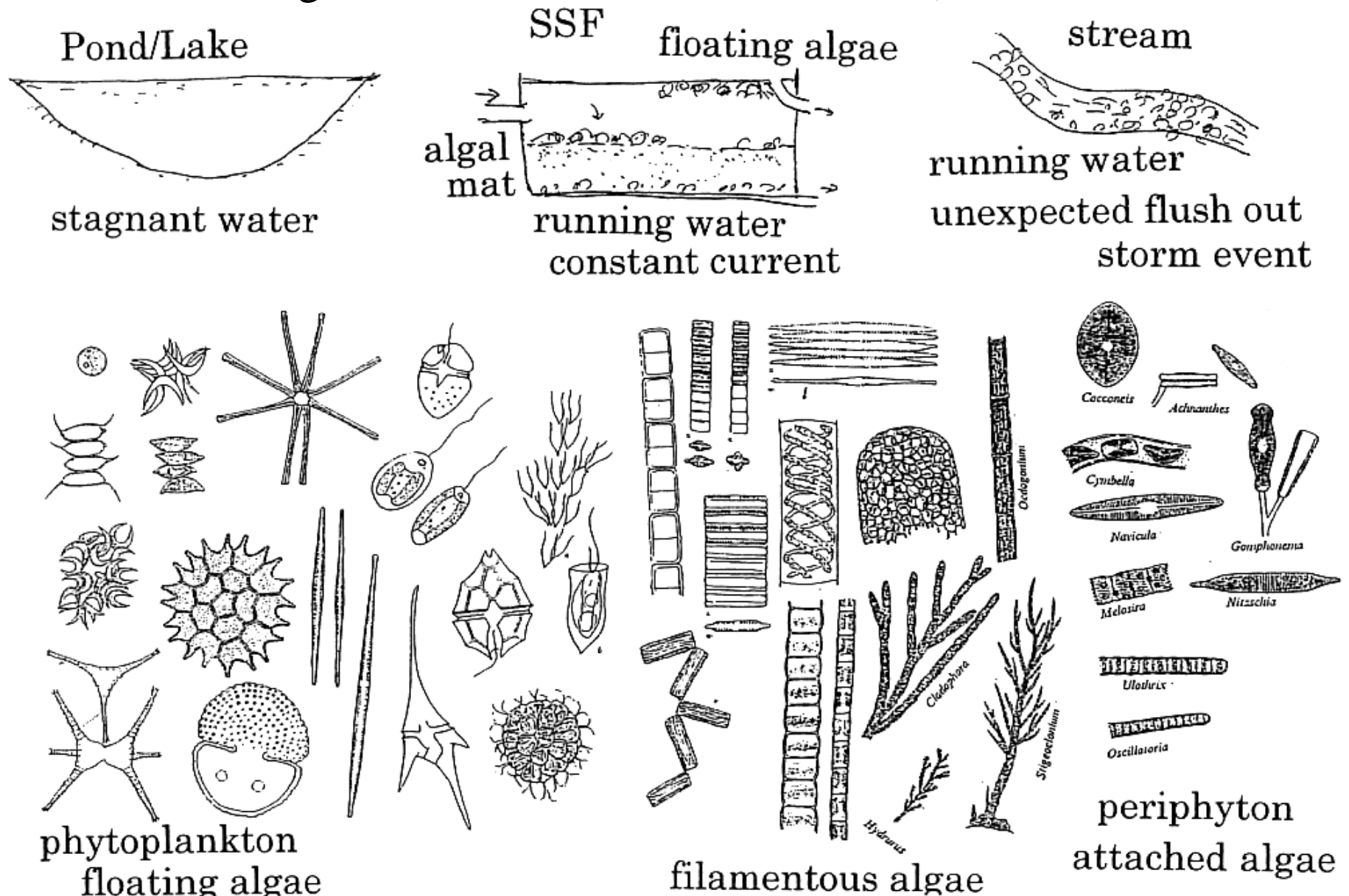


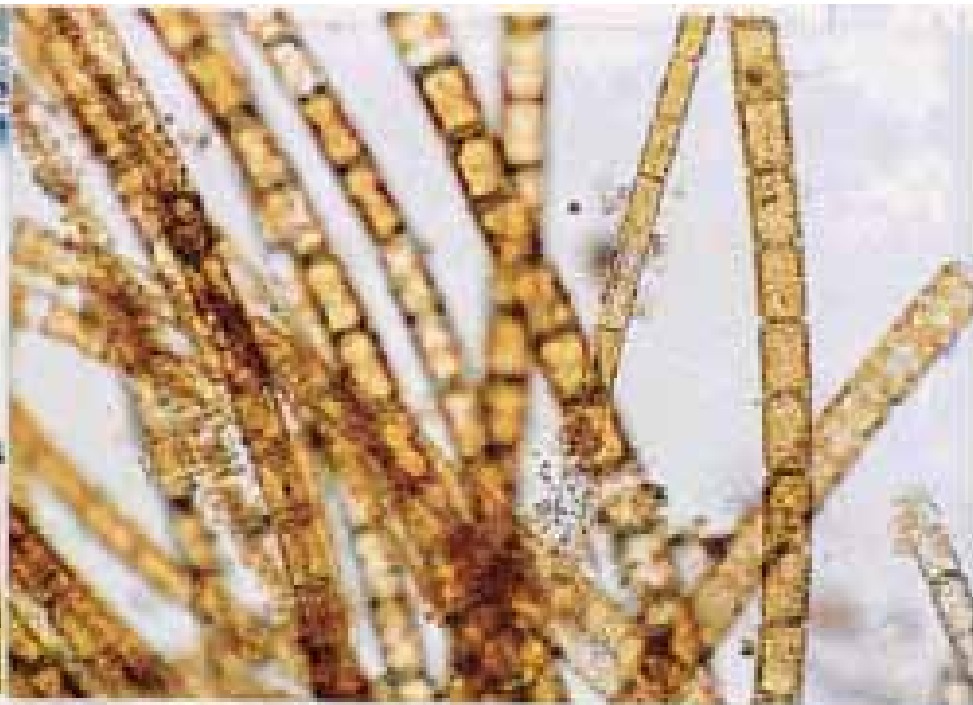
Development of algal mat on the sand bed in June at Someya waterworks, Ueda, Nagano. Initial 10 days, logarithmic algal growth was observed. Then the biomass as in chlorophyll became almost constant. It became under a continuous culture system of algae.



Initial few days, several algae from river bed were remarkable. Then filamentous diatom of *Melosira* became a dominant species.

SSF(Ecological Purification System) is the suitable environment for filamentous algae.





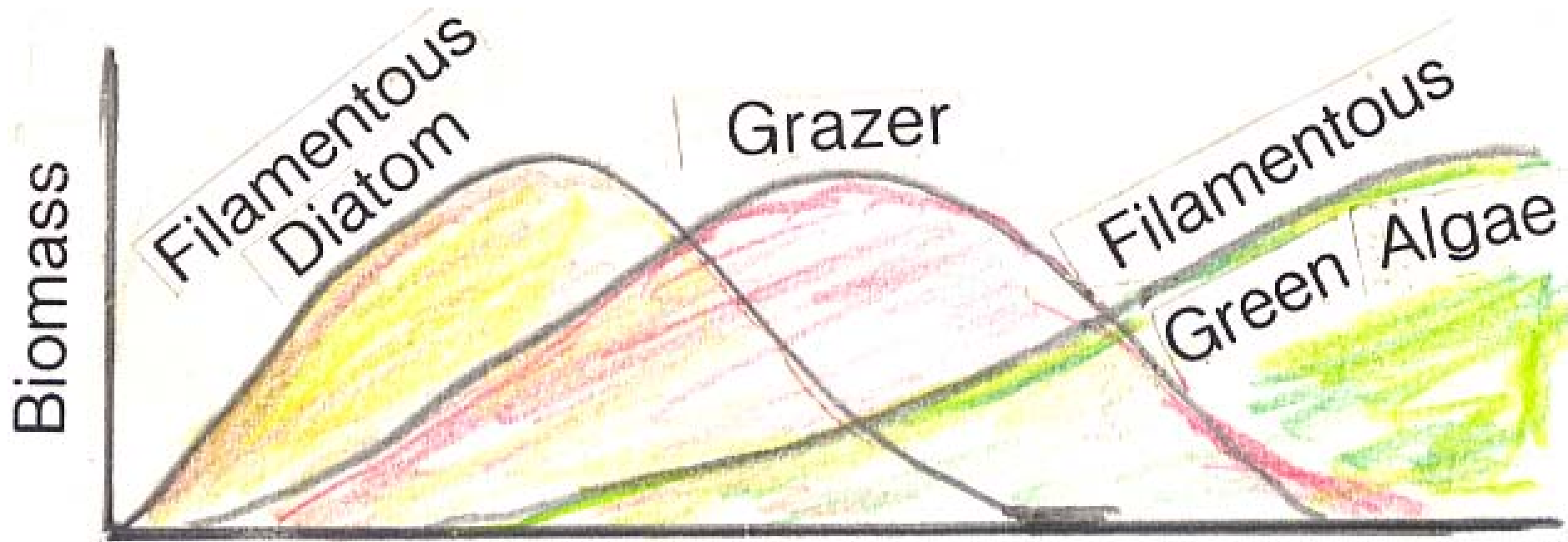
In cold water, diatom is dominated due to small grazing pressure.



Even cold winter, photosynthetic algae can grow under shallow water.



Succession: from filamentous diatom to filamentous green algae caused by grazing animals.

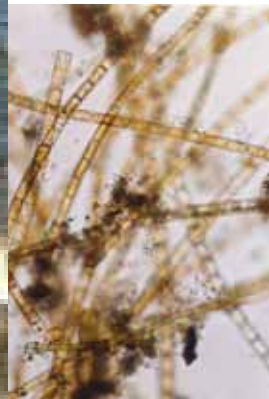


Filter Run

糸状珪藻がユスリカ幼虫に捕食されると糸状緑藻に遷移する。

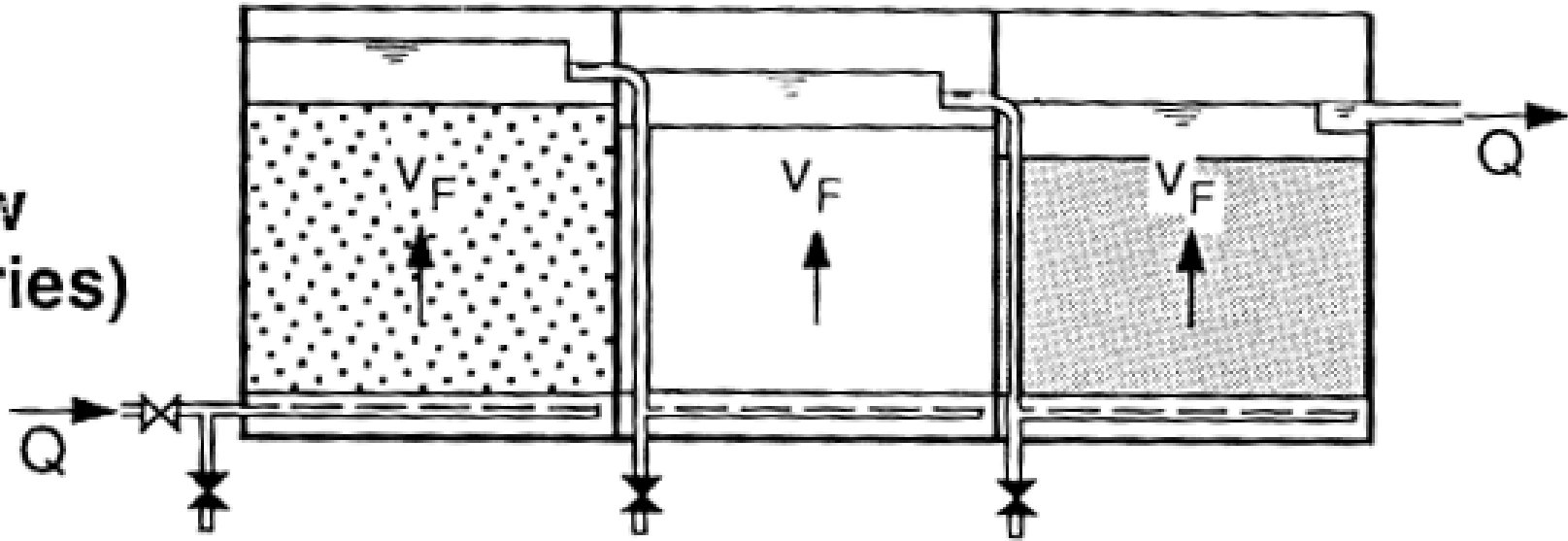
In case of long filter run, mollusk appears and other carnivorous animals are also seen.

Shallow depth is better for algal growth even in cold winter.

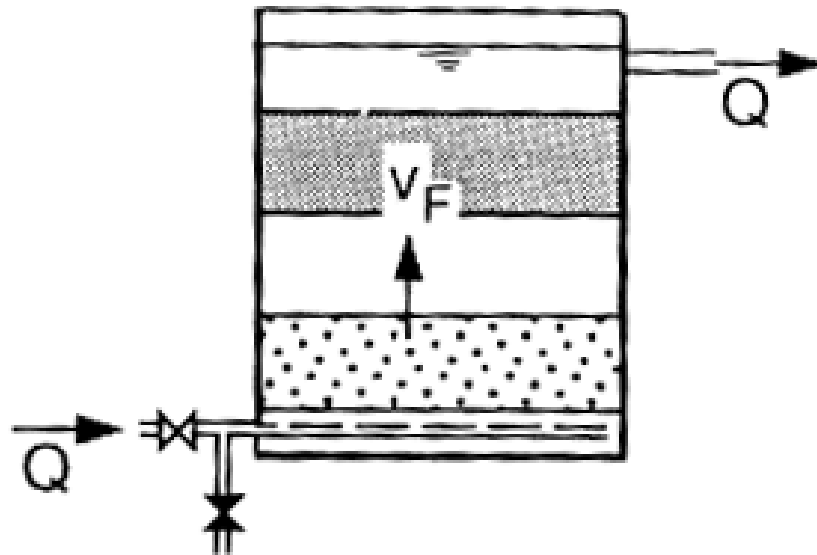


Up flow roughing filters

**upflow
(in series)**



**upflow
(in layers)**



Up flow filter is easy to conduct the elimination of clogging matter.

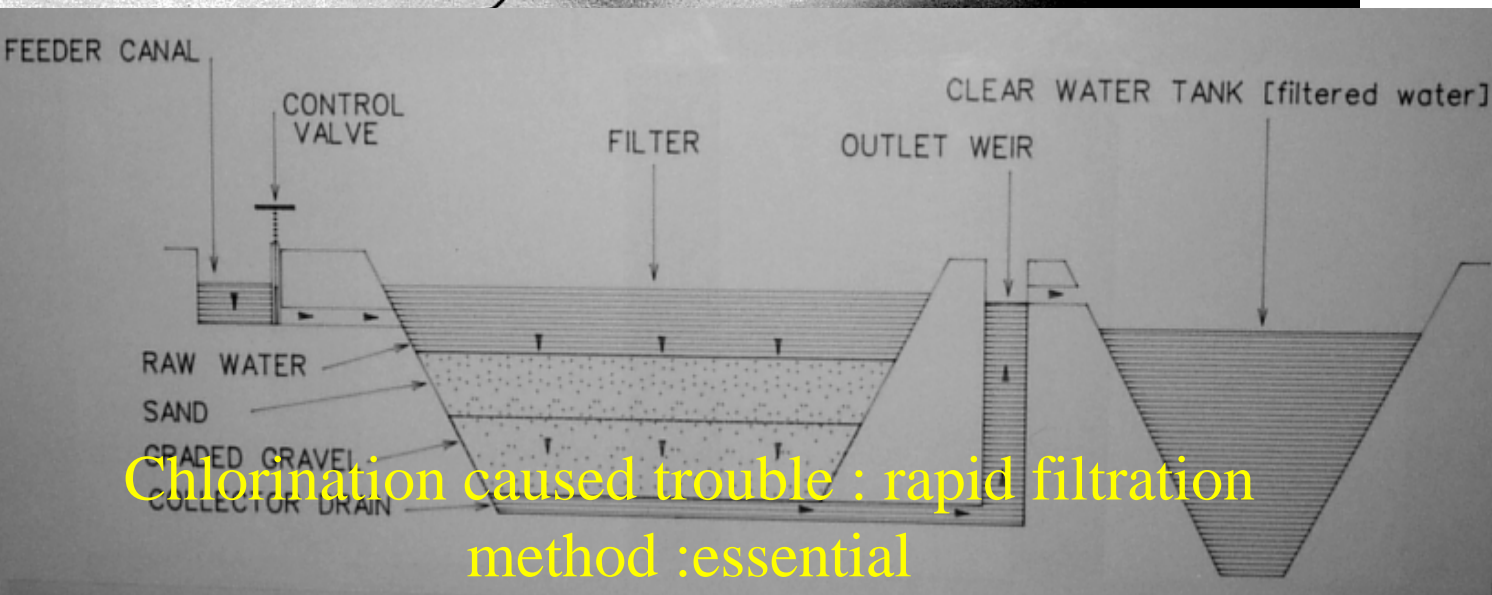
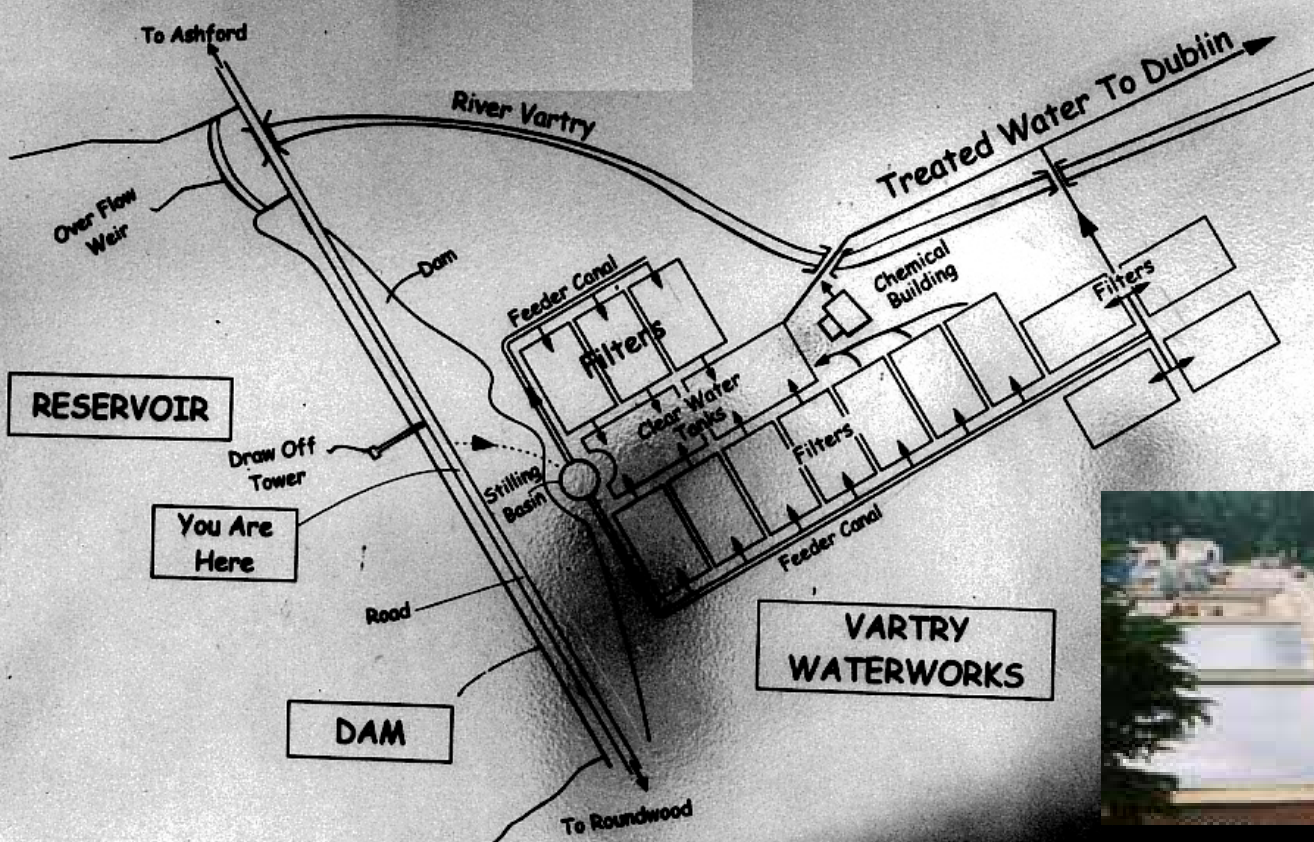
Nigeria, Africa: SSF plant was completed 2004.7: Niger delta.





Vartry Waterworks, Dublin The original scheme was constructed in 1862, and almost unchanged to this day over 140 years.

Filtered
water basin
is open!

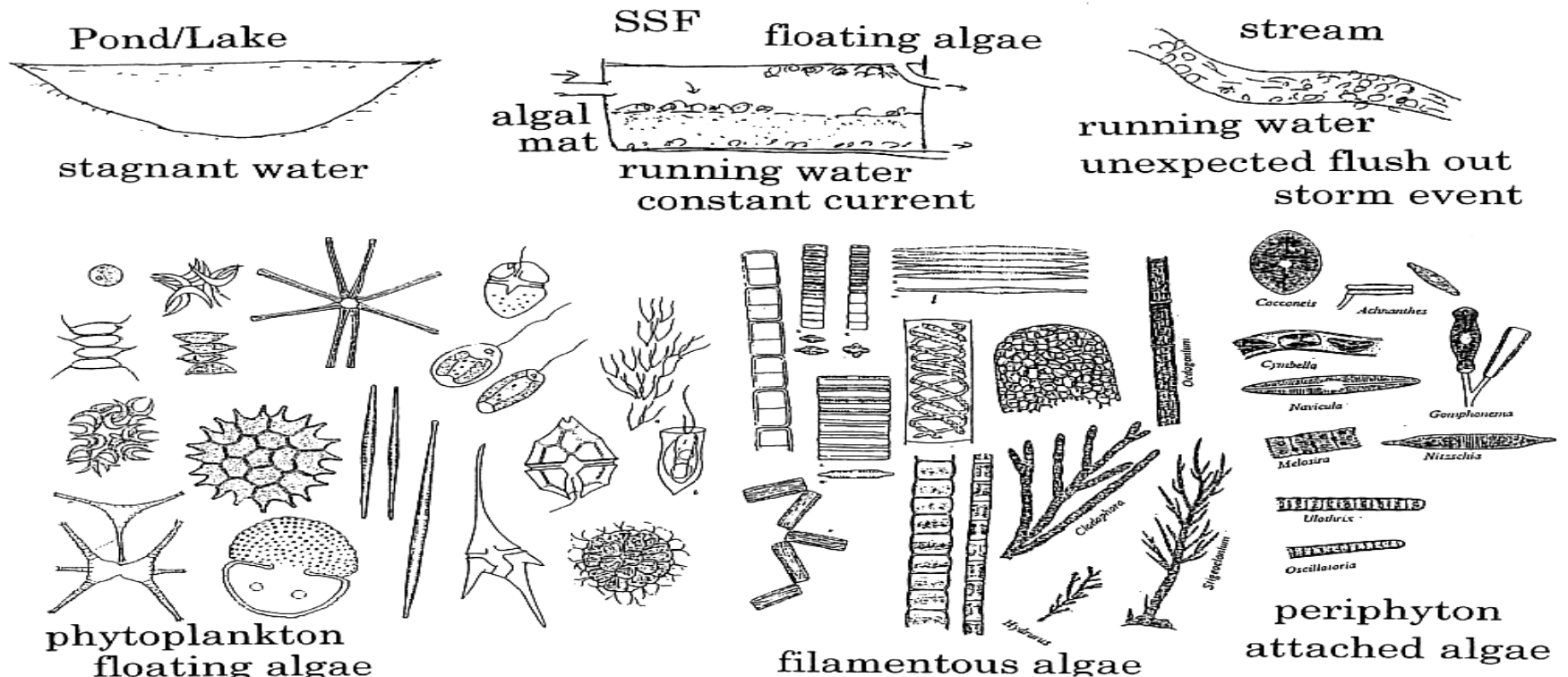


Brown filtered
water : This is
safe water
during 140
years.

Chlorination caused trouble : rapid filtration
method : essential

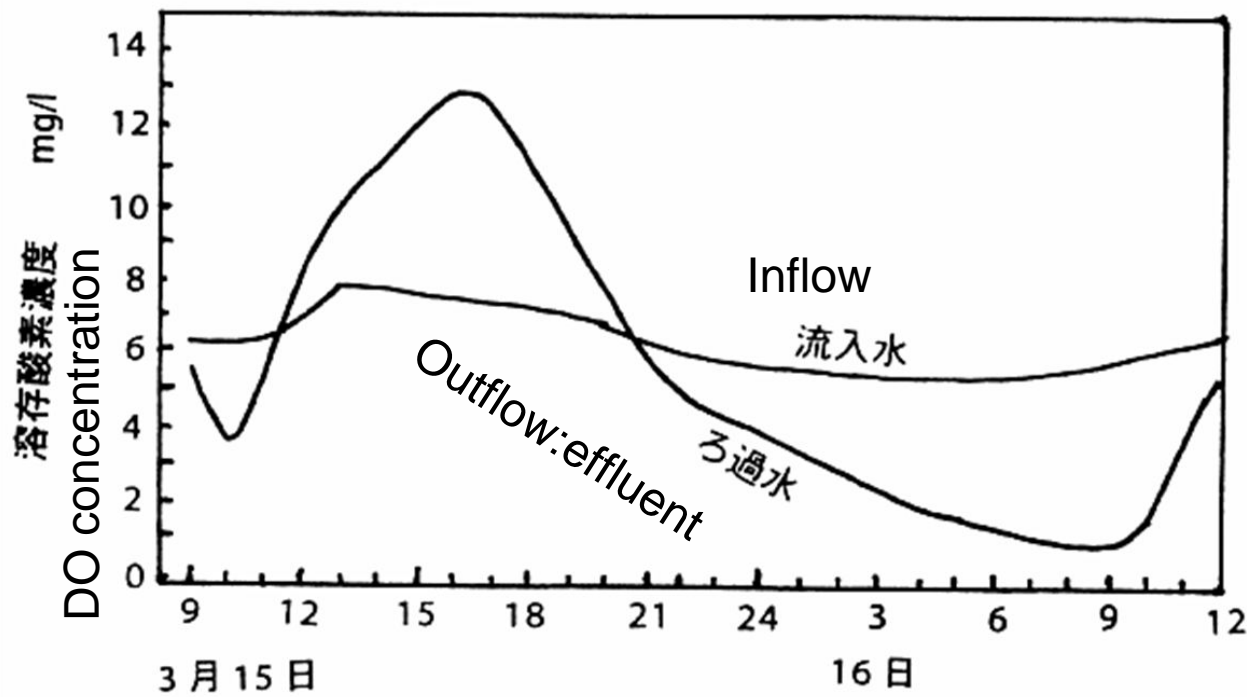
On the Toxic Algae of *Microcystis* (Cyanobacteria:Blue Green Algae)

A shallow pond sometimes turns in blue green color. *Microcystis* grows in this stagnant water. This alga sometimes produce a toxic substance of Microcystine. This is toxic for some mammals. However this alga can not grow in running water. SSF system is a running water system.

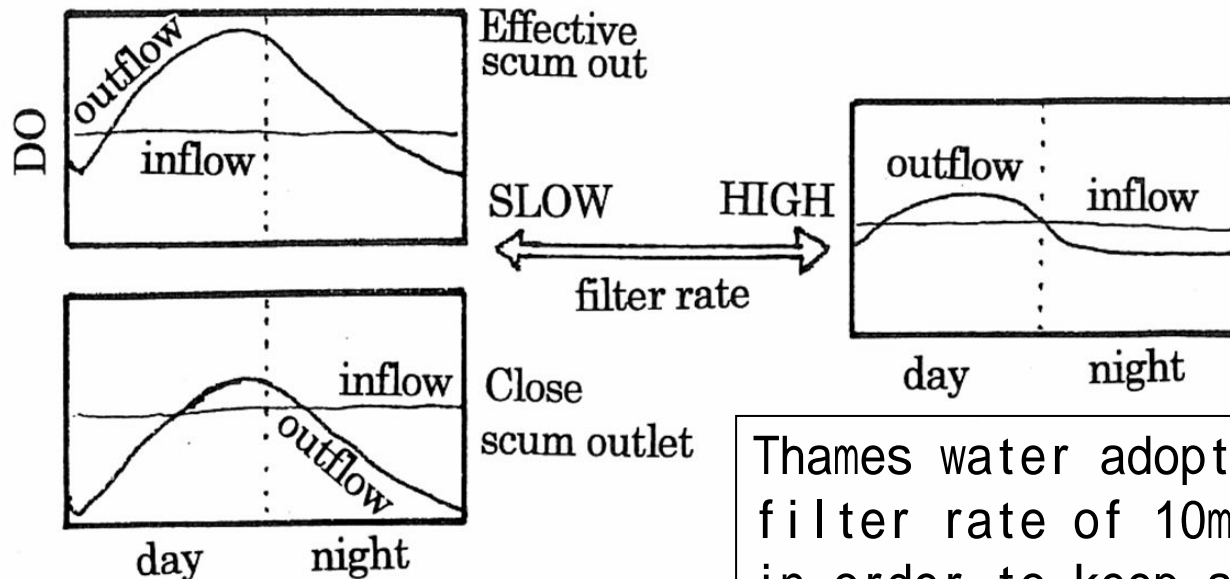




Kinuta waterworks, Tokyo. Raw water: SS free water of underground subsurface water which is taken several under drainage pipe in the flood plain. Filter does not clogged due to SS free water. Standard flow rate is 8.5 m/d (Kinuta Kami) and 9.5 m/d (Kinuta Shimo). Area of filter ponds: 2,690 m² x6 filters. Total area of filters : 16,140 m². Capacity of filter water : 137,190 m³/d. In case of water demand of 0.3 m³/d/person, this plant can supply for the demand of 457,300 persons.

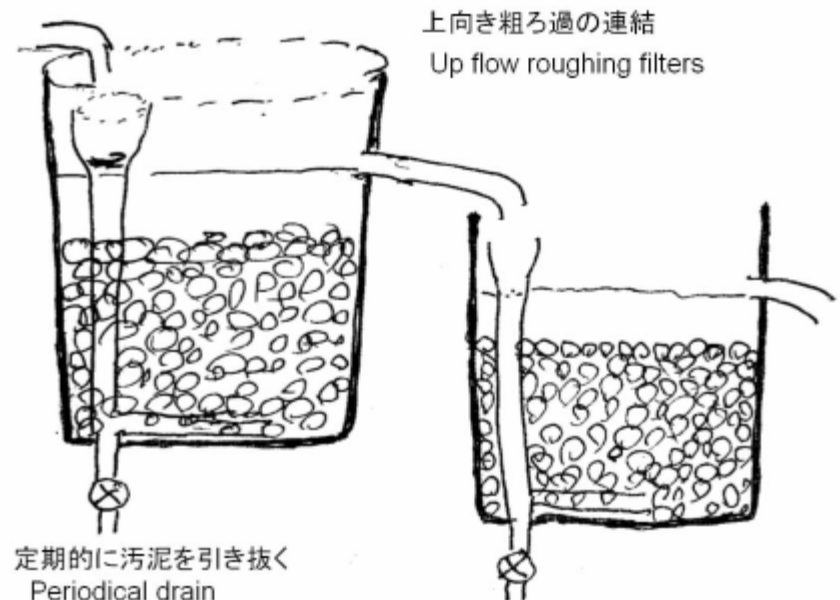
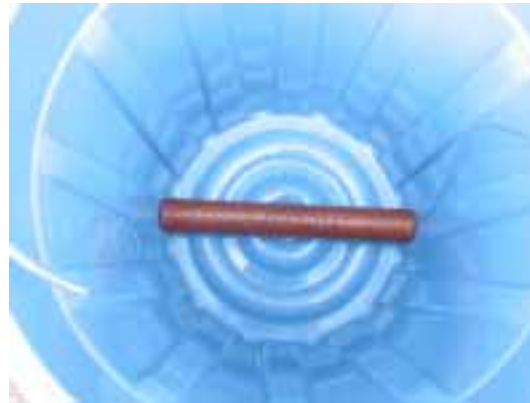


Dissolved oxygen depression in effluent water in the early morning at Kinuta water works in Tokyo. This was caused by the too slow filter rate. The rate was estimated to less than 2 m/d.



Thames water adopted high speed of filter rate of 10m/d instead of 5m/d in order to keep aerobic condition.

Surface water of a river + sub-surface water (low oxygen concentration)





Model experiment of role of algal growth on the filter. Covered and uncovered (open) filters.

Open filter: Algal growth. Production of food for animals. In open filter, biological community of algae and animals are active in the filter. Small animals collect small particle in water.

Covered filter: no algal growth resistant of filter increases : clog easily. There is rare food for small animals.

