SEWERAGE SYSTEM REVOLUTION TOWARD GLOBAL RENASCENCE

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〔地球復興に向けての画期的な下水システム〕

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It is theoretically necessary to lay sewerage systems within the upper reaches of rivers for securing innoxious drinking water. The revers is, however, the case. The sewerage systems are generally concentrated upon the cities within the lower reaches of rivers. All parts of the river are polluted, even though the existing sewerage systems are laid within the lower reaches of the river, so far as domestic drainage is discharged into the river from the households located within the upper reaches of the river where sewerage systems are difficult to be laid. It is, therefore, of urgent necessity for local self-governing bodies within the upper reaches of the river to strive for spreading the individual sewerage systems in order to cope with the pollution of river water. An individual sewerage system developed by Daiichi Technical College can purify polluted water by reducing the BOD value as low as a level of 1mg-BOD/l, though the water-quality standard of Japan is 20mg-BOD/l in Japan. Accordingly, the natural environment of rivers followed by the ecosystem will be able to be kept clean by installing such an individual sewerage system at each household. The security of excellent, innoxious drinking water depends upon the approach of each local self-governing body to the purification of river water. We expect that the individual sewerage system developed by Daiichi Technical College will be understood taking this opportunity.

1. Drinkin water crisis

Water, as is called "the origin of life", is necessary for all creatures. No living thing can live without water. What has become of such important water? Drinking water contains more or lessTHM (trihalomethane) which is one of the carcinogenic substances. In Japan, it is well known that this carcinogenic substance is threatening the people's heath any time.

I have once taken part in a water quality survey of Lake Biwa in order to investigate the actual state of public water supply system of Kyoto and Osaka cities which take their raw water for drinking water from Lake Biwa. To examine water whether it is good or not, the transparency of the water is used as one of the criteria for water quality. Transparency means the depth of water at which a white disc with 30cm diameter becomes invisible. At the south part of Lake Biwa, the transparency was 97cm. For reference, the transparency of Lake Mashu in Hokkaido is 44m.

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It is really terrible that such water is used in Kyoto and Osaka cities for the raw water of public water supply.

2. Domestic wastewater, the prime cause of pollution

From a close investigation, it has proved that the largest cause of water pollution is domestic wastewater. In Japan, the soure of water pollution in most rivers, lakes, and ponds is this domestic wastewater. Further, due to the dams constructed at many points on rivers, the amount of running water has extremely decreased. Moreover, the side faces and bottom of small rivers and channels are covered fully with concrete, which eliminates the self-purification of rivers peculiarthereto.

As to the pollution level of domestic water, by means of BOD which represents the degree of pollution, it was 40g in 1965. At preset, it is 50g, and some scholars say it will be 74g in severalyears. The domestic wastewater at present consits of 13g of night soil (feces, urine) and 37g of non-fecal drainage from kitchen, bath, and washing. More closely, the wastewater from kitchen occupies about half of total discharge, and, night soil, only a quater.

3. Preservation of river water

There is a well-known indicator, BOD which measures the degree of water pollution. The water completely free from pollution is defined as BOD-0 (ppm). In the water of BOD-1 (ppm), yamame, a kind of trout lives. In the water of BOD-2, ayu, a kind of sweet fish lives. In the water of BOD-3, haya, a kind of dace lives. According to the Environmental Standard, the water up to BOD-3 is permissible in quality of river water. BOD-5 is the limit of pollution, BOD-10 is the limit of putrefaction. The Standard further stipulates the water beyond BOD-10 is a decayed water and is at least the limit of environmental preservation. Meanwhile, in the actual practice of present sewage treatment facility, the quality of treated water is BOD-20 ppm at best, double of the limit level of putrefaction. As for Tandoku Johkaso (private sewage treatment tank to treat only night soil), the quality of treated water is BOD-90 ppm, out of the question. Therefore, to secure a clean drinking water, it must be given priority to purify the raw water (sewerage water) to be taken, before improving a water purification system.

4. Mistake in lean-to-sewerage policy

In Japan, it has been said the spreading of sewerage system is the most important to make revers clean. However, there are problems in this sewerage-oriented policy. Especially in the case ofa small city, town, or village having 40 to 50 thousand population, an introduction of present sewerage system will destroy the nature. A sewerage system is to collect dirty substance to the downstream of a river artificially through a pipe, and discharge the treated water at a time. As a result, the amount of running water in the river decreases with the spread of sewerarge system and then dries up finally. This is the actual state of s "waterless river" in question. A sewerage system is inevitable to city people but it has a limit and, if introduced wrongly, it may destroy the nature, spoil rivers, for example.

5. Necessity of private sewerage system (water recirculation system)

To eliminate the mistake discussed above, what we offer is to introduce a private sewerage system (a high-performance Gappei Johkaso (private sewage treatment tank to treat all domestic wastewater), a water recirculation system) instead of a sewerage system in the municipalities having arelatively small pupulation. In other words, the sewage of each house is to be purified at the origin of discharge.

It is generally said a person discharges 300 ℓ of domestic wastewater a day. If this amount of water is treated to be clean and discharged into drains, the clean water gathers into a small river and, while incareasing in amount, runs into a middle river, the main sream, and a lake or a pond. Then, by the self-purification of nature, the natural environment is kept as it is. In the present sewerage system of Tokyo and Osaka, even rainwater is all gathered and discharged out. This is against the way of Heaven, that is, nature. It may be said the vengeance of Heaven is the

carcinogenic substance THM in the tap water. Then we have developed a water recirculating system to recycle water by treating wastewater at its origin.

6. Dai-ichi University type water recirculation system (Ishii type)

The principle of this system is briefly the self-purification of rivers, which is applied maximumly to an action in an artificial system. The largest feature of the system is to use Yakult-containers. Why this system is suitable for removing dirty substance? The method of purifying water, especially the best way of treating organic matter, is to utilize microorganisms.

At present, the main constituent part of this system is an activated sludge process. In any case, however, the necessary conditions to purify a sewage biologically are:

(1) To propagate microorganism, and

(2) To keep the propagated microorganism hrealty.

These are called activation, and the key of a purification is to optimize these two conditions.

By the way, every creature has its own oxygen prespiration concentration. As we human being need 21% of oxygen in the air, Beggiatoa needs 0.03ppm of thin oxygen, and borteceller, a kind of protozoa can' t live without 4ppm or more oxygen. Accordingly, if the oxygen concentration in s sewage varies from 0 to maximum saturation, many kinds of microorganisms can propagate in this various oxygen concentrations. In a conventional method of treatment in which the activated sludge process is used, oxygen is injected into a sewage (this is called an aeration) and, as a result, the sewage given oxygen is circulated all over an aeration tank as a spiral flow. Namely, the sewage in the aeration tank is stirred into even. In such a state, the oxygen concentration in the sewage is even at any point, and only some kind of microorganisms that are suitable to that oxygen concentration can live. Therefore the kind of microorganisms that can be utilized is limited.

Every creature needs a place to take a rest. In the case of human being, for example, we work in the daytime and sleep at night. At bird rests on branch while it is not flying. As in of human and birds, a microorganism needs a perch but, in the conventional activated sludge process, a microorganism terminates its life only working from birth to death without taking any rest. Compared to human, all the microorganisums are so to speak the sick.

Then we put used Yakult containers into the tank at random. The bottom of each container is removed and if a container stays sideways in the tank, oxygen does not come into the container, and if stays lengthways, oxygen comes up to the maximum state of saturation. Since the containers stay in various positions such as inclined or upside down, the concentration of oxygen in each of the containers varies from 0 to satulation. Though it turns on an expertized fact, the rate of this variation is uniform. We call this principle a DO inclination.

Moreover, microorganisms can take a rest while adhering on the front and back surfaces of the containters. As explained above, Ishii type satisfies aforesaid conditions (1) and (2), enabling a high-efficient purification. In addition, though we came to know just recently, ordinary plastic containers include toxic styrene monomer, and if it is dissolved even if very little, it prevents microorganisms from adhering on the surface of such containers. To the contrary, in the case of Yakult containers in which a lactic acid beverage is held, rubber is included in stead of the styrene mpnomer. Futher, seeing through a microscope, the surface of a Yakult container is roughwith many concaves and convexes, suitable for microorganisms to adhere.

7. Other features

Our system has some other features. One of them is a flow control system. This system is a simple mechanism to make a specified amount of sewage to flow into the aeration tank not to allow all the sewage to rush at a time. In the case of a conventional purification system, if a drainagefrom bath room is charged into the system at a time, a large

amount of sewage flows into an aeration tank. This means that the microorganisms in the tank are taken away of their meal just when they begin to eat.

From the aspect of management, our system allows easy mainenance. In addition, according to the report of Dr. Hidaka of Kyushu Kyoritsu University, our system can remove 99% of incoming synthetic detergent. Further it proved that the Yakult container is most suitable to propagate denitrifying bacterium that decomposes nitrogen which is the source matter of eutrophication. Moreover, a timer is used in our system so as to make a intermittent aeration for power saving.

8. Conclusion

Now the outline of our purification system by means of Yakult containers has been discussed. Our system has once introducted to all over Japan on TV by NHK (Nihon Hoso Kyokai, Japanese National Broadcasting Institute) in a program titled "Revive Limpid Stream". Further, at present, our system is used at national facilities and at those of public bodies.

Above all, the first system installed at the author's house has been working for 16years and still keeps on outputting BOD-1.1ppm treated water. The treated water is used for flushing the toilet or for watering the plants in the garden. In the case of another system installed at BS golf course, where 110 to 120 tons of sewage is treated a day, BOD-0.5ppm is maintained, and the treated water is used for watering the grass to recycle the water resource. Other than those mentioned above, a large number of our system have been installed and working in Japan, maintaining the transparency of treated water at 1m (1m is equivalent to 1ppm of BOD), which is by far better than that of national standard, 20ppm.

In conclusion, it must be said that a sewerage system has no advantage of scale merit not only in its financial aspect but in its influenece to the environment. In case of s large-scale sewerage system, a huge amount of treated water is discharged at one point of a river or the sea, and this makes it difficult to control and preserve the environment of rivers and seas including ecosystem. Further the water running through the sewerage pipe or conduit does not perform its self-purification and may destroy the natural environment because it is not under a natural state.

Accordingly sewage should be treated by a small or an individual purification system as possibly, and the treated water should be discharged at plural points of rivers through small channels. This not only satisfies an economic rationality but secures the shortcut to preserve environment, with the water environment being the main factor.

In the regions not blessed in water, government authorities encourage water saving. The author thinks it rational to save water by recycling water trough the treatment of wastewater. At the same time, the author eagerly hopes that the world pays attention to our Gappei Johkaso which is rational, economic, and high-performance.