

Engineering for Purifying Water in Local Areas*

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Abstract: *To improve the water quality in a limited area has instant and actual importance, especially in the regions where the surface water system was polluted widely and the water quality of the system could not be improved effectively in a short term. The technology for improving the water quality in a local area has been developing in Taihu Lake Basin since 1991.*

Keywords: *Technology for purifying water, Eco-environmental engineering, Soft-wall*

1. Harnessing water in local areas

The surface water system in many regions is connected and has quite complex characteristics. Improving the water quality in a widely polluted water system, such as the surface water system in Taihu Lake Basin needs a lot of efforts during a long term period. But in many cases, for example, for drinking water supply and recreation purpose, or for limiting the spread of polluted water, the technology for improving water quality in local area is of extreme importance. This technology is similar the technology of "Green house" for establishment of microclimate in land, or for establishment an "Oasis in desert". It needs to establish a meso-scale aqua-ecosystem with improved water quality and landscape. The key techniques are:

- To construct for the local ecosystem, a physico-biological membrane, which may conserve the system and prevent it from serious environment;
- To construct a frame for guarantee of the normal growth of the aquatic organisms under the possible rapid change of water level and strong wind wave;
- To develop the technology for conducting the water current;
- To constitute a sustainable aquatic ecosystem with abundant biodiversity for improving water quality during whole year by using the natural energy and enhanced management measures.

A flexible barrier, named as "soft-wall", technology was developed for improving aqua-ecosystem in a local area. In comparison with the rigidity barrier, the flexible barrier possesses a lot of advantages: low cost, movable, adaptable to water depth, water level, wave, currents, bottom sediments, etc. The soft-wall may adjust the exchange rate of water mass, momentum, and energy

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between the water bodies separated by the wall. The meso-scale cosmoses with rapid different ecosystem conditions from that of surrounding waters may be constructed by using soft-wall. For example, the pollution loading into the meso-scale cosmos may be decreased obviously, while the surrounding waters are strongly polluted. Contrarily, the strongly polluted water can be restricted in the soft-wall enclosure and its spread can be limited. In these limited areas the environments can be improved by using limited cost, energy and management measures. Then, these areas can be enlarged to more and more areas till to whole lake or whole surface water system in a region, such as Taihu Lake Basin step by step, in combining with source control.

2. Construction and principle of soft-wall

The soft-wall is made from some synthetic fiber materials. In relation with their functions, the materials and processing procedures for making different kinds of soft-wall are different.

- The materials using for soft-wall should be strong enough for prevent wind wave and water current during a couple of years.
- The mesh of the material using for soft wall should be choused to meet the practical request.

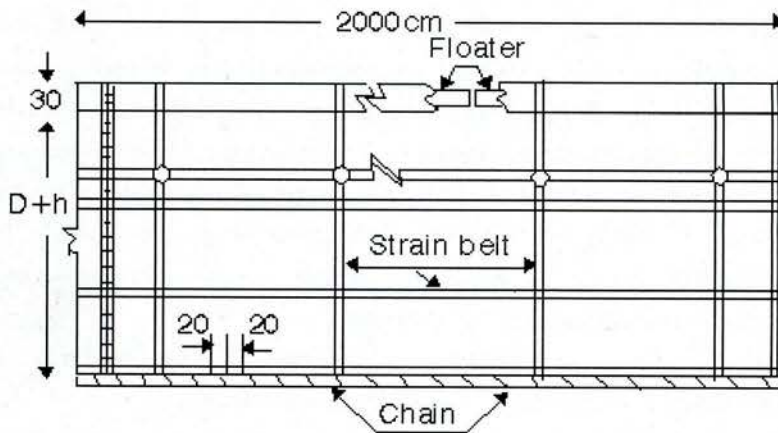


Fig. 1 Scheme of an element part of a soft-wall

- The soft wall should be sewed by using various ways and materials,
- such as cloth and belt with different sickness, strength, wideness, length, etc. In the places with concentrated stress, for example, at the position for fixing the soft-wall in the water, the enhanced materials and sewing patterns should be used.
- The soft-wall should be constructed into standard element-parts (Fig. 1) with certain length and wideness, and easy for constitution.
- The soft-wall has a floating upper part and heavy lower part (Fig. 1, 2). Its mooring pattern should be specially designed according to the concrete natural conditions. The

anchor-fix method are usually used for mooring the soft-wall, especially in deep water case.

Some examples of the construction of soft-wall are shown in Fig. 1 and 2.

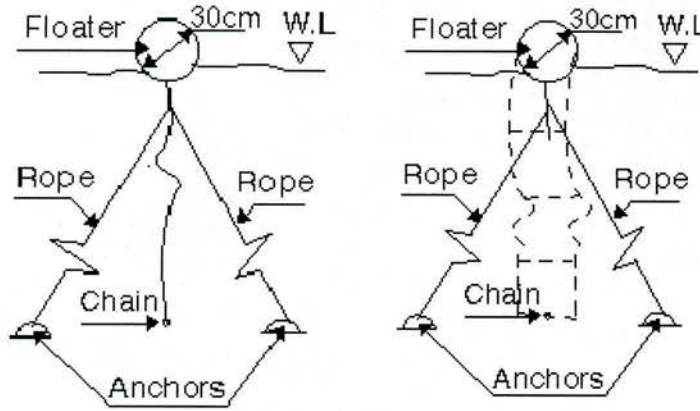


Fig. 2 Scheme of the construction and mooring pattern of soft-wall

3. Types and functions of soft-wall

According to the functional characteristics, the soft-wall may be divided into some types, such as:

- For conducting current,
- For controlling mass exchange,
- For filtration,
- For obstructing floating plants and other aquatic organisms from escape,
- For beautifying water surface,

- For increasing aquatic production.

According to the structure characteristics, the soft-wall can be divided into some types, such as:

- Vertical profile controlling,
- Vertical profile upper-part controlling,
- Semifloating,
- Floating-sink,
- Underwater standing type.

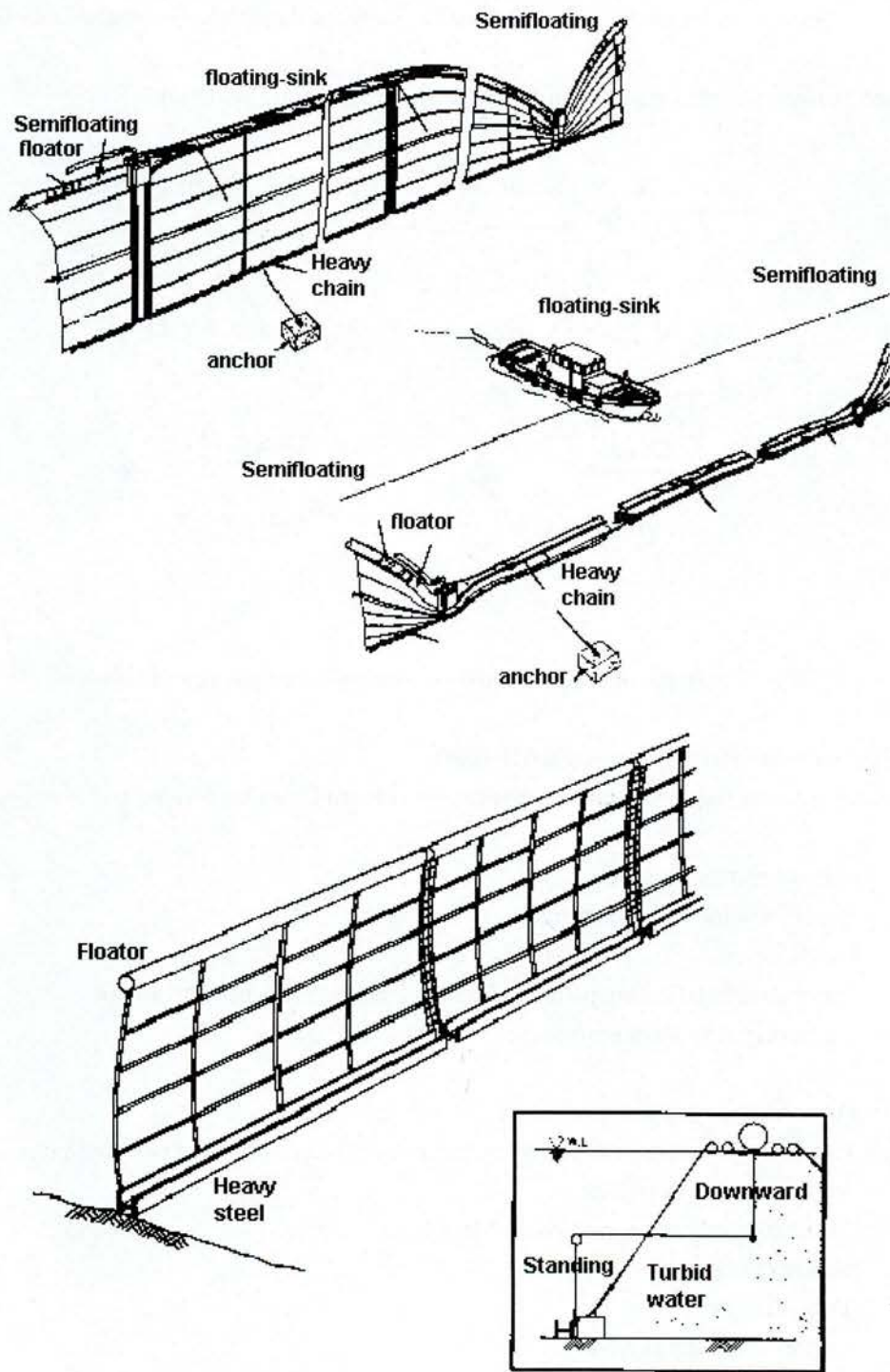


Fig. 3 Construction scheme of some types of soft wall (floating, semifloating, floating-sink, downward and standing types)



Photo 1. Obvious different water quality in and out the Physico-Ecological Engineering in Wulihu Bay, Taihu Lake, China, 29 July, 1996



Photo 2. Obvious different water quality in and out the Physico-Ecological Engineering in Wulihu Bay, Taihu Lake, China, 2 April, 1997. Left side water with submerged plant is much clear than out the engineering (right side)



Photo 3. Obvious different water quality in and out the Physico-Ecological Engineering in Meiliang Bay, Taihu Lake, China, at the Taihu Laboratory for Lake Ecosystem Research, Academia Sinica (TLLER), 7 September, 1997

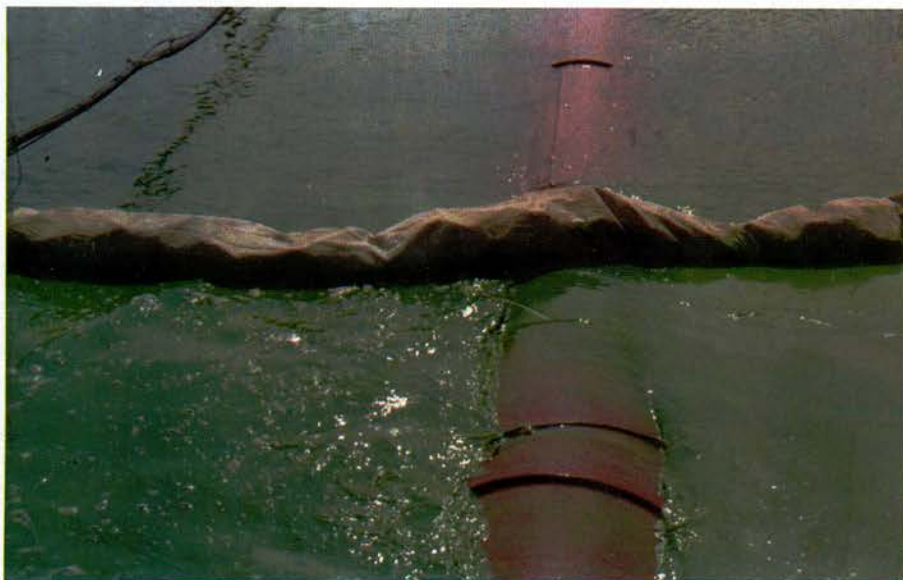


Photo 4. Obvious different water quality in and out the Physico-Ecological Engineering in the raw water area of Mashan Drinking Water Supply Plant in Meilian Bay, Taihu Lake, China, 20 August, 1993. The photo shows the filtration effect of the soft wall. Outside (down part) of the engineering has high concentration of phytoplankton (*Microcystis* spp.).



Photo 5. A sample of Floating Ecological Island in Wulihu Bay, Taihu Lake on 22 May, 1997



Photo 6. A view of floating garden in a channel of Nanjing, China. Photo by Dai Qiyanu

Some types of soft-wall were shown in Fig.3.

The effects of the soft-wall engineering for purifying water in local areas were shown in Photo1-4. The water quality is obvious different in and out the Physico-Ecological Engineering in the local experiment areas in Wulihu Bay and Meilian Bay of Taihu Lake, China.

Some examples of floating ecological islands for purifying water and beautifying the landscape are shown in photo 5 and 6.

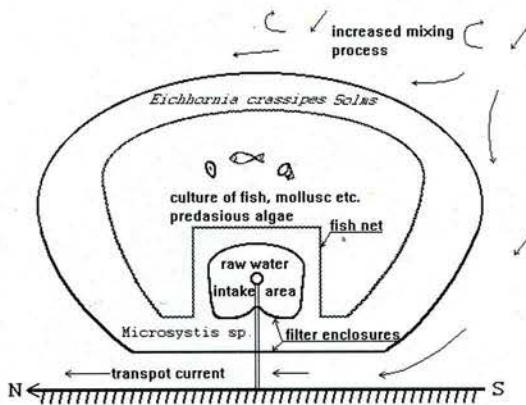


Fig. 4 Scheme of physico-ecological engineering (PEEN) in the intake area of Mashan Drinking Water Supply Plant, in Taihu Lake

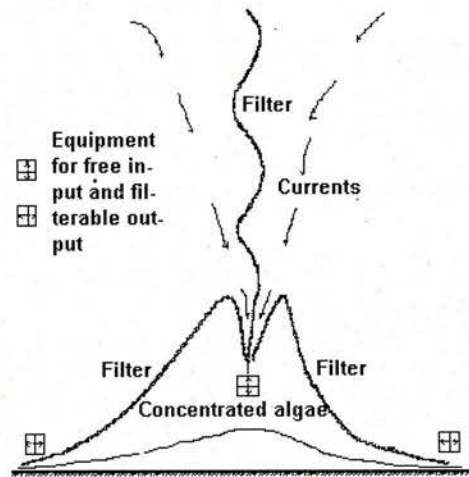


Fig. 5 Scheme of a Jellyfish Engineering (JEEN) in Meilian Bay of Taihu Lake

4. Application perspective

The water system was polluted from local areas to larger regions. Similarly, purifying water system also can be started from local areas to larger regions. The technology of purifying water in locale areas can be used for solving a lot of urgent practical problems. Fig. 4 shows a scheme of physico-ecological engineering (PEEN) in the intake area of Mashan Drinking Water Supply Plant. The effects of purifying water are shown in Photo 4.

A Jellyfish Engineering (JEEN) experiment was tested in Mailian Bay of Taihu Lake (Fig. 5). The soft-wall technology was used for filtration, conducting current and obstructing floating plants and other aquatic organisms from escape (Pu, P. *et al.*, 1973, 19).

The cost of soft-wall is much cheaper than that of the rigidity facility. It is easy for construction and moving. The soft-wall technology may be used in various depth and bottom conditions. It has wide application perspective also in oceanic engineering, especially in coastal zone, estuary, bay. For example, it may be used in engineering for environment harnessing and resources utilization in bay or coastal zone, for oil leak controlling in ocean, storage polluted water or fresh water in

coastal zone or in estuary, conducting and controlling water current and silt movement in coastal zone, etc.

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