RESTORATION OF POLLUTED WATER USING ECOLOGICAL FLOATING BEDS:
AN ENVIRONMENT FRIENDLY APPROACH

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INTRODUCTION

In India, the problem of water pollution is becoming serious. Water bodies are becoming toxic as India expands and urbanizes. Around 70 percent of the surface water in India is projected to be unfit for use. Polluted water restoration is a difficult technique, not just for large investments in physical and chemical restoration methods, difficult operations, secondary contamination, but also for these methods poor governance impact. Therefore, not only because of its limited investments, high productivity, no secondary emissions and other advantages, but also because it can offer greater benefits to the natural environment and landscape, EFB technology that relies mainly on plants should be used to restore contaminated water. EFB was also called Ecological Floating Island and Artificial Floating Island.

EFB MECHANISM IN POLLUTED WATER RESTORATION

Use of EFB technology to restore contaminated water includes the use of aquatic plants with roots formed to touch water, form a concentrated natural filtering layer, and absorb, adsorb, turn and degrade water contaminants. To accelerate the decomposition of macromolecular contaminants in water and increase the bioavailability of nitrogen and phosphorus, plant roots can also secrete significant quantities of enzymes and organic acid. Meanwhile, plant roots provide the oxygen source and attachment place for microorganisms and improve their metabolism to minimise the content of water contaminants. The object of purifying the quality of water is accomplished by moving the plants out and separating them from the water. In order to absorb dissolved contaminants, the roots are extended into the water, while the plant stem remains above the water surface. A hanging network of roots, rhizomes and attached biofilms is built underneath the floating mat, which provides a biologically active surface area for biochemical and physical processes such as filtering and trapping.

ABSORPTION OF NITROGEN AND PHOSPHORUS

In eutrophic water, aquatic plants have an obvious effect on the removal of nitrogen and phosphorus components. The inorganic nitrogen and phosphorus in water could be absorbed directly by plants through their root absorption as indispensable nutrient elements in the plant growing process, and then plant protein or organic components were synthesised to promote plant growth and development. Therefore, plants were able to fix nitrogen and phosphorus in a good way. The nitrogen and phosphorus ingested by them were also extracted from the water when aquatic plants were moved out of the water, so the purpose of purifying water was accomplished.

DEGRADATION OF ORGANISMS

Not only can EFB efficiently eliminate nitrogen and phosphorus components, but it is also effective at removing organic substances. In the course of development, aquatic plants have continuously secreted a great deal of macromolecular organics to the atmosphere, such as enzymes, saccharides, organic acid, etc. Not only did these secretions efficiently decompose organic matter, but they also supplied many nutrient substances to root microbes. In addition, the oxygen provided by photosynthesis of floating plants was released to water via plant roots, then many anoxic and aerobic areas were formed around its rhizosphere to intensify the growth and reproduction of both aerobic microbes and anaerobic microbes, to encourage the constant absorption and use of organic pollutants in water by microbes, and to increase their degradation efficiency of organic microbes.

ENRICHMENT OF HEAVY METALS

Aquatic plants are typically planted in the upper layer of the EFB, and many aquatic plants are capable of consuming, metabolizing, enriching heavy metals, in addition to the heavy metal content inside the plants themselves being linked to the level of contamination of the outside world, so EFB was seen as an effective way to regulate the contamination of heavy metals in water. Water hyacinth was a type of plant that effectively accumulates Ni, Pb, Zn, Cd, and Cu, since Cu, Ni and Zn accumulations of hyacinth roots are 2 to 17 times that of part above ground in the wild environment and their maximum bioconcentration factor (BCF) is 1344.6, 1250.0 and 22758.6. Each organ was positively associated with its concentrations with the enrichments of Pb and Cd for lotus inside roots and a successful enrichment under combined stress of Pb and Cd was shown. Of all the organs, the most enriched are lotus leaves and swollen stems, but some toxic reactions may be caused by the enrichment of Pb and Cd within lotus roots.

EFB TECHNIQUE APPLICATION

The EFB approach began at the beginning of the 20th century and was used for the habitat of birds and the breeding place of fish. German scholars developed the modern EFB in the 1980s and used it for the first time to purify dirty water. Since the EFB is not only able to recover contaminated water, but also prevents a variety of problems, such as substantial investments in physical and chemical processes, complicated operations and secondary emissions. In 1990s, China implemented EFB technology, which is now applied to the management of contaminated urban rivers, lakes and reservoirs, and has had a beneficial impact on purification and ecological landscape.

FUTURE ASPECTS:

In home and outdoor environments, there are many engineering cases that have achieved a good purifying effect, but there are also many problems. When the purifying capacity of the floating bed has reached saturation or when apoptosis seasons arrive, plant shift will cost a lot of time and use great efforts; regular management of EFB plants fails to form systematic specifications; the service life of EFB is low, typically less than 6 years; there have been no technology and management standards to be established. Therefore, how to apply it more efficiently to practical engineering requires more systematic study.