Pryagaraj or river city suffering from a water pollution and solution for safe a river to it by plants

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***Abstract*: In this paper mention the one of the most successive solution of water pollution. Today not only pryagraj but also every river bank suffering from poor water sources because of human activity .we know that plant is use as purifier of water in Ayurveda, Herbs are renowned for their anti-bacterial properties. ayurveda used herbs like tulsi, neem, amla, and wheatgrass for purifying water floating treatment method , in which we use plants for purifying water, this method fully explained in this paper. artificial weatland for sewage and wastewater treatment, aquatic plant also help in treatment of wastewater.**

***Keywords*: water pollution, floating treatment, herbs use as water purifier, waste water treatment.**

INTRODUCTION

Water pollution is the contamination of water bodies, usually as a result of human activities. Water bodies include for example lakes, rivers, oceans, aquifers and groundwater. Water pollution results when contaminants are introduced into the natural environment. For example, releasing inadequately treated wastewater into natural water bodies can lead to degradation of aquatic ecosystems. In turn, this can lead to public health problems for people living downstream. They may use the same polluted river water for drinking or bathing or irrigation. Water pollution is the leading worldwide cause of death and disease, e.g. due to water-borne diseases.

Water pollution can be grouped into surface water pollution. Marine pollution and nutrient pollution are subsets of water pollution. Sources of water pollution are either point sources and non-point sources. Point sources have one identifiable cause of the pollution, such as a storm drain, wastewater treatment plant or stream. Non-point sources are more diffuse, such as agricultural runoff.[3] Pollution is the result of the cumulative effect over time. All plants and organisms living in or being exposed to polluted water bodies can be impacted. The effects can damage individual species and impact the natural biological communities they are part of.

The causes of water pollution include a wide range of chemicals and pathogens as well as physical parameters. Contaminants may include organic and inorganic substances. Elevated temperatures can also lead to polluted water. A common cause of thermal pollution is the use of water as a coolant by power plants and industrial manufacturers. Elevated water temperatures decrease oxygen levels, which can kill fish and alter food chain composition, reduce species biodiversity, and foster invasion by new thermophilic species.

Water is typically referred to as polluted when it is impaired by anthropogenic contaminants. Due to these contaminants it either does not support a human use, such as drinking water, or undergoes a marked shift in its ability to support its biotic communities, such as fish. Natural phenomena such as volcanoes, algae blooms, storms, and earthquakes also cause major changes in water quality and the ecological status of water.

Water pollution is a major global problem. It requires ongoing evaluation and revision of water resource policy at all levels (international down to individual aquifers and wells). It has been suggested that water pollution is the leading worldwide cause of death and diseases. Water pollution accounted for the deaths of 1.8 million people in 2015.

India and China are two countries with high levels of water pollution: An estimated 580 people in India die of water pollution related illness (including waterborne diseases) every day. About 90 percent of the water in the cities of China is polluted.[10] As of 2007, half a billion Chinese had no access to safe drinking water.

Treatment of water body by plants:-

Herbs are renowned for their anti-bacterial properties. ayurveda used herbs like tulsi, neem, amla, and wheatgrass for purifying water the process involves drying and extracting of the leaves and fruits before using them for purification.

Wetland

A patch of land that develops pools of water after a rain storm would not necessarily be considered a "wetland", even though the land is wet. Wetlands have unique characteristics: they are generally distinguished from other water bodies or landforms based on their water level and on the types of plants that live within them. Specifically, wetlands are characterized as having a water table that stands at or near the land surface for a long enough period each year to support aquatic plants.

The most important factor producing wetlands is flooding. The duration of flooding or prolonged soil saturation by groundwater determines whether the resulting wetland has aquatic, marsh or swamp vegetation. Other important factors include fertility, natural disturbance, competition, herbivory, burial and salinity.[1] When peat accumulates, bogs and fens arise.

A constructed wetland (CW) is an artificial wetland to treat municipal or industrial wastewater, greywater or stormwater runoff. It may also be designed for land reclamation after mining, or as a mitigation step for natural areas lost to land development.

Constructed wetlands are engineered systems that use natural functions vegetation, soil, and organisms to treat wastewater. Depending on the type of wastewater the design of the constructed wetland has to be adjusted accordingly. Constructed wetlands have been used to treat both centralized and on-site wastewater. Primary treatment is recommended when there is a large amount of suspended solids or soluble organic matter (measured as BOD and COD).

Similarly to natural wetlands, constructed wetlands also act as a biofilter and/or can remove a range of pollutants (such as organic matter, nutrients, pathogens, heavy metals) from the water. Constructed wetlands are a sanitation technology that have not been designed specifically for pathogen removal, but instead, have been designed to remove other water quality constituents such as suspended solids, organic matter and nutrients (nitrogen and phosphorus). All types of pathogens (i.e., bacteria, viruses, protozoan and helminths) are expected to be removed to some extent in a constructed wetland. Subsurface wetland provide greater pathogen removal than surface wetlands.

There are two main types of constructed wetlands: subsurface flow and surface flow constructed wetlands. The planted vegetation plays an important role in contaminant removal. The filter bed, consisting usually of sand and gravel, has an equally important role to play.[2] Some constructed wetlands may also serve as a habitat for native and migratory wildlife, although that is not their main purpose. Subsurface flow constructed wetlands are designed to have either horizontal flow or vertical flow of water through the gravel and sand bed. Vertical flow systems have a smaller space requirement than horizontal flow systems.

Nitrogen removal

The dominant forms of nitrogen in wetlands that are of importance to wastewater treatment include organic nitrogen, ammonia, ammonium, nitrate and nitrite. Total nitrogen refers to all nitrogen species. Wastewater nitrogen removal is important because of ammonia's toxicity to fish if discharged into watercourses. Excessive nitrates in drinking water is thought to cause methemoglobinemia in infants, which decreases the blood's oxygen transport ability. Moreover, excess input of N from point and non-point sources to surface water promotes eutrophication in rivers, lakes, estuaries, and coastal oceans which causes several problems in aquatic ecosystems e.g. toxic algal blooms, oxygen depletion in water, fish mortality, loss of aquatic biodiversity.

Ammonia removal occurs in constructed wetlands – if they are designed to achieve biological nutrient removal – in a similar ways as in sewage treatment plants, except that no external, energy-intensive addition of air (oxygen) is needed.[3] It is a two-step process, consisting of nitrification followed by denitrification. The nitrogen cycle is completed as follows: ammonia in the wastewater is converted to ammonium ions; the aerobic bacterium *Nitrosomonas* sp. oxidizes ammonium to nitrite; the bacterium *Nitrobacter* sp.

then converts nitrite to nitrate. Under anaerobic conditions, nitrate is reduced to relatively harmless nitrogen gas that enters the atmosphere.

Nitrification

Nitrification is the biological conversion of organic and inorganic nitrogenous compounds from a reduced state to a more oxidized state, based on the action of two different bacteria types.[8] Nitrification is strictly an aerobic process in which the end product is nitrate (NO^-
$_3$). The process of nitrification oxidizes ammonium (from the wastewater) to nitrite (NO^-
$_2$), and then nitrite is oxidized to nitrate (NO^-

Denitrification

Denitrification is the biochemical reduction of oxidized nitrogen anions, nitrate and nitrite to produce the gaseous products nitric oxide (NO), nitrous oxide (N
$_2$O) and nitrogen gas (N
$_2$), with concomitant oxidation of organic matter. The end product, N
$_2$, and to a lesser extent the intermediary by product, N
$_2$O, are gases that re-enter the atmosphere.

Ammonia removal from mine water

Constructed wetlands have been used to remove ammonia and other nitrogenous compounds from contaminated mine water, including cyanide and nitrate.

Phosphorus removal

Phosphorus occurs naturally in both organic and inorganic forms. The analytical measure of biologically available orthophosphates is referred to as soluble reactive phosphorus (SR-P). Dissolved organic phosphorus and insoluble forms of organic and inorganic phosphorus are generally not biologically available until transformed into soluble inorganic forms.

Biomass plants incorporation

Aquatic vegetation may play an important role in phosphorus removal and, if harvested, extend the life of a system by postponing phosphorus saturation of the sediments.[11] Plants create a unique environment at the biofilm's attachment surface. Certain plants transport oxygen which is released at the biofilm/root interface, adding oxygen to the wetland system. Plants also increase soil or other root-bed medium hydraulic conductivity. As roots and rhizomes grow they are thought to disturb and loosen the medium, increasing its porosity, which may allow more effective fluid movement in the rhizosphere. When roots decay they leave behind ports and channels known as macropores which are effective in channeling water through the soil.

Metals

Constructed wetlands have been used extensively for the removal of dissolved metals and metalloids. Although these contaminants are prevalent in mine drainage, they are also found in stormwater, landfill leachate and other sources (e.g., leachate or FDG washwater at coal-fired power plants), for which treatment wetlands have been constructed for mines

Mine water—Acid drainage removal

Constructed wetlands can also be used for treatment of acid mine drainage from coal mines.

Pathogen removal

Constructed wetlands are a sanitation technology that have not typically been designed for pathogen removal, but instead, have been designed to remove other water quality constituents such as suspended solids, organic matter (BOD/COD) and nutrients (nitrogen and phosphorus).

All types of pathogens are expected to be removed in a constructed wetland; however, greater pathogen removal is expected to occur in a subsurface wetland. In a free water surface flow wetland one can expect 1 to 2 log10 reduction of pathogens; however, bacteria and virus removal may be less than 1 log10 reduction in systems that are heavily planted with vegetation.[1] This is because constructed wetlands typically include vegetation which assists in removing other pollutants such as nitrogen and phosphorus. Therefore, the importance of sunlight exposure in removing viruses and bacteria is minimized in these systems.

some acceptable method are use for decrease the pollution in water body which are physical method and some are chemical method to save our water environment. Floating method is one of thebest method which described below:-

Floating treatment wetland

The former types are placed in a basin with a substrate to provide a surface area upon which large amounts of waste degrading biofilms form, while the latter relies on a flooded treatment basin upon which aquatic plants are held in flotation till they develop a thick mat of roots and rhizomes upon which biofilms form. In most cases, the bottom is lined with either a polymer geomembrane, concrete or clay (when there is appropriate clay type) in order to protect the water table and surrounding grounds. The substrate can be either gravel—generally limestone or pumice/volcanic rock, depending on local availability, sand or a mixture of various sizes of media (for vertical flow constructed wetlands).

Design considerations

Depending on the type of constructed wetlands, the wastewater passes through a gravel and more rarely sand medium on which plants are rooted.[3] A gravel medium (generally limestone or volcanic rock lavastone) can be used as well (the use of lavastone will allow for a surface reduction of about 20% over limestone) is mainly deployed in horizontal flow systems though it does not work as efficiently as sand (but sand will clog more readily).[2]
Constructed subsurface flow wetlands are meant as secondary treatment systems which means that the effluent needs to first pass a primary treatment which effectively removes solids. Such a primary treatment can consist of sand and grit removal, grease trap, compost filter, septic tank, Imhoff tank, anaerobic baffled reactor or upflow anaerobic sludge blanket (UASB) reactor.[2] The following treatment is based on different biological and physical processes like filtration, adsorption or nitrification. Most important is the biological filtration through a biofilm of aerobic or facultative bacteria. Coarse sand in the filter bed provides a surfaces for microbial growth and supports the adsorption and filtration processes. For those microorganisms the oxygen supply needs to be sufficient.
Especially in warm and dry climates the effects of evapotranspiration and precipitation are significant. In cases of water loss, a vertical flow constructed wetland is preferable to a horizontal because of an unsaturated upper layer and a shorter retention time, although vertical flow systems are more dependent on an external energy source. Evapotranspiration (as is rainfall) is taken into account in designing a horizontal flow system.[3]
The effluent can have a yellowish or brownish colour if domestic wastewater or blackwater is treated. Treated greywater usually does not tend to have a colour. Concerning pathogen levels, treated greywater meets the standards of pathogen levels for safe discharge to surface water.[1] Treated domestic wastewater might need a tertiary treatment, depending on the intended reuse application.[2]
Plantings of reedbeds are popular in European constructed subsurface flow wetlands, although at least twenty other plant species are usable. Many fast growing timer plants can be used, as well for example as Musa spp., Juncus spp., cattails (*Typha* spp.) and sedges.

Operation and maintenance
Overloading peaks should not cause performance problems while continuous overloading lead to a loss of treatment capacity through too much suspended solids, sludge or fats.
Subsurface flow wetlands require the following maintenance tasks: regular checking of the pretreatment process, of pumps when they are used, of influent loads and distribution on the filter bed.
Wetlands are effective nutrient sinks and absorbers of organic and inorganic pollutants. The biotechnological solution to wastewater involves installing artificial wetlands to act as natural filters. By locating constructed wetlands between the wastewater source and aquatic resources (rivers, lakes, lagoons), these systems require no maintenance, consume no electricity, and cost less than one quarter that of a traditional waste treatment system. Such constructed wetlands employ different species of plants that commonly abound in natural wetlands: cattails, waterlilies and rushes.

ARTIFICIAL WETLANDS FOR SEWAGE AND INDUSTRIAL WASTE

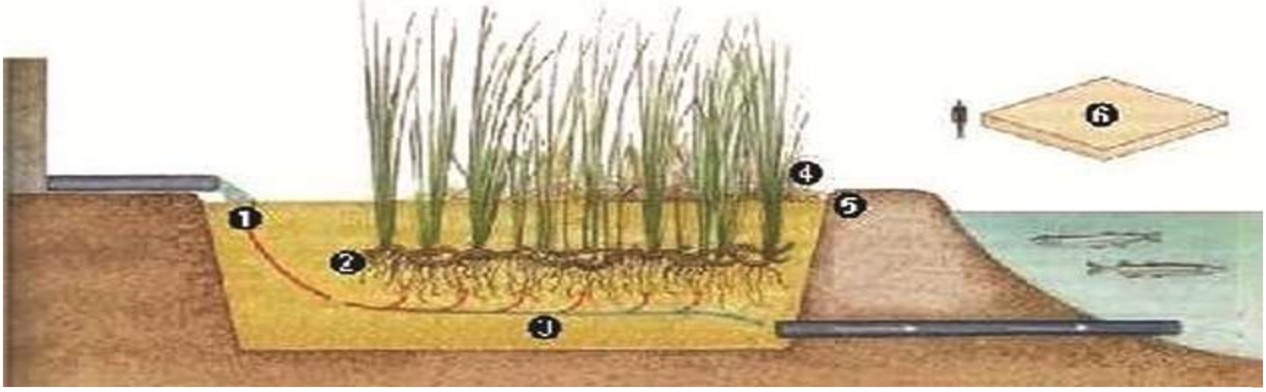
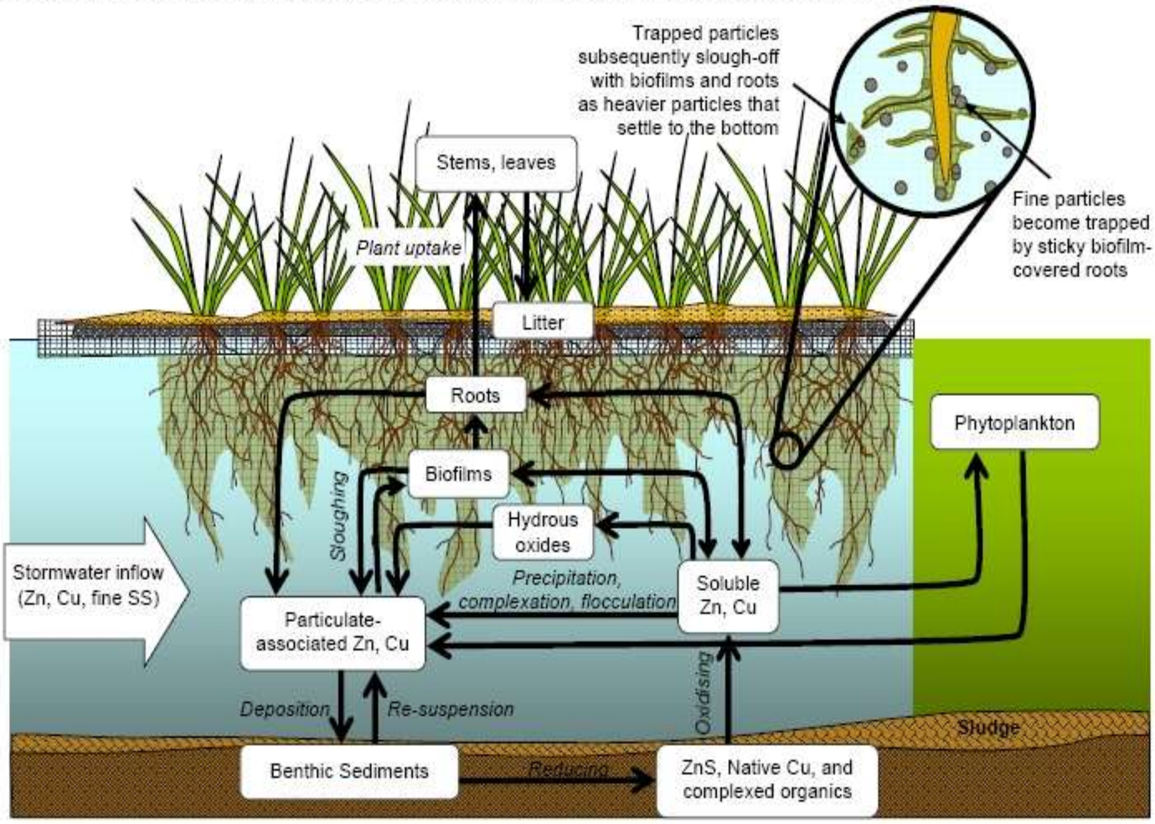


Figure 39.

Conceptual model of copper and zinc pathways and interactions within a floating wetland stormwater treatment system.



Sewage flows into the constructed wetland, which is an excavated cell filled with sand that serves to filter out odors.
The filter consists of a large vegetative planting, in this case rushes, whose roots in the sand are fed by the wastewater.
The nutrients in the water are absorbed by rushes (Juncus), which sequester them in their tissues as they grow.
The nutrients absorbed are eliminated with vegatative dieback of the rushes, whose remnants form an insulating layer.
The purified water filters from the wetland into the lagoon.
Proportioning a wastewater treatment wetland: The area required is proportional to the size of the residential population and is calculated as follows: 1 person = around 5 m^2.

WASTEWATER TREATMENT WITH AQUATIC PLANTS

Treatment systems using aquatic plants consist of shallow reservoirs containing floating or submerged aquatic plants. The best studied wastewater systems are those utilizing duckweed (Lemna minor). Generally, treatment systems break into two types based on the dominant plant types. The first type uses floating plants which are distinguished by their ability to meet their need for carbon dioxide and oxygen directly from the atmosphere. Such plants derive their mineral needs from the water.
The second type of treatment system consists of submerged plants, which are distinguished by their ability to absorb oxygen, carbon dioxide, and minerals directly from the water column. Submerged plants are easily inhibited by high turbidity because their photosynthetic parts are under water..

ARTIFICIAL WETLANDS

An artificial wetland is a system of treating wastewater in a shallow constructed pond or channel no more than 0.60 meters deep, in which aquatic plants have been planted, and natural processes are utilized to treat wastewater. Artificial or constructed wetlands have the advantage over alternative treatment systems in that they require little or no energy to operate. If there is adequate cheap land available near the effluent source, installation of the water treatment wetlands can be a cost effective alternative. In addition, constructed wetlands provide habitat for wildlife, and are aesthetically pleasing to the eye.

Advantages:

1. Plants can be used as low-cost extraction devices to purify polluted water.
2. In some cases, plants decompose waste faster than microorganisms.
3. The method can be applied to large areas or to complete the decontamination of restricted areas in lengthy periods.

Limitations:

1. The process is limited to shallow water or the depth to which roots can penetrate.
2. The process can be time consuming.
3. There is a biological limit to the metals and compounds that can be captured.

The various processes through with plants can incorporate pollutants are illustrated below and described in the following table:

Types of phytoremediation and the location in the plant where the process occurs.

TYPE	PROCESS INVOLVED	POLLUTANTS TREATED
Phyto-extraction	The plants are used to concentrate metals in parts harvestable (leaves and roots).	Cadmium, cobalt, chromium, nickel, mercury, lead, selenium, zinc
Rhizo-filtration	Plant roots are used to absorb, precipitate and concentrate heavy metals from contaminated liquid effluents and to degrade organic compounds.	Cadmium, cobalt, chromium, nickel, mercury, lead, selenium, zinc radioactive isotopes, phenolic compounds
Phyto-stabilization	Metal-tolerant plants are used to reduce the mobility of metals and prevent their passage to ground-water or the air.	Lagoons rid of mineral deposits. Proposed for phenolic and chlorinated compounds.
Phyto-stimulation	Root exudates promote the development of microorganisms (bacteria and fungi) capable of biodegrading compounds.	Petroleum hydrocarbons and polyaromatic, benzene, toluene, atrazine, etc.
Phytovolatilization	Plants take up heavy metals and organic compounds, bind or modify them and release the by-products into the atmosphere via transpiration.	Mercury, Selenium and chlorinated solvents (tetraclorometano and trichloromethane)
Phyto-decomposition	Both aquatic and terrestrial plants capture organic compounds and store them or decompose them to less toxic or non-toxic byproducts.	Munitions products (TNT, DNT, RDX, nitrobenzene, nitrotoluene), atrazine, chlorinated solvents, DDT, phosphate pesticides, phenols and nitriles, etc.

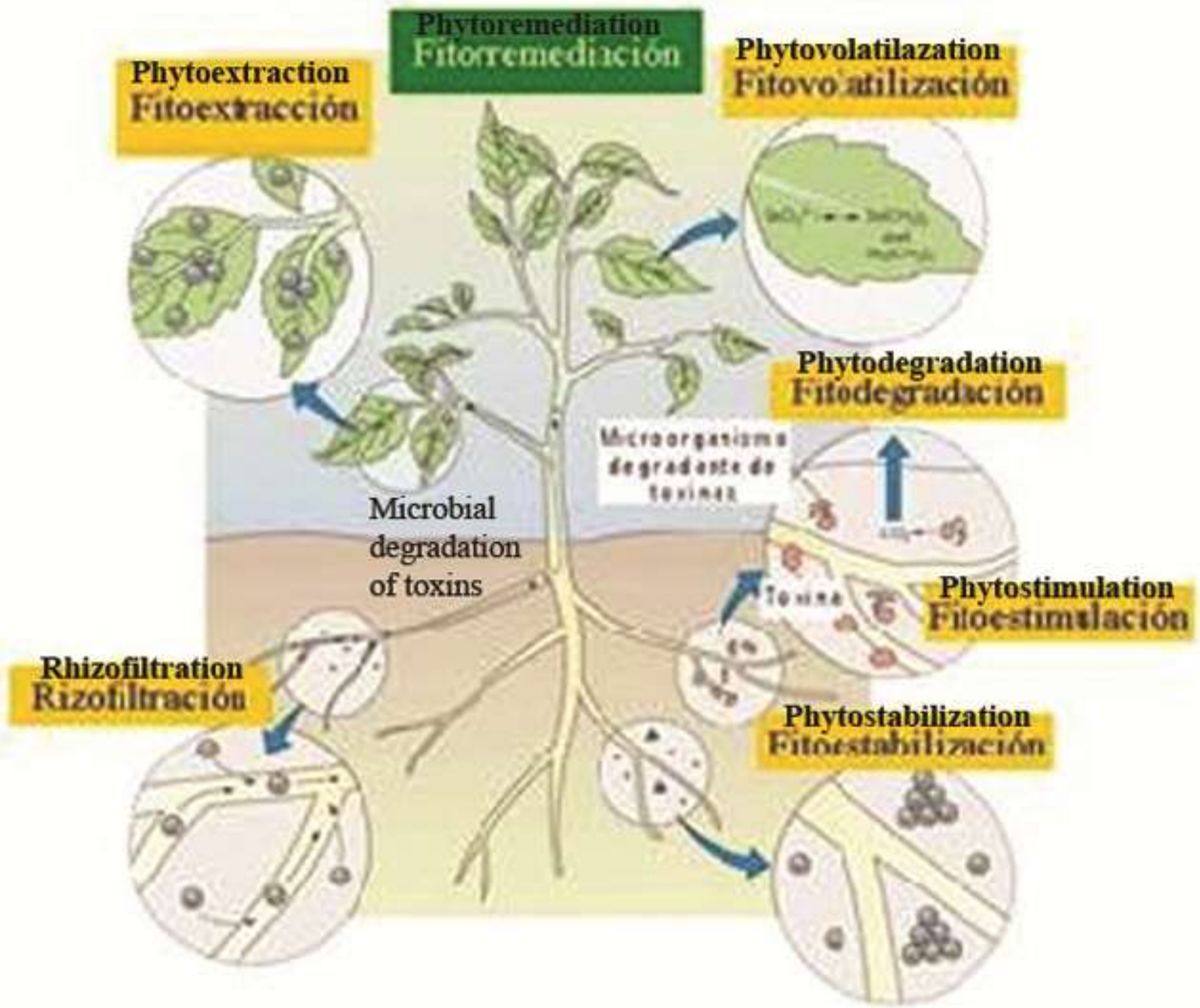
FUNCTIONS OF WETLANDS

Human activities have given and continue to give rise to a variety of wetlands valuable for a variety of plant species.

Physical remediation processes:

Constructed wetlands are capable of physically removing contaminants bound to particulate matter efficiently.

Biological remediation processes:
Biological remediation is perhaps the most important mechanism removing pollutants in constructed wetlands. Wetland plants are widely recognized for their ability to capture and remove contaminants, particularly since some of the pollutants are essential nutrients, such as nitrate, ammonium and phosphate which are easily taken up in such wetlands.
Chemical remediation processes:
Wetland soils perform the important process of chemical absorption, which leads to short-term retention or long-term immobilization of various kinds of pollutants.



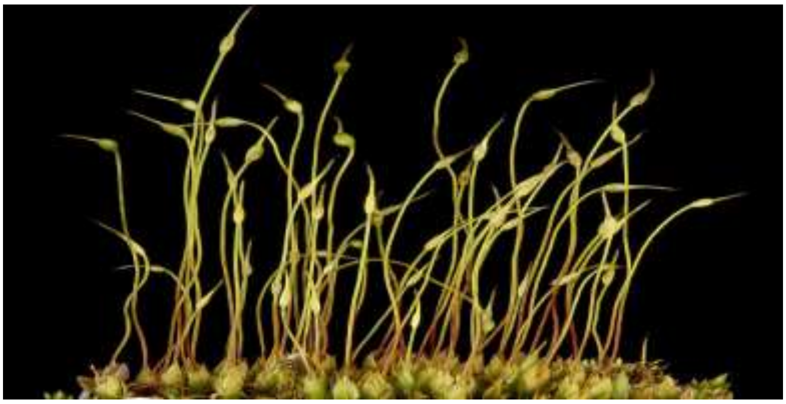
Plants on the 'flolating treatment wetland' help to clean the lake by absorbing nitrates in the water.

water body India's largest 'floating treatment wetland' will use hydroponics to clean up the
From a distance, it might appear as if hyacinth has consumed the Neknampur Lake in Hyderabad city. But a closer inspection will reveal that there is more to the water body than meets the eye. Gently floating on the surface is an artificial 'island' made of meticulously chosen plant species.
"The island is a floating treatment wetland (FTW). Several plants on this FTW help clean the lake by absorbing nutrients such as excess nitrates and oxygen present in the water. They thus reduce the content of these chemicals," says Madhulika Choudhary, who heads Dhruvansh, an NGO.
The FTW on Neknampur Lake was inaugurated on February 2, World Wetlands Day. Measuring 3,000 sq. ft., the FTW is a joint effort of Dhruvansh, the Hyderabad Metropolitan Development Authority, the Ranga Reddy district administration and other organisations. It has already been recognised by the India Book of Records as the largest FTW in the country.
Based on the soil-less hydroponics technique, the FTW comprises four layers. Floatable bamboo forms its base, over which Styrofoam cubicles are placed. The third layer consists of gunny bags. The final layer is of gravel. "Hydroponics permits plants to grow only on sunlight and water. There is no need of soil. There are small holes at the bottom which facilitate the flow of nutrients from the water to the plants (biological uptake process), which are held upright by the gravel layer," Ms. Choudhary says.
Cleaning agents planted on the FTW include vetivers, canna, cattalis, bulrush, citronella, hibiscus, fountain grass, flowering herbs, tulsi and ashvagandha.

Micro-organisms growing on the FTW and plant root systems break down and consume the organic matter in the water through microbial decomposition. The root systems filter out sediments and pollutants. The NGO claims that FTW is strong and can hold the weight of as many as four people. Compared to sewage treatment plants, this method is much cheaper.
Periodic biochemical oxygen demand (BOD) readings are taken from the Pollution Control Board. When the project began, the BOD was 27 mg/l. "When the first small island (100 sq ft) was floated here eight months ago, we knew it was too little to clean up the entire lake. We are hoping that in four to six months there will be a fundamental change because of the FTW," Ms. Chaudhary says.

Moss

The **moss Funaria** hygrometrica can absorb an impressive amount of lead thanks to a special kind of acid contained in its cell walls. (Credit: USGS Bee Inventory and Monitoring Lab)
Want cleaner drinking water, free of toxins and contaminants? Mother Nature's here to help.
A number of studies have come out over the past year looking at the role different plants could play in remediation, i.e. the removal of dangerous substances. This green technology is known as phytoremediation, from the Greek "phyto" for plant, and "remedium" for restoring balance.
Take, for example, moss. A non-vascular plant, mosses lack a root system, absorbing water and nutrients throughout their entire bodies. Researchers at the RIKEN Center for Sustainable Resource Science (CSRS) in Japan published a study last January showing that the moss Funaria hygrometrica can absorb an impressive amount of lead thanks to a special kind of acid contained in its cell walls.



After 22 hours of exposure, the moss cells had absorbed up to 74 percent of their dry weight in lead. Some 85 percent of the accumulation happened within the cell walls, which absorbed lead even after being removed from the living plant.

The aquatic moss Warnstofia fluitans can remove arsenic from water with astonishing speed. (Credit: Arifin Sandhi)

Moss Filters Toxins

A few months later, a group at Stockholm University in Sweden published another pollution-eating moss study, this one demonstrating that the aquatic moss Warnstofia fluitans can remove arsenic from water with astonishing speed, showing an 80 percent decline in arsenic levels from a container of water in less than an hour. Over 90 percent of the arsenic taken up was bound firmly to the moss tissue.

This sort of phytofiltration could be particularly useful in areas like northern Sweden, where naturally occurring arsenic sometimes seeps into water supplies due to mining operations.

Purifying Water With Produce

Another low-cost path to cleaner water may be lying in your produce drawer. Based on the work of Singapore's Suresh Valiyaveettil, Dickinson College chemistry professor Cindy Samet and her students boiled, dried and crushed a variety of seeds and peels before placing them in contaminated solutions.

The above photo shows dried and ground avocado peels, which in a matter of hours cleaned out methylene blue dye (shown without peels on the right) from water through a process called adsorption, where atoms, ions or molecules bind to a surface — in this case, avocado peels.

The study, published last month in the *Journal of Chemical Education*, found lemons and okra were especially proficient; lemons seeds removed 100 percent of lead ions, and their peels eliminated 96.4 percent. Okra peels also removed 100 percent of lead ions, and their seeds removed 50 percent.

So it couldn't hurt to add another slice of lemon to your water.

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