Xenobiotics and Bioremediation (Review)

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Abstract: Science of Aquatic ecosystem is the multidisciplinary study of aquatic systems, encompassing both marine and freshwater systems. Scientific investigations within this field often examine the human impact on and interaction with aquatic systems and range in scale from the molecular level of contaminants to the stresses on entire ecosystems. Some of the major fields of study within aquatic sciences include: biogeochemistry; aquatic ecology; oceanography; marine biology; hydrology and the study of lakes, rivers, groundwater and wetlands (limnology). Dense mate of water hyacinth can lower dissolved oxygen level in water bodies leading to reduction of aquatic fish production. Water hyacinth very efficient in taking up Calcium, Magnesium, Sulfur, Ferric, Manganese, Aluminum, boron, Copper, Molybdenum, Zinc, Nitrogen, Phosphorus and Potassium favoring it growth over other aquatic species. When this macrophyte (water hyacinth) dies, sinks and decomposes, the water becomes more eutrophic due to the large release if nutrients. Water quality deteriorated, clean drinking water can be threatened and human health impacted.

Keyword: Xenobiotics, Bioremediation

Introduction:

Phytoremediation is process of recovery of hazardous substances from soil and wastewater by using plants. Aquatic macrophytes such as species of *Salvina, Lemna, Azolla, Eichhornias, Sedeges* and even tree species are also known to tolerate, uptake and even accumulate heavy metals and other toxicants in their cell. Water hyvinth, *Eichhorina crassipes* is already being used to clean up wastewater in small-scale sewage treatment plants. This plant utilizes vast amount of many extreme nutrients and pollutants, which are poisonous to humans in these amounts. The water hyacinth has been shown to reduce nitrogen and phosphates, as well as biochemical oxygen demand of sewage water and other industrial effluents.

Maine ecosystems cover approximately 81 per cent of the Earth's surface and contain approximately 96 per cent of the plant's water. They generate 20 per cent of the world's net primary production. They are distinguished from freshwater ecosystems by the presence of dissolved compounds, especially salts, in the water. Approximately 85 per cent of the dissolved materials in seawater are sodium and chlorine. Seawater has an average salinity of 36 parts per thousand (ppt) of water. Actual salinity varies among different marine ecosystems. Marine ecosystems can be divided into the following zones: oceanic (the open part of the ocean where animals such as whales, sharks, and tuna live); profundal (bottom or deep water); benthic (bottom substrates); intertidal (the area between high and low tides); estuaries; salt marshes; coral reefs; and hydrothermal vents (where chemosynthetic sulfur bacteria form the food base). Classes of organisms found in marine ecosystems include brown algae, in marine ecosystem are the biggest source of commercial foods obtained from wild populations. Environmental problems concerning marine ecosystem include unsustainable exploitation of marine resources, marine pollution, climate change, and building on coastal areas.

Lake Ecosystem

Lake ecosystems can be divided into zones:
- Pelagic (open offshore waters);
- Profundal;
- Littoral (nearshore shallow waters); and
- Riparian (the acre of land bordering a body of water).

Two important subclasses of lakes are ponds, which typically are small lakes that intergrade with wetlands, and water reservoirs. Many lakes, or boys within them, gradually become enriched by nutrients and fill in with organic sediments, a process called eutrophication. Eutrophication is accelerated by human activity within the water catchment area of the lake.

Aquatic pollutants

Around 1500 substances have been listed as pollutants in freshwater ecosystems, and each of them occurs in the following types of freshwater pollutants. The major pollutants are: Acids & alkalis; Anions; Domestic sewage and farm manures; Detergents; Gases (e.g. chlorine, ammonia); Oil and oil dispersants; Organic toxic wastes (e.g. formaldehyde, phenols); Heat; Metals (e.g. cadmium; lead, mercury); Food processing wastes (including processes taking place on the farm); Nutrients (especially phosphates, nitrates); Pesticides; Polychlorinated biphenyls; Pathogens; Radionuclides; etc.

The different pollutants put forth different problems to different freshwater ecosystem [1]. Mostly, expressed in the amount of oxygen that is available for fish and other species. This sometimes results in habitat destruction and extinction of local populations.

Freshwater ecosystems and pollution

The dissolved O_2 concentrations highly depends also on the amount of pollutants, because most water pollutants cause low oxygen levels in freshwater. These pollutants make it difficult for species to live, and many aquatic organisms, especially fish, die when dissolved oxygen levels fall below 4 or 5 ppm. There are a few natural sources of pollutants present in aquatic ecosystems. But mostly freshwater ecosystems may become unbalanced by factors due to human activities. Human activities affect the bioavailability of chemicals to organisms, cause temperature fluctuations, and modify rainfall, pH and salinity.

Water plays a key role in diluting pollutants and because of that superiority as a solvent, it also means that water–soluble wastes pollute water easily. For instance, runoff from nearby land provides freshwater life zones with an almost constant input of organic material, inorganic nutrients, and other pollutants. Some 1500 substances have been listed as pollutants in freshwater ecosystems.

Freshwater biota

The types of species that could become affected by water pollution in freshwater ecosystems are:
- Insects.
- Crustaceans.
- Fish.
- Amphibians.
- Arthropods.
- Aquatic plants.
- Fungi.
- Bacteria.
- Algae.
- Viruses, etc.

Zooplankton are tiny animals suspended in the water column. Like phytoplankton, these species have developed mechanisms that keep them from sinking to deeper waters, including drag-inducing, body forms and the active flicking of appendages such as antennae or spines (Brown, 1987). Remaining in the water column may have its advantages in terms of feeding, but this zone's lack of refugia leaves zooplankton vulnerable to predation. In response, some species, especially Daphnia sp., make daily vertical migrations in the water column by passively sinking to the darker lower depths during the day and actively moving towards the surface during the night.

Aquatic toxicity

The harmful effects that chemicals have upon individual organisms depend on many different factors. Not only the differences between the freshwater species, but also the form in which pollutants occur, and if the pollutant shows up in lotic or lentic systems. To measure the toxicity there has to get done some toxicity tests. Then there is clarity what the dose is of a chemical that a type of specie will die, which will be expressed in a LC50 or LD50.

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