White biotechnology: An advanced approach to manage the environment

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Abstract:

The complex of physical, chemical, and biotic factors (as climate, soil, and living things) that act upon an organism or an ecological community and ultimately determine its form and survival. Toxic air pollutants, such as sulfates, nitrates, dust, lead and mercury, accumulate in the food chain and harm plant and animal species. These pollutants emanate from industries, power plants and pesticide applications. Acid rain is formed when nitrogen oxides and sulfur dioxide react with oxygen and water in air to form acidic compounds. Sound plays a key role in the ecosystem. Our neighborhood lakes and wetlands form an interconnected ecosystem that, because of the cumulative effects of such things as grass clippings, leaves and fertilizer, is in danger. There are various Techniques used to improve lake water purity like Mulch or compost your grass clippings, Mulch or compost your leaves, Use zero-phosphorous fertilizer and Reduce storm water runoff from your property. Biosorbents were used to remove all the particulate material present in the wastewater released in the environment. An entire branch of biotechnology, known as 'white biotechnology', is devoted to environmental management. It uses living cells—from yeast, moulds, bacteria and plants—and enzymes to synthesize products that are easily degradable, require less energy and create less waste during their production.

Keywords: White Biotechnology, Biotic factors, Pesticide, Grass clippings, Biosorbent, Biodegradable.

Introduction

The objective of environmental management is improved human life quality. It involves the mobilization of resources and the use of government to administer the use of both natural and economic goods and services. It is based on the principles of ecology. It uses systems analysis and conflict resolution to distribute the costs and benefits of development activities throughout the affected populations and seeks to protect the activities of development from natural hazards. Conflict identification is one of the more important tasks in environmental management planning and the resolution of conflicts is a fundamental part of what makes up "environmentally sound development." An entire branch of biotechnology, known as 'white biotechnology', is devoted to manage the environment in a biological way. It uses living cells—from yeast, moulds, bacteria and plants—and enzymes to synthesize products that are easily degradable, require less energy and create less waste during their production.

Conflicts between natural hazards and development activities also exist and result from a confrontation between hazardous natural events and human activity. So-called "natural disasters" occur because we have not paid sufficient attention to natural hazardous phenomena. Indeed, the term "natural disaster" is misleading for this reason: it places the blame on nature when, in fact, the blame belongs to those who decided that projects be implemented under circumstances that jeopardize the very objectives that the development activities were designed to meet.

Water pollution

Over two thirds of Earth's surface is covered by water; less than a third is taken up by land. As Earth's population continues to grow, people are putting ever-increasing pressure on the planet's water resources. In a sense, our oceans, rivers, and other inland waters are being "squeezed" by human activities—not so they take up less room, but so their quality is reduced. Poorer water quality means water pollution.

We know that pollution is a human problem because it is a relatively recent development in the planet's history: before the 19th century Industrial Revolution, people lived more in harmony with their immediate environment. As industrialization has spread around the globe, so the problem of pollution has spread with it. When Earth's population was much smaller, no one believed pollution would ever present a serious problem. It was once popularly believed that the oceans were far too big to pollute. Today, with around 7 billion people on the planet, it has become apparent that there are limits. Pollution is one of the signs that humans have exceeded those limits. At the opposite end of the spectrum are highly toxic chemicals such as polychlorinated biphenyls (PCBs). They were once widely used to manufacture electronic circuit boards, but their harmful effects have now been recognized and their use is highly restricted in many countries.

Air Pollution

Toxic air pollutants, such as sulfates, nitrates, dust, lead and mercury, accumulate in the food chain and harm plant and animal species. These pollutants emanate from industries, power plants and pesticide applications. Acid rain is formed when nitrogen oxides and sulfur dioxide react with oxygen and water in air to form acidic compounds. These compounds acidify streams, lakes and the soil, causing chemical

alteration and damage to the ecosystem. Acid rain also corrodes buildings and other materials. Air pollutants, such as carbon dioxide and methane, cause climate change by depleting the ozone layer, leading to increased amounts of ultraviolet radiation on the Earth's surface. Excessive heat causes damage to crops and diseases, such as cataracts and skin cancer, in humans.

Automobile Pollution

Vehicle emissions can affect the environment in several ways. Cars emit greenhouse gasses, such as carbon dioxide, which contribute to global warming. Some air pollutants and particulate matter from cars can be deposited on soil and surface waters where they enter the food chain; these substances can affect the reproductive, respiratory, immune and neurological systems of animals. Nitrogen oxides and sulfur oxides are major contributors to acid rain, which changes the pH of waterways and soils and can harm the organisms that rely on these resources. The ozone layer helps to protect life on earth from the sun's ultraviolet rays, but human activities have contributed to the accelerated depletion of this protective shield.

Noise Pollution

Sound plays a key role in the ecosystem. The National Park Service indicates that the acoustical environment affects wildlife in terms of its ability to find adequate habitat, avoid predators, protect young, locate food and attract a mate. As noise pollution from human beings in the form of motor vehicle and airplane traffic among other causes increases, wildlife is forced to adapt in ways that are not sustainable. For example researchers discovered that the males of a particular frog species began calling at a higher pitch in an effort to distinguish their calls from traffic noise. However, the females of that species prefer a lower pitch, which means there is less successful mating within the species in general.

Management of the Environment

Our neighborhood lakes and wetlands form an interconnected ecosystem that, because of the cumulative effects of such things as grass clippings, leaves and fertilizer, is in danger. As organic materials (grass, leaves, etc.) reach the water, they decay, releasing phosphorous into the system. Additional phosphorous from fertilizers and pesticides also enter via storm water runoff. This excess phosphorous fuels an explosive growth of algae which forms a green scum on top of the water. This layer blocks sunlight. With no light, there is no photosynthesis and underwater plants can't grow. Then, as all of this algae dies and decays, it uses up oxygen. With depleted oxygen, fish and other underwater creatures can't exist.(http://www.extension.umn.edu/garden/turfgrass/fertilizers/fertilizing-lawns/)

Technique Used	Effect on the natural lakes purity level
Mulch or compost your grass clippings	Mulching your grass *reduces the need for fertilizer* because, as the grass clippings break down, nutrients are released into your lawn. And, less fertilizer on your lawn means less fertilizer in the water.
Mulch or compost your leaves	This minimizes the chance that they will reach our waters.
Use zero-phosphorous fertilizer	Reduces the algal growth in the lakes
Reduce storm water runoff from your property	Reduces the content of additional pollutants in our lakes
Use native plants; remove invasive, non-native plants	Improves Ecosystem

Table 1: Techinques used to improve lake water purity

Name	Microorganism	Immobilization matrix	Particle size
Bio-fix U.S. Bureau of Mines(Golden, Colorado)	Cyanobacteria (*Spirullina*) Yeast Algae Plants (*Lemnasp.,Sphagnum sp.*)	Polyethylene or Polypropylane or Polysulfone in dimethyformide	0.5-2.5mm
AMT-bioclaim	*Bacillus subtillis*		
AlgaSORB Bio-recovery system Inc., (Las Cruces, New Mexico)	*Chlorella vulgaris*	Silica or polyacrylamide gels	
B.V.Sorbex Inc., (Montreal, Canada)	*Sargassumnatans* *Ascophyllumnodosum* *Halimedaopuntia* *Palmyra pamata* *Chondruscrispus* *Chlorerlla vulgaris*		
Tsezos-Baird-Shemilt	*Rhizopusarrhizus*	Proprietary Methods	1mm

Table 2: Use of Biosorbents to improve the purity level of waste water released in the environment:

For tens of thousands of years, humans relied on nature to provide them with all the things they needed to make themselves more comfortable. They wove clothes and fabrics from wool, cotton or silk, and dyed them with colours derived from plants and animals. Trees provided the material to build houses,

furniture and fittings. But this all changed during the first half of the twentieth century, when organic chemistry developed methods to create many of these products from oil. Oil-derived synthetic polymers, coloured with artificial dyes, soon replaced natural fibres in clothes and fabrics. Plastics rapidly replaced wood and metals in many consumer items, buildings and furniture. However, biology may be about to take revenge on these synthetic, petroleum-based consumer goods. Stricter environmental regulations and the growing mass of non-degradable synthetics in land-fills have made biodegradable products appealing again.

An entire branch of biotechnology, known as 'white biotechnology', is devoted to this. It uses living cells—from yeast, moulds, bacteria and plants—and enzymes to synthesize products that are easily degradable, require less energy and create less waste during their production.

One of the first goals on white biotechnology's agenda has been the production of biodegradable plastics. Over the past 20 years, these efforts have concentrated mainly on polyesters of 3-hydroxyacids (PHAs), which are naturally synthesized by a wide range of bacteria as an energy reserve and carbon source. These compounds have properties similar to synthetic thermoplastics and elastomers from propylene to rubber, but are completely and rapidly degraded by bacteria in soil or water. A small amount of PH**B**first produced in *Arabidopsis thaliana* after the introduction of *R. eutropha* genes encoding two enzymes that are essential for the conversion of acetyl-CoA to PHB (Poirier *et al*., 1992). Monsanto (St Louis, MO, USA) then improved this process in 1999. Plans to manufacture a T-shirt from corn sugar have reached the same impasse. Dupont (Wilmington, DE, USA), the company that invented nylon, has for many years been developing a polymer based on 1,3-propanediol (PDO), with new levels of performance, resilience and softness. Cargill Dow (Minnetonka, MN, USA) has gone a step further. The company has developed an innovative biopolymer, NatureWorks™, which can be used to manufacture items such as clothing, packaging and office furnishings. The polymer is derived from lactic acid, which is obtained from the fermentation of corn sugar.

Another product that could benefit greatly from innovative biotechnology is paper. Much of the cost and considerable pollution involved in the paper-making process is caused by 'krafting', a method for removing lignin from the wood substrate. Lignin is the second most abundant polymer in nature after cellulose and provides structural stability to plants. In view of the significant economic benefits that might be achieved, many research efforts went into reducing the amount of lignin or modifying lignin structure in trees, while preserving their growth and structural integrity. Genetically modified trees with these properties already exist (Hu *et al*., 1999; Chabanne*et al*., 2001; Li *et al*., 2003)

White biotechnology also concentrates on the production of energy from renewable resources and biomasses. Starch from corn, potatoes, sugar cane and wheat is already used to produce ethanol as a substitute for gasoline—Henry Ford's first car ran on ethanol. Today, some motor fuel sold in Brazil is pure ethanol derived from sugar cane, and the rest has a 20% ethanol content. In the USA, 10% of all motor fuel sold is a mixture of 90% petrol and 10% ethanol. But turning starch into ethanol is neither the most environmentally nor economically efficient method, as growing plants for ethanol production involves the use of herbicides, pesticides, fertilizers, irrigation and machinery. Companies such as Novozymes (Bagsvaerd, Denmark), Genencor (Palo Alto, CA, USA) and Maxygen (Redwood City, CA, USA) are therefore exploring avenues to derive ethanol specifically from celluloid material in wood, grasses and, more attractively, agricultural waste.

White biotechnology may also benefit medicine and agriculture. Vitamin B2 (riboflavin), for instance, is widely used in animal feed, human food and cosmeticsand has traditionally been manufactured in a six-step chemical process. At BASF (Ludwigshafen, Germany), more than 1,000 tonnes of vitamin B2 are now produced per year in a single fermentation. Using the fungus *Ashbyagossypii* as a biocatalyst, BASF achieved an overall reduction in cost and environmental impact of 40%.

Conclusion

White Biotechnnology and recent agricultural techniques can be used at every step in order to manage the environment. . Plastics rapidly replaced wood and metals in many consumer items, buildings and furniture. However, biology may be about to take revenge on these synthetic, petroleum-based consumer goods. Stricter environmental regulations and the growing mass of non-degradable synthetics in land-fills have made biodegradable products appealing again.

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