

ENVIRONMENTAL TOXINS AND ECOTOXICOLOGY

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ABSTRACT

Environmental toxicology is a multidisciplinary field of science which deals with the study of harmful effects of toxic chemicals, biological and physical agents on various organisms. Ecotoxicology is a sub discipline of environmental toxicology concerned with effects of these toxic chemicals particularly on the community and at ecosystem level. Saving our environment is the foremost concern of the human being because our existence on this earth depends on our effort to keep our environment safe for the living organisms. Because of the polluted ecosystem many species have become the talk of the past and many other are on the verge of extinction like bald eagle, ospreys and peregrine falcons etc. Ecotoxicology can inform us the best possible measures to restore our contaminated ecosystem. This paper attempts to analyze the effect of these harmful chemicals on individuals and community and to suggest the possible ways of preventions. The common environmental toxicants are pesticides, phthalates, volatile organic compounds such as formaldehyde, asbestos, heavy metals, and chlorine etc. Since we are all connected to the ecosystem through food chain plants absorb these toxins through their roots and leaves, when animals consume these contaminated plants these toxins transfer through the food chain into other animals and finally transmit to human beings which is called as secondary poisoning. So ecotoxicology is an ongoing battle that can affect everything and everyone in an ecosystem. Hence preventive measures to check the flow of toxicants are the dire needs to maintain a healthy and well balanced ecosystem.

KEYWORDS: Toxins, Ecosystem, Environment, Species, Chemicals

Ecotoxicology is a scientific discipline combining the methods of ecology and toxicology in studying the effects of toxic substances and specially pollutants on the environment. It is a branch of science which deals with the effect of toxic chemicals on biological organisms especially on population community and ecosystem. Today each and every system is getting polluted by harmful chemicals and it has become dire need of the day to analyze the effect of pollution so that effective measures may be taken to prevent the effects which are identified. Ecotoxicology can inform us the best measures to restore the polluted ecosystem.

Ecosystem includes rivers, ponds, deserts, grasslands and forests. They too can be affected by pesticides. Ecotoxicology also studies about what happens to the pesticides themselves, where do they go in the environment, how long they last and how they finally breakdown. The term Ecotoxicology was coined by Rene Truhaunt in 1969 who defined it as

“A branch of toxicology concerned with the study of toxic effects caused by natural or synthetic pollutants to the constituents of ecosystem animals, vegetables and microbes in an integral contexts.”

The term ecotoxicology is now used to describe the researches defining the ecological effects of various biotic and biotic stresses such as ocean acidification resulting from increased dissolution of carbon dioxide into surface water of oceans.

COMMON ENVIRONMENTAL TOXINS

1. PCBs—(Polychlorinated biphenyls) found in pesticides, coolant and insulating fluids, adhesives and hydraulic fluids.

2. Phthalates---These are found plastic wrap plastic bottles and plastic food storage containers which constitute a major part of household plastic waste materials.
3. Pesticides- These are the chemicals widely used for preventing, destroying or repelling any organisms which are considered harmful to protect commercially grown pulses vegetables and meals.
4. VOC—(Volatile Organic Compounds) Such as formaldehyde that may be found in drinking water and sewage system.
5. Dioxins—These are chemical compounds which are formed from waste incarnation or from combustion process such as from burning fuels like oil, wood and coal.
6. Asbestos-Found in water pipes.
7. Heavy Metals--- Includes arsenic, mercury, lead, aluminum, cadmium which are found in pesticides.
8. Chloroform—Chlorine found in house holds cleaners.

TYPES OF TOXICANTS

Based on their type of effect caused on human beings the toxicants are classified as follows:-

1. Carcinogens- Cause cancer
2. Mutagens- Cause mutation in genes
3. Teratogens- Cause birth defects
4. Allergens – Cause unnecessary immune response
5. Neurotoxins- Damage nervous system
6. Endocrine disruptors- Interfere with hormones

CLASSIFICATION OF ECOTOXICITY

Based n amount of toxins ecotoxicology is classified into three types.

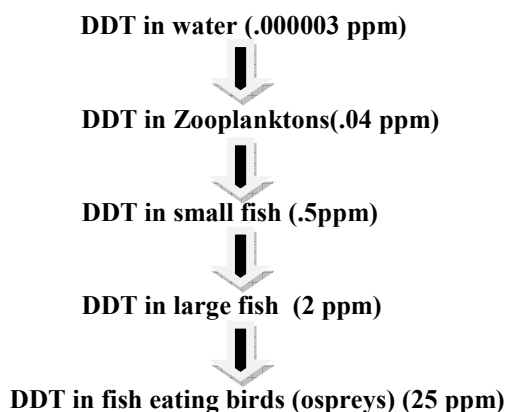
Class I < 1 part per million.

Class-II 1 to 10 parts per million

Class-III 10 to 100 parts per million

EFFECT OF ECOTOXICITY ON INDIVIDUALS AND ENTIRE POPULATION

The toxic chemicals keep on transferring in the food chain from one organism to another and pose the risk of another animals food supply and change the overall population of the prey. We are all connected with the communities of living beings. Plants can absorb toxins through their roots and leaves. Animals and human beings are in turn exposed to these chemicals through the air they breathe, things they touch, and eat. Animals and human beings can also eat other animals or plants that are already contaminated which will continue the spread of chemicals which is referred as secondary poisoning. The toxic chemicals are accumulated in the body of organisms both directly from abiotic environment i.e. air, water, soil etc. and from dietary sources this process is called bioaccumulation. When these toxins transfer to the higher tropic levels biomagnifications takes place which can be defined as chemical compounds concentrate in an organisms achieves a level that exceeds in the organisms diet due to dietary absorption i.e. higher tropic level accumulate more chemicals. The stages in biomagnifications can be illustrated through the amount of DDT found in various tropic levels of the food chain as shown below:-



The adverse effects of these toxicants can be listed as follows.

- Individuals and population are affected directly by consumption of a toxin or any other contaminated food materials by eating drinking or breathing.
- Organisms are also affected by the loss of food which has declined due to toxins.
- Some toxic cause lethal effects i.e. they do not kill but make the organism sick or change its behavior.

- The chronic use of pesticide can cause abnormality in chromosome structure in human being and also affects nervous system and cardiovascular system.
- Toxic exposure also causes genetic disturbances, which if not cured leads to appearance mutations.
- Contaminants can modify the distribution of individuals in a population, effective population size, mutation and migration rate.

EFFECTS OF TOXICITY ON A COMMUNITY

Since in every ecosystem there exists a predator prey relationship. If the predator is affected by the toxins resulting in the decline of predators population and subsequently increase in the prey population. If the prey population is affected by the toxins it results in decline of prey population and finally decreases in the predators [population because of lack of food resources.

Communities that depend heavily on competition and predation will have a difficult time responding and thriving in disturbances from these toxins whereas a community which is species- rich will have a better chance of recovering from disturbances caused by exotoxins rather than a community which is not species rich. A community can be completely wiped out to the expense of contamination from harmful chemicals. Protecting all these communities their species richness and diversity is essential for maintaining a healthy and well balanced system.

Chemicals are shown to prohibit the growth of seed germination. Since plants are primary producers they make the most important tropic level at the bottom level of the pyramid of food chain. If plants are contaminated other consumers either get diseased by consuming these diseased plants or they starved and die. Hence ecotoxicology is an ongoing battle connected to every level of ecosystem through food chain and it can affect each and every component of an ecosystem.

REGULATIONS AND WAYS OF PREVENTION

Key agencies and the products they regulate are as follows

1. FDA-(Food and Drug Administration) It is a regulatory body for food, additives, cosmetics, drugs and medical devices.
2. EPA -(Environment Protection Agency) It works for regulating pesticides, industrial chemicals and any synthetic chemicals not covered by other agencies
3. Occupational Health and Safety Act. (OSHA) It looks after work place hazards
4. Stockholm Convention – An International treaty to phase out 12 Persistent Organic Pollutants POPs.

There are many central and state laws protecting birds, animals and endangered species and plants but the

first order of protection comes from we people because we are the main source of all toxins. We must have a close look on labeling.

When using a fertilizers. There should a search for the products that will have less of an impact on the environment.

CONCLUSION

Organisms can be introduced to toxins at various stage of their life cycle. The degree of toxicity varies according to the position of organism in the food web. Bioaccumulation occurs when molecular compounds are stored in the body of organism in its fatty tissues. Over time, this leads to the establishment of a tropic cascade and the biomagnifications of the accumulated toxins. This process is typically limited in the areas affected by environmental toxicants.

Harmful effects of chemical and biological agents can include toxicants from pollutants, insecticides, pesticides and fertilizers. All of these can affect an organism and its community through shifts in species diversity and abundance and ultimately the resulting change in population dynamics impact an ecosystem by altering its stability and productivity. Its harmful effects can be cause extinction of various species. For example, bald eagle, peregrine falcons and ospreys are at the brink of extinction because their food resources (fish and other birds) are contaminated with toxins. Hence to maintain a well balanced and healthy ecosystem in which all the components of the ecosystem thrive successfully is the foremost requirement for existence of human beings in the universe.

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