

Toxicological Chemistry

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Abstract -

Toxicology is the science that deals with the effects of poisons upon living organism. Toxicology is the relationship between the demonstrated presence of a chemicals or its metabolites in the body and observed symptoms of posing mechanisms by which toxicants are transformed to other species by biochemical processes, the process by which toxicants and their metabolites are eliminated from an organism and treatment of poisoning with antidotes.

Key words - Toxicology, Toxicants, Toxicity, Immune system.

Introduction -

Toxicological chemistry is the science that deals with the chemical nature and reactions of toxic substances, including their organs, uses and chemical aspects of exposure, fates and disposal. Toxicological chemistry addresses the relationship between the chemical properties and molecular structure of molecules and their toxicological effects. Acute toxicity refers to responses that are observed soon after exposure to a toxic substance. Chronic toxicity deals with effects that take a long time to be manifested. Chronic responses to toxicants may have latency periods as long as several decades in human. Acute effects normally result from brief exposure to relatively high levels of toxicants and are comparatively easy to observe and relate to exposure to a poison. Chronic effects are often obscured by normal background maladies and tend to result from low exposure to a toxicant over relatively long periods of time. Chronic effects are much more difficult to study, but are of greater importance in dealing with hazardous wastes and pollutants.

Toxicants in the Body -

The major routes and sites of absorption, metabolism, binding and excretion of toxic substances in the body. Toxicants in the body are metabolized and excreted; they have adverse biochemical effects; and they cause manifestations of poisoning. It is convenient to divide these processes into two major phases, a kinetic phase and a dynamic phase.

Responses to Toxicants -

Prominent among the more chronic responses to toxicant exposure are mutations, cancer and birth defects and effects on the immune system. Other observable effects, some of which may occur soon after exposure, include gastrointestinal illness, cardiovascular disease, hepatic (liver) disease, renal (kidney) malfunction, neurologic symptoms (central and peripheral nervous systems), skin abnormalities (rash, dermatitis),

Among the more immediate and readily observed manifestations of poisoning are alterations in the vital signs of temperature, pulse rate, respiratory rate, and blood pressure. Poisoning by some substances may cause an abnormal skin color (jaundiced yellow skin from CCl_4 poisoning) or excessively moist or dry skin. Central nervous system poisoning may be manifested by convulsions, paralysis, hallucinations and ataxia (lack of coordination of voluntary movements of the body), as well as abnormal behaviour.

Carcinogenesis and immune system effects -

Chemical Carcinogenesis is the term that applies to the role of substances foreign to the body in causing the uncontrolled cell replication commonly known as cancer. In the public eye chemical carcinogenesis is the aspect of toxicology most commonly associated with hazardous substances.

Chemical carcinogens usually have the ability to form covalent bonds with macromolecular life molecules, especially DNA. This can alter the DNA in a manner such that the cells replicate uncontrollably and form cancerous tissue. Many chemical carcinogens are alkylating agents.

Immune System Response -

The immune system acts as the body's natural defense system to protect it from xenobiotic chemicals; infectious agents, such as viruses or bacteria; and neoplastic

cells, which give rise to cancerous tissue. Adverse effects on the body's immune system are being increasingly recognized as important consequences of exposure to hazardous substances. Toxicants can cause immunosuppression. Another major toxic response of the immune system is allergy or hypersensitivity. This kind of condition results when the immune system overreacts to the presence of a foreign agent or its metabolites in a self-destructive manner. Among the xenobiotic materials that can cause such reactions are beryllium, chromium, nickel formaldehyde, pesticides, resins, and plasticizers.

Health hazards -

In recent years, attention in toxicology has shifted from readily recognized, usually severe acute maladies that developed on a short time scale as a result of brief, intense exposure to toxicants.

Conclusion -

Toxicological considerations are very important in estimating potential dangers of pollutants and hazardous waste chemicals. One of the major ways in which toxicology interfaces with the area of hazardous wastes is in health risk assessment, providing guidance of risk management, cleanup and regulation needed at a hazardous waste site based upon knowledge about the site and the chemical and toxicological properties of wastes in it, risk assessment includes the factors of site characteristics; substances present, including indicator species; potential receptors potential exposure pathways.

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