General classification of water pollutants

Environment, Water

Water pollutants can be grouped according to their physical properties (e. g. color, odor, state, or temperature), biological traits (e. g. pathogens), or chemical characteristics (e. g. organic or inorganic compounds). However, water pollutants can generally be classified into the following.

Organic Pollutants: Organic contaminants in waste water are a major problem due to the failure of conventional water-treatment technologies to completely mineralize these contaminants in their aqueous compartments. Volatile organic compounds (VOCs) are well known to be toxic, as they are carcinogenic and have been associated with the depletion of the stratospheric ozone layer while also contributing to global warming. Also, VOCs have been identified as mutagenic pollutants, thus may be responsible for the occurrence of antibiotic resistant bacteria and genes. Some organic pollutants are referred to as persistent organic pollutants (POPs), since they are resistant to degradation for an extensive period of time, after its emission into the environment and therefore, bioaccumulate along the food chain; polychlorinated biphenyls (PCBs) is a typical example. Also, organic pollutants are a serious threat due to their ease of transportation from the source of contamination to other areas through various physical and chemical processes. Eventually, some of these organic pollutants contaminate groundwater and surface waters; however, Hoffmann, et al., 1995 notes that groundwater contamination is most likely the primary source of human contact with these toxic chemicals. Usually, human exposure to organic contaminants could be through breathing, drinking, ingestion, or by skin contact.

Natural Organic Matter: Natural organic matter (NOM) can be generally described as the organic compound products, obtained from the natural decomposition of plants and animals. NOM is comprised of a wide variety of compounds with different chemical properties (as a result of geographic origin and age of the decomposing organism) and it is obtainable in all natural water sources. NOM elements consist of a heterogeneous mixture of complex organic materials, comprising of hydrophilic and hydrophobic components. The major hydrophilic components are microbial by-products and contain a high amount of aliphatic carbon and nitrogenous compounds, which have relatively high charge density; examples include proteins, amino acids and polysaccharides. Treatment methods for the removal of Natural Organic Matter include coagulation, activated carbon, magnetic ion-exchange resins, membrane filtration, and advanced oxidation processes. The presence of NOM in wastewater leads to an increase in the amount of coagulant and disinfectant dosage resulting in increased sludge. It can also increase biological growth in water-distribution networks and may result in increased levels of heavy metal complexes and absorbable organic pollutants. Thus, understanding the influence of NOM on water-treatment processes is necessary for water-treatment plants infrastructure, as well as industrial processes where pure water is a prerequisite. This will ensure the wellbeing of plants and animals who rely on water for consumptions.

Inorganic Pollutants: Along with organic matter discharged into the water body through sewage and industrial wastes, high concentration of heavy metals and other inorganic pollutants in discharged effluent also contaminate the water. These compounds are non-biodegradable and

therefore persist in the environment for a long time. These pollutants include mineral acids, inorganic salts, trace elements, metals, metal compounds, complexes of metals with organic compounds, cyanides, sulphates, etc. The accumulation of heavy metals has adverse effect on aquatic flora and fauna and may constitute a public health problem where contaminated organisms are used as food.

Industrial effluents: Industrial activity is directly linked to the emission of various toxic pollutants into the environment, especially to water resources, and the pollutants in industrial effluents are very harmful and hazardous to the environment. Husain, et al., 2008 has indicated that prevention of industrial pollution is presently a major area of emphasis for environmentalists, by ensuring that treatment of industrial effluents before disposal into the ecosystem is implemented to protect human life and environmental quality. Therefore, a sustained effort to protect water resources is being made by various governments and nongovernmental organizations (e. g., USEPA, WHO, and DWAF) through the introduction of increasingly stringent legislations covering pollutant release into the environment, with particular emphasis on liquid industrial effluents. Examples of such industries include mining, petroleum and petrochemicals, pulp and paper mills, food, pharmaceutical, electroplating, photographic, textile, agriculture and allied industry. It has been observed that these industries do not generate uniform waste streams, as reported by Hajem, et al., 2007, who stated that, industrial effluents are complex mixtures, that are comprised of chemical and biological compositions, having various

environmental impacts depending on the source(s) and identity of the toxicants.

Other classes of pollutants include pathogens, suspended solids and sediments, disinfection by products, radioactive and thermal pollutants.