PHOTOCATALYTIC DEGRADATION OF SOME WATER CONTAMINANTS WITH GRAPHITIC CARBON NITRIDE

An

Abstract

Submitted for the Award of the Ph.D. Degree of

PACIFIC ACADEMY OF HIGHER EDUCATION AND

RESEARCH UNIVERSITY

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ABSTRACT

Water is a natural resource, which is necessary for life. It is available in various sources like rivers, streams, lakes and oceans. Through the last century, fresh water has been depleted enormously due to the explosion of human population and eco-unfriendly activities. The disposal of human waste in water bodies causes severe threats to the environment which affects all kinds of living organisms. In order to save water bodies, we need to understand the sources of wastewater and its polluting components. Domestic, industrial and agricultural sectors are the three major sectors of wastewater. Domestic wastewater includes water from household activities. Industrial wastewater comes from various sectors of industry like food, chemical, paper & pulp, nuclear & thermal power, laundry, pharmaceuticals, mine, iron & steel, etc. These wastewaters are rich in organic and inorganic contents. But excessive release of such nutrients into the water causes a rise of minerals and nutrients in water bodies leading to the excessive growth of plants and algae, which in turn leads to oxygen depletion in water bodies and, hence, eutrophication. This wastewater can be reused, if treated suitably by removing different pollutants.

Issues pertaining to water contamination becomes of paramount importance due to fundamental role of water in sustaining life. Water constituted a significant portion of the human body (about 70%) and served as a cornerstone of life. The adverse effect of water pollution on human health and environmental integrity deepens the critical nature of water-related concerns. Therefore, an urgent attention is required to find out some solution for pressing need to combat water pollution.

Advanced oxidation processes are genuinely efficient for treating various toxic organic pollutants and complete destruction of contaminants of emerging concern like naturally occurring toxins, pesticides, dyes, and other deleterious contaminants. These organic pollutants interact with hydroxyl radical via addition or hydrogen abstraction pathways, resulting in a carbon-centered radical, which then reacts with molecular oxygen to form a peroxyl radical that undergoes subsequent reactions; thus, generating a host of oxidation products like ketones, aldehydes, or alcohols. Hydroxyl radicals can also form a radical cation by abstracting an electron from electron rich substrates, which can readily hydrolyze in aqueous media giving an oxidized product.

The oxidation products are often less toxic and more susceptible to bioremediation like CO_2, water, etc.

Photocatalysis is a phenomenon, in which an electron-hole pair is generated on exposure of a semiconducting material to light. Photocatalysis can be used to break down a wide variety of organic materials, organic acids, estrogens, pesticides, dyes, crude oil, microbes (including viruses and chlorine resistant organisms), inorganic molecules such as nitrous oxides (NOx) etc.

The present thesis has been divided in four chapters-

Chapter-I deals with introduction of waste water, Advanced oxidation processes, mechanism of photocatalysis and photocatalytic degradation of organic pollutants using different types of photocatalyst.

Chapter-II presents introduction of graphitic carbon nitride, modification of photocatalyst and literature survey related to photocatalytic degradation of organic pollutants using graphitic carbon nitride as photocatalyst.

Chapter -III is divided in six parts as Chapter III A – III F. Each sub-chapter is devoted to the experimental work related to a dye in presence of graphitic carbon nitride. It includes the effect of various parameters such as; pH, dye concentration, amount of photocatalyst, and light intensity on rate of degradation.

Chapter-IV deals with discussion part of the present work.

The order of degradation rate of different dyes was;

Azure A > Methylene blue > Evans blue > Rhodamine B > Alizarin red-S > Rose Bengal.

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