



Organic Pollution and Its Effects: A Global Issue



Apurva
Research Scholar
P.G. Depart. of Zoology
B.R.A. B. Univ. Muzaffarpur
(Bihar)

ABSTRACT

Industrial, agricultural and other anthropogenic activities have lead to the introduction of thousands of pollutants; most of them are synthetic organic compounds. A fraction of these organic compounds, called organic pollutants or persistent organic pollutants (PoPs) are chemicals that have become a major concern because of their toxicity, persistence, bioaccumulation tendency, and susceptibility to undergo long range atmospheric transport. Our current knowledge indicates that the cycling of these chemicals in the environment is highly complex; indeed their local, regional and global cycle is controlled by repeated air – surface exchange and interactions with the carbon cycle. These chemicals have also the potential to accumulate in all the tropic levels of ecosystems, including those far away from sources. The main objective of this paper is to analyse the relationship between organic pollution and its effect on species diversity as well as organisms.

Keywords - Organic, Pollution, Effects, Global, Issue, Organic pollution.

INTRODUCTION

Organic pollution of water refers to the pollution caused by organic materials that can be decomposed by the microorganisms. In balanced aquatic system, the indigenously produced organic matter (detritus formed from primary and secondary production) is always in amounts that allow its complete degradation by the oxygen available in water, without disturbing its natural balance. It is only when the system receives organic matter in excess from outside, the oxygen tend to diminish and lead to the development of hypoxic or totally anaerobic conditions.

All the organic substances which can serve as food for living organisms to obtain their energy needs and to build new cells can be termed as organic nature. The organic matter, based on its origin, can be divided into two main categories i.e., synthesized naturally by biochemical means, and synthesized chemically in the laboratory. The most commonly encountered organic materials, both in the nature and in organic wastes, are the biologically originated carbohydrates, fats (lipids) and proteins, which are readily utilized by the microorganisms as then every source. Apart from these three basic organic materials, there are a number of

other organic molecules, ranging from simple hydrocarbons to complex molecules, but these are much less abundant.

SOURCE OF ORGANIC MATTER :

The most important sources of organic matter in water are:-

(a) Disposal of Municipal and Domestic Sewage:- The municipal sewage consists mainly of human excreta and other household organic wastes. Average raw sewage contains usually 1.0% solids which remain both in suspended and dissolved form. Of the organic constituents 65% are nitrogenous, 25% are carbohydrates and 10% are fats (Tabbut, 1977).

Even after conventional secondary treatment a large quantity of dissolved organic matter remains in sewage and may cause organic pollution, especially in the waters with low self – purification capacity. They even labour a number of pathogenic microbes.

(b) Industrial Effluents and Waste Water :- A number of industries like food processing dairy, paper and pulp, sugar, distilleries, breweries, tanneries, textile and others have considerable quantities of organic matter of varying nature beside other pollutants. Table lists the characteristic of some important wastes released from the different industries.

Industry	Characteristics
Dairy products	High dissolved organic matter mainly proteins, fats and lactose.
Canned food	Organic matter in colloidal and dissolved form. High TSS
Meat & Poultry	High dissolved and suspended organic matter especially protein and fats Blood.
Coffee	High BOD mainly of carbonaceous nature.
Cane sugar	High dissolved organic solid mainly of fermented starches or their products and organic nitrogen.
Breweries & distilleries	High BOD, colours, high pH, high suspended solids
Textiles	High BOD and total solids, sulphides, hardness
Leather	High suspended, colloidal and dissolved solids, organic matter mainly of cellulose, high or low pH, colours.
Pulp & Paper	High BOD and odours, high suspended solids, chlorides
Natural Rubber	High BOD mainly due to starch and related material

Starch	High BOD, odour, sulphur compounds, phenol
Oil refineries	Organic fatty acids
Candle manufacturing	

- (c) **Urban and Rural Run – off** :- The run – off origination from urban areas picks up large quantities of organic matter from the streets, houses, gardens and other places and reach bodies of water through municipal sewers or directly. The urban run – off is especially important at onset of rainy season after the dry spell, during which, huge quantities of organic matter accumulate in the city drains. Though the BOD (Biological Oxygen Demand) of urban run – off is highly variable, its values as high as 7700 mgL⁻¹ have been reported in certain cases (Mason, 1981).

Rural run – off originating from the sparsely populated and from natural vegetated areas. It contains variable quantities of organic matter derived mainly from the dead plant mater of annual and deciduous vegetation. The run – off, passing through the agricultures areas may also pick up substantial quantities of organic manure, drived parts of crop plants etc. The rural run – off, in general, is of diffuse nature with no point sources.

- (d) **Detritus formed by indigenous primary and secondary production**:- The advanced stages of eutrophication often show the symptoms of organic pollution due to accumulation of excessive dead organic matter which exhaust the oxygen resources of water bodies and convert them into hypereutrophic or dystrophic ones.

The growing plants and animals also secrete a variety of trace organics in natural waters. The algal and fungal growth produce several organic compounds which impart characteristic tastes and odours to the waters. Some of the important exudates are sulphur containing compounds like methyl mercaptan, isopropyl mercaptan etc. The excreta of aquatic animals also contains several refractory organic compounds.

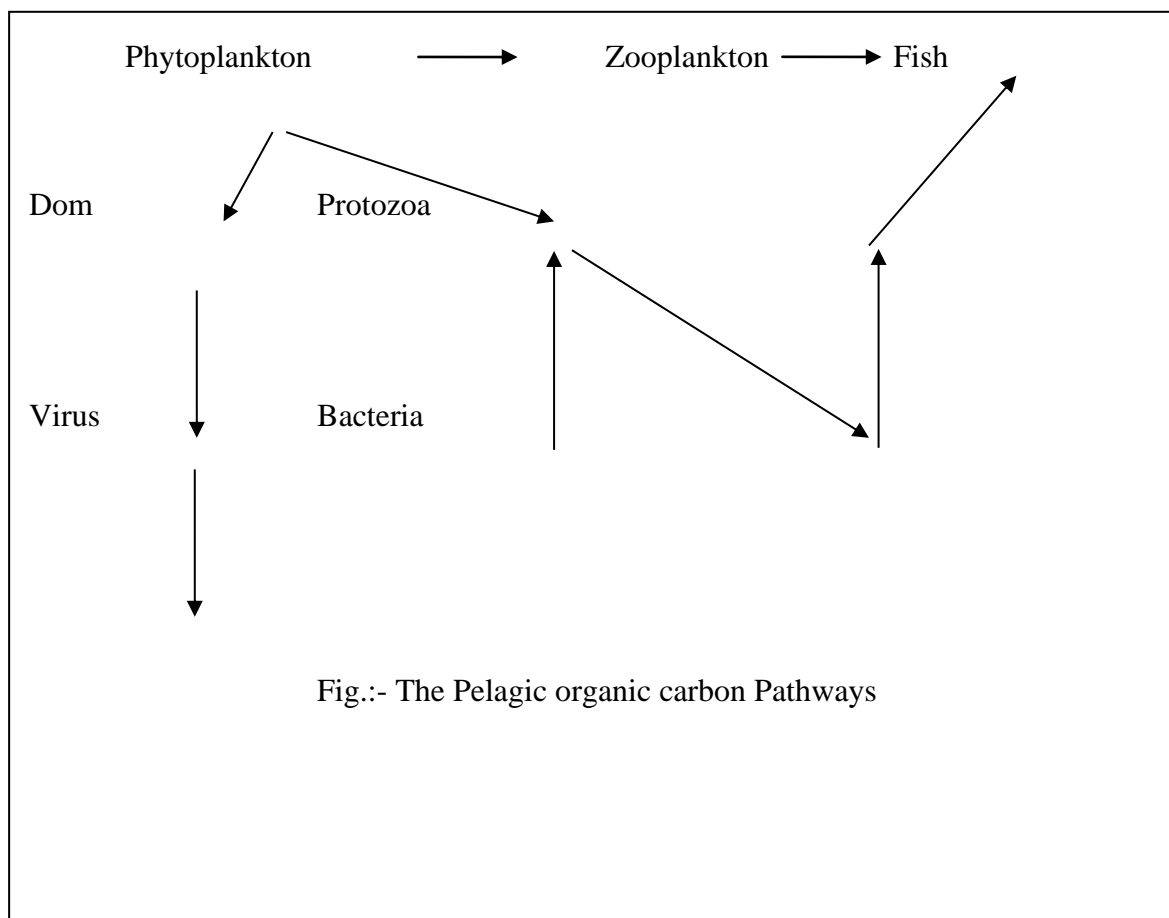
EFFECTS OF ORGANIC POLLUTION :-

The discharge of organic matter in water bodies brings about characteristic changes and effects which are –

- (a) **Aesthetic Effects** – Accumulations of certain degradation products in water like H₂S, mercapans and others produce unpleasant odours and disagreeable tastes.
- (b) **Effects on Oxygen Balance** – In most non – polluted waters, oxygen is usually maintained at the saturation level because the factors responsible for its addition and removal remain at an equilibrium. However, the addition of organic matter disturbs this equilibrium and the respiratory demand for

oxygen by aerobic bacteria increases beyond the level that can be replenished. As a result, the oxygen concentration goes down and the water becomes anoxic.

- (c) **Effect on physico – chemical characteristics** – The hypoxic conditions, prevent the oxidation of ammonia and hydrogen sulphide formed after the degradation of organic matter, thus allowing their build – up to dangerous levels. The organic pollution decreases nitrate content, due to microbial denitrification and increases the phosphorous content due to decomposition. The built up of carbon dioxide (CO₂) is associated with drop in pH. The reduction in pH and dissolved oxygen modifies the redox potential that governs the movement of nutrients across the water and sediment interface.
- (d) **Effect on Primary Production** – The organic pollution may increase photosynthesis initially due to luxuriant supply of nutrients released from the organic matter. However, respiration continue all the time, consuming more oxygen than what is generated. At higher levels of organic pollution, accumulation of toxic H₂S and NH₃, adversely affects the phytoplankton and higher plants species, causing the fall in the rate of primary production.
- (e) **Effect on Species Diversity** – The diversity of all the groups of aquatia organisms including phytoplankton, zooplankton and benthic invertebrates falls with the rise in level of organic pollution. Only a few tolerant species tend to dominate resulting in the fall of diversity.



- (f) **Zoning and watershed management** – The land use pattern in the watershed of catchment area will determine the nature of drainage. A check on deforestation and erosion will help in reducing the nutrient land of the water resources. The selections of suitable sites for industries urban development and so on will also controlling the water quality.
- (g) **Effect on Organisms** – Organic pollution may affect almost all the aquatic organisms in a variety of ways by reducing the dissolved oxygen, accumulating toxic gases and by products of decomposition, increasing suspended matter and cutting light. Low oxygen affects aerobic organisms. Accumulation of methane, alcohols, aldehydes, ketones, acids and several other byproducts of decomposition is harmful to the organism – Sometimes, a heavy growth of benthic microbial community called “sewage fungus” is seen on heavily polluted conditions. The “sewage fungus” consists of a mixture of several microorganisms, dominated by bacteria and appears as fluffy, fungoid growth over the surface of the substratum. A list of common organisms present in the sewage fungus is –

<u>Group</u>	<u>Name</u>
1. Bacteria	Beggiatoa alfa Flavobacterium spp. Sphaerotilus natans Zoogloca < pp.
2. Fungi	Geotrichum candidum Laptomitus lacteus
3. Algae	Fragilaria spp. Navicula spp. Stigeoclonium tenue
4. Protozoa	Chitodonella cuculluluc C. uncinata Colpidim camphylum C.colpoda Paramecium caudatum P.trichium Uronema migricans

Algae respond to organic pollution by complete elimination of the original species. Very heavily polluted areas are almost devoid of alagal species. In oderately polluted water bodies, cyanoplycean members like **Oscillatoria** and **Spirulina** are observed.

Some macro invertebrates like members of annedia *Tubifex tubifex*, *Lumbriculus* species, *Lumbriculus rubellus*, diptra members *chirenomus* larval and *Eristalis tenax*, Isopoda member *Asellus aquaticses* etc are tolerant to different levels of organic pollution.

Critical ranges of dissolved oxygen for the survival of fish varies from species to species. Fish kills caused by organic pollutions have been frequently reported from all over the world.

CONCLUSION

Even though the study of the organic pollutants has been active since the early days of the research on the environmental studies. However during the last decade, the amount of research on organic pollutants has increased considerably. Because of the fast development during the last decades of the global economy. The use of resources has increased exponentially and presumably the number of organic chemicals that have entered the environment has also been increasing. In fact, every year there are new pollutants that are “discovered” in the environment. Their introduction should be viewed as another vector of current global change which represents an additional stressor for organisms, communities and ecosystems that is largely not understood.

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