

ORIGIN AND BIOAVAILABILITY OF DISSOLVED ORGANIC MATTER IN GROUNDWATER

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ABSTRACT

Water contains various organic matter. To study the water quality, it is essential to know the effect of o.m.Present study is the focus on origin & impact of o.m.on water environment. It is concluded that There are several possible environmental consequences associated with organic matter in water. Aqueous o.m.is in same cases, toxic at frequently takes part in reactions with other aquatic species when present in high concentration, it can create anoxic conditions in the water.

Key words-groundwater ,organic matter ,environment, toxic, concentration anoxic

Origins of organic matter in water.

1)Natural sources:-

The o.m.that is of natural origins is derived primarily from plant & microbial residues. On land plants grow ,sometimes shed leaves & die, leaving roots within the upper soil layers & 'litter' on soil surface.Microganism also flourish within the soil .When they die their biomass adds to soil organic content.

In their original or chemically modified form, the residues of organic matter produced on land are available to be transferred from the soil into the hydrosphere. Transport usually occurs due to rainfall that runs off or percolates through the solid column carrying soluble and particulate OM to streams, lakes, and oceans or into ground water organic matter is also produced in situ within a water body. Wetlands, both natural and constructed, are a prime example. There the luxuriant growth of vegetation produces a thick mat of aerial material and roots that, upon death, are deposited in the water after dying, the organic residues from larger plants and animals, as well as the microbial biomass, become chemically modified by a variety

of decomposition and new synthesis processes. Many of the reactions to produced altered organic species are facilitated by the presence of living microorganisms in the soil or water.

2) Artificial sources:-

Besides the natural sources, there are human inputs that contribute to the organic matter in water. These include large volumes of poorly defined wastes, such as domestic sewage or pulp mill effluent, that are sometimes discharged directly or after treatment in to rivers, lakes, and oceans. Beside the bulk effluents, anthropogenic sources also supply specific organic compounds-agricultural chemicals, medicinal and products or by products of industrial processes. The range of these is as broad as the range of organic chemistry itself.

Organic matter and its Impact on Environment

a) Toxicity of specific organic compounds

Organic matter in water is Environmental importance for several reasons. Particular compounds may be toxic in varying degrees to living organisms, including humans. Polyaromatic hydrocarbons, polychlorinated biphenyls, and dioxins are all well known contribution to real and alleged Environmental problems. Residues of pesticides and their metabolic products can also be carried in to water.

b) Reaction with other aquatic species

In organic tin undergoes alkylation in aquatic Environments to form compounds such as monomethyl tin ($\text{CH}_3\text{Sn}^{3+}$) and dimethyl tin $(\text{CH}_3)_2\text{Sn}^{2+}$. The alkylation process is takes place in the fish gut or via micro organisms in the water column. Toxicity becomes greater as the number of organic groups increases. In the series $\text{R}_n\text{Sn}^{(4-n)+}$ for $n=1$ to 3. Toxicity is also inversely related to the length of R and is at a maximum where R is methyl or Ethyl group.

c) Consumption of oxygen

A third Environmental feature of aqueous organic matter, in particular the bulk residues of plants and animals or some industrial discharges, is that the non-living organic material can be

oxidizes by oxygen and other oxidizing agents in water. Therefore when released into a water body, the bulk OM degrades, consuming oxygen- deprived state.

d) Humic material

Humic material is a form of Environmental organic matter of plant or microbial origin. The humic material is not made up of discrete, well defined molecules but is a class of substances that are produced and reside in soil and water, forming a major component of both the terrestrial and aquatic carbon pools. In the hydrosphere HM typically makes up about 50% of the dissolved organic matter in surface water as well as much of the organic sediment.

Humic material is sub divided in an operational sense in to three classes or categories.

- Fulvic acid is the fraction of humic matter that is soluble in aqueous solutions that span all PH values.
- Humic acid is insoluble under acid conditions (PH₂) but soluble at elevated PH.
- Humin is in soluble in water at all PH values.

Formations of humic material –1) Degradative pathway-Humic substance are formed via a complex sequence of only partly understood reactions. Several hypothesis have been proposed plant bio polymers are modified through degradation to form the central core of humic substances. These theories propose that labile macromolecules such as carbohydrates and proteins are degraded and lost during microbial attack, while refractory compounds or bio polymers for example lignin, paraffinic macromolecules melanin's and cutin are selectively transformed to produced a high molar mass precursor of humin. Further oxidation of these materials increased oxygen content in the form of typical functional group like carboxylic acid and as this process continues the molecule become small enough and hydrophilic enough to be soluble in alkali. Eventually the molecules become even smaller and sufficiently oxygen rich to dissolve in both acid and base.

Plant material —Humin—Humicacid—Fulvicacid—Small molecule

Formation of humic material-2) synthetic pathway-As an alternative hypothesis based on ideas of condensation polymerization suggest that plant bio polymers are initially degraded to small molecule after which these molecules are repolymerized to form humic substances. It has been proposed that polyphenols synthesized by fungi and other microorganisms, together with those liberated from the oxidative degradation of lignin, undergo oxidative polymerization. A consequence of this scheme is that fulvic acid would be precursor of humic acid and then of humin.

Plant material → small molecule → Fulvic acid → Humic acid → Humin

Conclusion:-

Organic matter is present to varying degrees in dissolved and particulate forms in all natural waters. The OM originates from both natural and anthropogenic sources. Specific organic species can be identified usually in low concentration, in sample, but much of the organic matter is present as poorly defined broad classes of material. There are several possible Environmental consequences associated with organic matter in water. Aqueous OM is in some cases, toxic. It frequently takes part in reaction with other aquatic species when present in high concentration, it can create and anoxic condition in the water.

References:-

- Environmental Chemistry a global perspective- Gary w. Vanloon, Stephen J. Duffy
- A Natural Organic Matter, Green facts, 22 apr.2007.
- “The priming effect of organic matter: a question of microbial competition.” soil biology and bio chemistry **35**:837-843 Fontaine, Sebastien, mariotti, Abbadie (2003).
- “Researchers study role of natural organic matter in Environmental” Science daily 20 Dec.2006, 22 Apr.2007.
- “Topic snapshot: natural organic material “, American water works association research foundation, 2007.
- Cho, Min, Hyenmi chung and jeyong yoon,” Disinfection of water containing natural organic matter by using ozone- Initiated Radical Reaction” Abstract, applied and Environmental micro biology vol.69 No.4 2003.



- Inamdar S. Singh S. Dutta S. Levia D. Mitchell M, Scott D, Bais H Mettale P (2011)
- Kaiser K. Benner R (2005) Hydrolysis-induced racemization of amino acids. *Limnol oceanogr- Methods* 3:3 18-325
- Raymond PA, Bauer JE (2000) Bacterial consumption of DOC during transport through a temperate estuary. *Aquat Microb Ecol* 22 (1):1-12