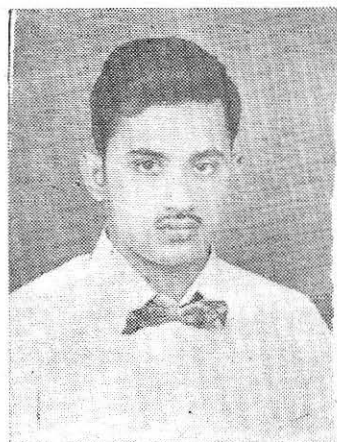


## AQUATIC POLLUTION

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### What is pollution?

Today the world is faced with an unprecedented menace of growing pollution\* of its air, land and water. These three have been termed as the world's major environments. The technological advances of the nations have been largely achieved as a result of great strides which the industry has made. Pollution of the environments thus seems a prize which mankind is paying for achieving affluence. India, which is on the threshold of industrialization, must make a serious note of the dangerous consequences associated with pollution and take lessons from those countries which are faced with a formidable task of pollution control. The awareness towards pollution is so alarming that International agencies like the FAO have already started a number of programmes for fighting environmental pollution. The environment in which we live, the air we breathe, the water we drink and the food we eat, is polluted everywhere, varying only in degree and intensity in different parts

of the world. It is true that nature does its own adjustments by purifying the environments to maintain an ecological balance. But, certainly there is a limit upto which this purification process can go. When the quantity of impurities exceeds a limit, pollution is the outcome. That is exactly what is happening around us.

When seen from the black depths of space, the earth appears to be a lovely blue and white object with three-fourths of its surface covered with water. Next to air, water is the most important substance for all living objects on earth. The total quantity of water on earth has been estimated to be about 1574 million cubic kilometers. The magnitude of this figure will become clearer when one begins to realize that 1 cubic kilometer contains 34047 million litres of water. Of this, 97% is sea water, 2% is frozen water in glaciers and ice caps and the remaining 1% is what is available on land. The term 'marine pollution' is defined as "introduction by man of substances into the marine environment resulting in such deleterious effects as harm to living resources, hazards to human health, hindrance to

\* The word pollution comes from the latin root 'Lutum' meaning 'mud' and 'silt'.

marine activities including fishing, impairment of quality for use of sea water and reduction of amenities" (FAO. Fish. Rep. No. 99. Conf. on pollution, Rome, Dec. 1970). In general this definition covers all aquatic pollution.

### Causes and effects

Strong acids, other chemicals and toxic mineral wastes, pollute the once pristine rivers and streams. Agricultural pesticides poison and kill millions of fish and other forms of aquatic life. The role of the oceans and seas as vital links in the life-giving cycle on the earth may one day end if they continue to be polluted at the present rate.

Domestic sewage largely includes dissolved organic and suspended constituents. These give it a high biochemical oxygen demand (BOD\*) and a high concentration of nutrients (phosphorus and nitrogen compounds etc.). This type of pollution, to a certain degree, gives rise to enrichment of water or eutrophication.\*\*

Pesticides like DDT, Dieldrin, Malathion and Parathion are harmful to aquatic animals. Crustaceans are particularly sensitive to these chemicals, which in concentrations as low as 0.003 ppm have often been found to be lethal to shrimps. Fish have been found to tolerate even higher concentrations of these chemicals for short periods.

Inorganic wastes such as acids, alkalis, ammonia, phosphorus, mercury,

lead and many other materials are periodically discharged into the water, mainly from factories. Sea water, however, has a considerable buffering capacity; it can absorb relatively large amounts of acids and alkalis which undergo little change in pH. Inorganic effluents therefore, within limits, have only a localized effect. Fish and small crustaceans are able to detect concentrations of acids and alkalis much below the lethal (toxic) limit and will thus avoid these concentrations. The toxic action of both acids and alkalis is largely associated with the effect that they produce on the transfer of oxygen and carbon dioxide across the gill surface. At higher concentrations these substances corrode the gills which eventually will prove to be lethal.

Phosphate enters the sea via rivers and from the sewage. Nitrate is introduced into the sea from rainfall and land runoff. Ammonia is made available to the marine environment either through nitrogen fixation in the sea or by denitrification. Both these nutrients (nitrates and phosphates) are essential for increasing the productivity of the marine environment. But over-abundance of these can lead to situations when blooms of phytoplankton appear and these are generally followed by deoxygenation and anaerobic conditions.

The major sources of pollution by industrial wastes are the effluents from chemical factories and refineries. In many cases these are discharged directly into the rivers, estuaries and the sea. A variety of organic compounds thrown as wastes become toxic to marine organisms. In pulp mill wastes there are usually sulphur-containing compounds,

\*BOD - number of parts of oxygen absorbed by 10,00,000 parts of water in five days.

\*\*Eutrophication - The term (eutrophication) refers to natural or artificial additions of nutrients to bodies of water and to the effects of added nutrients.

arising from the wood digestion process and chlorinated phenolic compounds as a result of bleaching of the pulp. A high BOD is characteristic of untreated sulphite pulp effluents, and organic wastes. Many instances of fish mortality have been reported because of the depletion of oxygen in waters receiving effluents with a high BOD load. The effects of industrial organic wastes are often of a long-term nature. These interfere at various trophic levels of the food chain, and ultimately lead to a gradual depletion of the coastal marine resources.

Oil and oil-products enter the marine environment from shipping operations, both on the high seas and at ports, and also by the discharge of oil products into the rivers, sewers and finally to the sea (upto 5 million tonnes per annum). In general, oil is lighter than water and spreads fairly rapidly, forming a thin film, which moves over the surface by wind, waves and tides. The accident which occurred to the giant oil-tanker, *Torrey Canyon*, polluted vast stretches of water and beaches with crude oil. Such extensive films of oil affect the floating plankton and also the marine life along the beach. Much of the earth's supply of oxygen is produced by the phytoplankton of the sea, which are easily killed by the floating oil.

Thermal pollution or warm water discharge from industries and power plants also has a deleterious effect on the aquatic life. The worst offenders seem to be the atomic reactors, fertilizer and rayon factories. Besides killing the fish and smaller aquatic animals, the solubility of the salts present in water increases and when evaporation takes place, the concentration of dissolved salts increases. It also decreases the

solubility of oxygen in water and thus increases the metabolic activities of microflora and fauna. This in turn may lead to high BOD and eutrophication. Special care is therefore needed in erecting power stations which employ water for cooling, particularly in tropical areas where animals and plants have a rather narrow range of temperature tolerance.

#### **Aquatic pollution in India**

Our country has a coast line of more than 5000 km with a number of rivers and estuaries that periodically enrich the coastal waters with essential nutrients and minerals. The rivers, estuaries and backwaters serve as nursery grounds for many of our fishes and prawns. Lately, there have been complaints that our rivers, backwaters, estuaries and bays are getting polluted, resulting in considerable decline of fishery in these waters. It may be true that pollution of our waters is not so serious as in the industrially advanced countries, but a complacent attitude should not be taken before the problem becomes too far advanced. The rapid urbanization and industrialization without proper planning are the main causes of pollution in our waters. Most of our factories do not have proper waste treatment plants to control pollution. Most of our cities also lack sewage treatment plants.

Almost every river in India is to some extent contaminated or polluted. It can adversely affect the use of water for our domestic needs, industrial use, pisciculture and recreational activities. Cholera, typhoid and dysentery have long been known to be associated with polluted water. Organic matter consumes oxygen of water, kills the fish

and produces offensive smells. Excessive fertilizers in the water act as nutrients for weeds and algae in the rivers and estuaries which may then grow to alarming proportions. One of the best examples of this is the African weed (*Salvinia* spp.) which has become a menace in the backwaters of Kerala.

The river Ganga is a sacred river and for various reasons its water is considered pure and holy. But the havoc done to Ganga at Monghyr by the wastes from Barouni Oil Refinery is still fresh in our minds. What is true of Ganga is true of most of the other rivers in India. The conditions of Cooum and Adayar rivers and the Buckingham canal in the Madras city are really pathetic. Here the main pollutant is the sewage from the city. Fish have virtually disappeared from these waters and the area serves as a breeding ground for mosquitoes. The rivers and canals in and around Bombay city are other examples of the carelessness because of which pollution has become a menace. More than 100 industries including chemical and rayon factories are pouring their toxic wastes into the Kallu and Ulhas estuaries and these waters are so polluted that no fish can live in them. Adding to this, the city's sewers are also opening into these areas. It is reported that fish catch around Bombay has considerably declined in recent years.

The industrial growth and urbanization is now becoming a problem for Kerala, and as a result the rivers Kallayi and Periyar with their adjoining backwaters are becoming highly polluted. Once well known for its fishes, the Kallayi river is now a polluted stream because the effluence from the Mavoor rayons factory is discharged into it. The area between the factory and Beypore

harbour has become practically devoid of any fish life. The scientists from the Sub-station of CMFRI, Calicut, have reported fish mortality from this area due to pollution as early as 1968. Now the situation is so serious that the paddy cultivators of the area are agitating against the factory management because even the paddy fields are affected by the polluted river. Pollution of the river Periyar because of the adjacent industrial belt near Alwaye is becoming more and more widely known. Tonnes of hydrochloric acid, phosphoric acid, hot water and other effluents are poured into the river every day. All these flow into the backwaters enroute the Arabian sea, annihilating everything living. Sometimes the pollutants are so strong that even the trees along the shores get dried up.

The highly poisonous organo-phosphorus insecticides which are commonly used in the paddy fields (eg. Ekatox and Paramar, standard solution 100-200 cc/450 litres of water) remain in the medium for a very long time. These compounds affect the survival of fish eggs and larvae in our estuaries and backwaters. Their affects is felt to a greater degree on crustaceans which are more susceptible to these compounds than fishes. This may be one reason for the decline in the prawn fishery of backwaters in recent years.

#### Control and regulation

1. Domestic sewage should never be passed untreated into the river. It should at least be treated by such simple methods as settling, which reduces the polluting effect by about 50%. The sewage after sedimentation should be treated biologically and then oxidised.

2. Sources of industrial pollution in our rivers are increasing rapidly. The most economic way of reducing pollution is to incorporate the waste-treatment processes at the time of construction of plants. Normally it proves to be very expensive to introduce it in the process later on.
3. A country like India situated as it is in the tropical zone should take advantage of the bright sunshine and high air temperature for purifying the water used in industries, which could be utilized for irrigation or over and over again in the industries.
4. For better dilution it is preferable to store the effluents and sewage discharge at the time when the flow of river is low and then release it at the time when the flow is greater.
5. Legislation for the control of pollution is absolutely essential to avoid inter-state disputes. The formation of a high powered body like the Pollution Control Board is very essential if the rivers are to be kept free from pollution.

Over and above this, it is high time to educate the common man about the hazardous effects of aquatic pollution. It will be of much help to create an awareness amongst the public about this man-made evil. So far, there have been no serious efforts to assess the hazards caused by pollution of our waters. Even though marine pollution is not very serious in India as compared to industrially advanced nations, we cannot neglect it. There are very few agencies in India which have initiated some steps to assess the seriousness of this menace in our country. A new project which is being organized at the Central Marine Fisheries Research Institute for making an assessment of pollution and its effect on aquatic living resources should be considered a welcome move. ●

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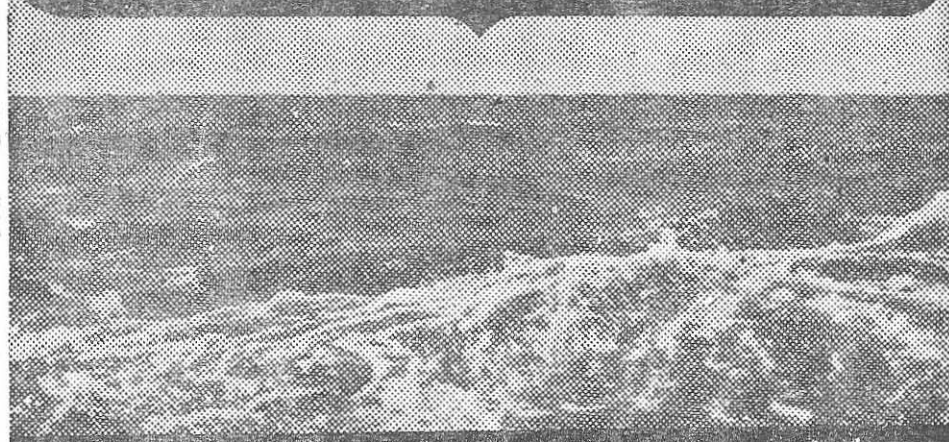
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