

Water pollution

Introduction

Water has a great self-generating capacity, that can neutralize the polluting interventions carried out by humans.

However, if human activities continue this uncontrolled and unsustainable exploitation of this resource, this regenerating capacity shall fail and it will be jeopardized definitively.

Man is now aware of this and is increasingly aware of the mechanisms that regulate the water cycle, and allow rivers, lakes, seas and oceans to live, and know where and how to intervene.

Pollution sources

Industrial and agricultural pollution

Its industrial origin is related to processing waste. It can occur when discharging the water used in productive processes that contains a high concentration of solved substances. Or it can occur when rainwater washes away solid waste dumping grounds. Or because of the accidental break of a tank and/or pipe that carries extremely polluting products that flow straight into the rivers or are spilled on the ground or underground and reach the water-bearing strata. There is also another form of industrial water pollution that does not concern its contents, but its temperature: thermal pollution.

Cooling waters are taken from the seas, lakes and rivers at a given temperature and, after use, are sent back at a higher temperature. This thermal difference often causes alterations in the marine ecosystem that sometimes can have non-negligible effects, but can actually lead to the disappearance of animal and vegetal species.

Water pollution of agricultural origin is produced by manure fields being washed down by rainwater or by the leaching of lands treated with chemical fertilisers, weed-killers and plant chemicals.

Household pollution

Water pollution of household origin is related to household waste. This waste is very often carried from the sewage works to the depurators, but not in all countries. In addition, also when it is collected and carried, there may be failures or inefficiencies in the sewage works, pipelines and depurators that may cause the polluted water to leak.

Water alterations

The different types of pollution cause chemical or physical alterations in the water through mechanisms that sometimes can be very complex.

The contaminants spread in the water are harmful to the animal and vegetal species; such effects can be divided into the following classes:

- deoxygenating effects: they are caused by organic substances contained in industrial waste that, once in the water, are degraded by micro-organisms, with an excessive consumption of the oxygen contained in the water. Since there is less oxygen available, the animal and vegetal species that cannot live without oxygen die, and those areas are invaded by other species that are not affected by the lack of oxygen;
- eutrophic effects: it is a phenomenon caused by substances (nitrogen and phosphor salts) that promote an abnormal growth of phytoplankton and seaweed populations to the detriment of other vegetal and animal species. This affects lakes and coastal sea areas in particular;
- physical effects: they are caused by wastewater at high temperatures;
- effects of radiations;
- pathogenic and toxic effects: they are caused by wastewater containing high concentrations of toxic or pathogenic substances in suspension (heavy metals, mineral oils, hydrocarbons, bleach, solvents, detergents, plant chemicals and so on).

Water regenerates itself

Fresh water basins, once polluted, have the capacity to depurate themselves, that is to bring water back to its original quality and purity. The self-depuration phenomenon is due to bacteria that, in the presence of oxygen, degrade and transform polluting substances into inert inorganic compounds. Obviously this type of process does not work with all pollutants and with for all quantities. In some cases man's intervention is needed in order to reclaim previously-contaminated water reserves.

The type of treatment to use in order to reclaim water mainly depends on the type of pollutant to be eliminated: reclamation is more complicated if there are many pollutants in the water.

In some cases polluted water is extracted and treated. It is then put back in the water-bearing stratum, river or lake. In some other cases an in situ treatment is done (that means without moving the water from its original place).

The sea also has a self-regeneration capacity, as it able to neutralize man's polluting actions. But if human activities keep on exploiting a resource that looks (but is not) inexhaustible, this regeneration capacity will be reduced, not allowing the sea to carry out all its current vital functions.

Man is aware of it and knows very well the mechanisms that regulate the water cycle and allow rivers, lakes, seas and oceans to live. Therefore we know where and how to act; the problem is to manage to improve and disseminate the good practices for a sustainable use of water all around the world, both in our communities and in those poor countries where the protection of natural resources is perceived as a luxury only reserved to rich countries.

Sea pollution

Sea and the ocean pollution

The use of seawater and the exploitation of marine resources may cause serious damages unless they are carried out in a way that guarantees its sustainable use, i.e. that guarantees compatibility between the marine ecosystems and man's activities. Unfortunately, in many cases, since the antiquity the sea has been wrongly considered as a huge dumping ground in which all waste and dirt could be freely thrown. And it is still considered as such by poorly educated summer tourists, especially those who use sailing or motorboats and throw all their waste into it.

Today, the main causes of pollution in the seas and oceans can be:

- pollutants from human activities discharged into the rivers and carried to the sea (degradable and non-degradable organic materials from urban waste, organic products of agricultural origin, such as plant chemicals and fertilisers, pollutants from industrial waste)
oil spilled by oil tankers, following accidents or improper practices when cleaning tanks or discharging ballast water;
- radioactive substances: released during nuclear tests, by now stopped in all countries, and when producing atomic fuels;
- overheating of coastal waters, due to hot water coming from industrial cooling plants;
- excessive exploitation of fishing resources (too much fishing), that causes the fishing populations to decrease or even disappear;
- uncontrolled urban development along the coasts and uncontrolled and massive seaside tourism;
- discharge of nuclear and toxic waste;
- discharge of plastic containers and other non-biodegradable solid waste.

Heavy metal pollution

The most dangerous are: cadmium, lead, mercury that can be harmful to human health even in very low concentrations, as well as being highly toxic and non-degradable. They accumulate in those organisms that occupy the highest levels in

the food pyramid: mercury pollution in the sea provokes the concentration of this metal in fish and the organisms that eat the fish, including men. Mercury that derives from the dumping of industrial waste and that reaches the sea is ever lasting and continues its cycle by passing from one organism to another through the food chain.

Eutrophication of the sea

Oxygen, light and mineral substances are very important for the sea, as they allow organisms to develop. These nutrients melt into the water and their excessive presence makes the sea particularly rich in organisms. In fact the result is an intense growth of algae and aquatic plants that develop rapidly, altering the balance of the ecosystem. Herbivores that eat algae and plants are not enough and do not manage to control these vegetal populations, that form a large quantity of decomposing material as they die. The decomposition and fermentation of dead organisms means consumption of oxygen, which is less and less available in the environment for those organisms that need it to survive. As a consequence the number of organisms drastically drops.

This situation might occur in the Adriatic sea, where the Po river waters collect the agricultural, industrial and urban waste coming from the plain of the Po. These polluted waters are rich in nutrients and in the summer of 1989 a phenomenon of eutrophication occurred in the Adriatic sea, which was largely covered by a layer of mucilage produced by unusually growing algae.

Do not pollute

In order to prevent water pollution of industrial, household and agricultural origin, over these years many countries have enforced stricter and stricter laws that oblige companies and public administrations to take special care of the prevention, control and reduction of water pollution. New technologies and new products have therefore been developed and used to produce goods and services with little or no water pollution at all.

Many international bodies, including the European Commission, have also issued a series of simple recommendations for a sustainable management of our water resources. These recommendations range from reforming the bodies in charge of managing the water resources to the definition of a suitable price for water in order to promote a more careful and less waste-orientated use of it. A sustainable use of water is actually based on not wasting it and on recycling it in productive processes: these practices may increase the availability and improve the quality of the water available in a place.

The problem remains, instead, in those countries where these laws have not been enforced yet or where compliance with these laws is not strictly controlled. In this case, we hope that, aware that water pollution is often something that goes behind a country's borders (if pollution gets into the water cycle, it can move to remarkable distances), the industrialised countries may find efficient methods to transfer clean technologies and suitable environmental laws to those poor countries that do not use them, either because they are too expensive or because they do not have the required knowledge and training.

Such behaviour would certainly bring us closer to a sustainable use of the natural resource of water all over the world.