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A systematic study of contribution of different type of pollution in water quality deviation

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Abstract

One of our most important natural resources is water, but like many of our other resources it is affected by the human activity and surrounding environment. The water that we use for drinking, crop irrigation, household uses and many other things should be healthy so that it provides good health. For its needs, in fact over 1/3 of earth's population relies on ground water, including 99% of the rural population in the U.S. ground water also moves around a lot, not only underground, but also as a source of discharge in to earth's stream, lakes rivers and oceans. But just because it's underground does not mean that ground water is safe from many of the same environmental issues that surface water faces. Ground water is the receptor of large quantities of waste products i.e. domestic, human, animal, industrial and agricultural which causes deviation in quality of water All potable water viz. open well, tube well, tap and canal are becoming polluted due to wastes waters of sewage, indiscriminate use of pesticides chemical fertilizers dumping off radioactive wastes in agriculture and public health programme. The influence of waste water and pesticides on drinking water would depend on its characteristics resistance to biodegradability before reaching these water sources. A number of studies have been carried out on water quality deviation due to pollution of water throughout the world.

Keywords: Water quality deviation, sewage, pesticides, dumping off, waste product, chemical fertilizers, resources

Introduction

Water is the most common liquid on our planet, vital to all life form. It is the dispersion medium for all biochemical reaction of the living process & takes part in many of reactions. The characteristics of water physical & chemical form is known as Water quality of water. It is a measurement of water requirement with respect to the human being or some other biotic species.

As we know that mostly anions likes chlorides, fluoride, carbonate, bicarbonate, nitrate & phosphate and cations likes Ca^{2+} , Mg^{2+} , Na^+ , K^+ are present in underground water of the earth. These ions are equally responsible to maintain the quality of water, so these ions are called water quality parameters. Since the excess quantity of these ions are harmful for human beings, so it is very necessary to asses these water parameters to know that they are good for health of ecosystems, safe for human being for drinking purpose.

Factors affecting water quality

1. Physical Parameters &
2. Chemical Parameters

Physical parameters include

- Temperature
- Turbidity
- Color
- Taste & Odour
- Suspended Solids
- Electrical Conductivity

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Chemical Parameters include

- pH
- Alkalinity
- Hardness
- Metallic ions
- Nonmetallic ions

The water which comes on earth through rain is associated with atmospheric gases like CO_2 , SO_2 and NH_3 . The rain water when reached into the ground gets percolated in soil and becomes underground water. Generally Underground water is clear and colour less but when water seeps down the ground it mixed with inorganic salts. The surface water resources continue to be contaminated with runoff water from agricultural fields containing pesticides, fertilizers, soil particles, chemical wastes from industries, sewage from cities and rural areas. During the analysis of former studies it is observed that the water present in ground surface of the earth get polluted drastically due to increasing human activities. It means that the ground water properties are largely changed by human and natural activities. Water resource management is an important parameter for development of any nation as it is directly related to the development & growth of the economy. Because of rapid growth of urban area, domestic & irrigation uses, prolonged discharge of industrial effluents, domestic sewage & solid waste dump, water quality & water quantity has been affected very badly. Since the chemical wastes of industries, sewage from cities & rural areas and the water comes from agricultural fields containing different types of chemical in the form of pesticides, fertilizers, soil particles etc mixed with surface water resources specially rivers, so most of Indian rivers are polluted hence National River Conservation Directorate (NRCD) has launched an action plan for several rivers. In surrounding water is distributed in different water sources such as rain, rivers, lakes, sea, ponds and ground water sources etc.

On globe there is a marginal change in environmental activities due to increasing population & industrialization. So in nature man made activities and use of fertilizers are increased hence there is a specific change in the physical, chemical and biological characteristics of air, water and soil. Specially water is highly polluted with various harmful particles of rocks & soils which produce mining process. Since the human being is suffering from various type of water borne diseases due to the use of polluted water so It is very necessary to check the level of water qualities likes acidity and basicity of water, color, odour and temperature as physical properties besides this softness and hardness of water, pH, biological and chemical oxygen demand, sulphate, chloride etc as chemical parameters because heavy metals like Pb, Cr, Fe, Hgetc produce water or chronic poisoning in aquatic animals. So there is needed to treat polluted water before use so that water borne diseases are prevented. As we know that water is very useful natural resource for human life and environment specially ground water. But in present, the quality of water is reduced due to human activities which are felts by its different color and odour.

Water quality deviation

The change in natural range of physico-chemical parameters present in water is known as water quality deviation. This deviation in water quality is arises due to the pollution. In

polluted water there are a number of undesired particles such as soil particles, agricultural waste, chemical contents, gaseous pollutants, radioactive particles, sewage waste particles etc are present which play a major role in water quality deviation which can be described as follow:-

Role of soil pollution in water quality deviation

The contamination of soil with rain, excess of fertilizers, insecticides and herbicides is called soil pollution insecticides are the chemical compounds which can kill the insects while herbicides are those chemical compounds which can kill plants. The main sources of soil pollution are following as:-

1. Acid rain - The excess quantity of SO_2 and H_2O forms sulfuric acid and nitric acid which comes down the atmosphere as acid rain which increase the acidity of soil as well as water.
2. Repeated or excess use of same fertilizers may pollute the soil. E.g.- When ammonium sulphate is used as fertilizers in excess than NH_4^+ ion absorb by crops but SO_4^{2-} ions get accumulated into the soil. Which makes the soil as well as water highly acidic that is unfit for plant and human growth.
3. Since the inadequate drainage system certain excess amount of salts. When this drainage system is used in agricultural fields than soil and water will become highly saline which is harmful for crops and human beings.

Role of gaseous pollutants in water quality deviation**1. Carbon monoxide (CO)**

It is a very dangerous gas which is slightly soluble in water. The incomplete combustion of coal, industrial wastes, nutrients, cigarette smoke etc increase the CO level in water as well as air. The natural sources like forest fires, seed germination also generate carbon monoxide gas. It is have toxic effect on human as well as animals. Since the affinity of CO gas with Haemoglobin is greater than oxygen. The excess quantity of CO binds up with Hb as compared to O_2 and forms carboxyhaemoglobin (HbCO). As a result the supply of O_2 gas to the body cells gets reduced which produces suffocation and may lead to death. This is called anoxia or oxygen starvation.

2. Carbon dioxide (CO₂)

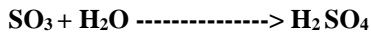
The small quantity of CO_2 is not act as pollutant but the excessive amount of CO_2 in the atmosphere acts as air pollutants. As we know that there are a protective layer of O_3 gas is found in the atmosphere at the high of 23 km from the earth surface, and then a blanket of CO_2 gas was exists in the lower part of the atmosphere that is lies of 15 km from the earth surface. The excessive amount of CO_2 gas helps in the thickness of CO_2 layer. This CO_2 layer allows the infra-red rays fall on the earth but don't allow the infra-red radiation reflected by the earth's surface to go out of the atmosphere. It means that the CO_2 layer trapped the IR-rays coming from the earth surface. These trapped rays heat the earth's atmosphere. "The heating up of earth due to the trapping of infra-red radiation by CO_2 layer in the atmosphere is called "greenhouse effect". This greenhouse effect is responsible for climate change in atmosphere which caused deviation in water quality parameter.

3. Oxides of nitrogen

NO and NO₂ are two important oxides of nitrogen which are responsible for acidic rain. There are severe ecological impacts of acidic rain. It makes the water as well as soil so acidic that they can no longer support fish life and the yields of agricultural crops are also reduced. NO₂ is very corrosive and attacks skin. It also forms smog which causes irritation in eyes. The above discussion explains that the acidic rain changed the normal range of water parameters.

4. Oxides of sulfur

The oxides of sulfur like SO₂ and SO₃ produced sulfuric acid by reacting with rainy water or moisture.



The formed sulfuric acid comes down the atmosphere in the form of sulfuric acid rain which increases the level of sulphate ion parameters in water.

5. Ozone (O₃)

The presence of nitrogen oxides in atmosphere catalyzed the reaction between ozone and nitrogen oxide which caused the depletion in ozone layer. As a result there are the effects of global warming. This is responsible for increasing in temperature of aquatic and earth environment. It caused the change in physio-chemical parameters of water.

Role of agriculture in water quality deviation

Agriculture plays an important role in water pollution. Agriculture is a major cause of water pollution. 70% of water is withdrawn for agriculture. Agriculture releases most of polluted water of world, due to this polluted water many animals and human beings lose their life and some of them get a serious disease. These diseases have a very less chance of cure. The major keys of water pollution caused by agriculture are diagenesis, predation and monotoning. Water pollution is caused due to agriculture pollution and agriculture is polluted due to the intensive use of chemical fertilizers. Farmers use the fertilizers for the more production of crops, fruits etc. Due to the over use of these fertilizers the soil becomes infertile and soon the land becomes barren.

Because of the over use of chemical fertilizers the important biological factors are destroyed like earthworms. Due to this the crops are totally poisonous for human beings as well as animals. Due to the destruction of earthworm they cannot perform their function or they cannot destroy the bacteria developing in the crops. Fertilizers involve many ions which are harmful if we use them in more quantity. In olden times farmers used cow dung and biological factor for agriculture. But in modern methods of agriculture farmers used chemical fertilizers which is important for agriculture. They include nitrogen, phosphorus, potassium, sulphur, magnesium and calcium. But if we use these chemical fertilizers in maximum amount then it becomes harmful for us.

Fertilizers can be natural or man made. But over use of fertilizers supports the growth of algae & bacteria. Then the dying algae converted in feed bacteria which have include too much dissolved oxygen that is harmful for fishes, water bodies, animals, as well as humans. Some of the algae release toxic substance that is harmful for everyone. Fertilizers include nitrogen and phosphorus and some amount of potassium. Nitrogen and phosphorus plays an

important role in pollutants. Nitrogen has nitrate which is soluble in water, highly used nitrate is harmful for humans, especially children. Lower used nitrate can die to amphibians. These gases can cause acid rain which can cause skin cancer, destroy the fertility of soil etc.

So to stop water pollution government has to make specific policies because it is a challenge for world to stop water pollution. Firstly, farmers should use natural fertilizers like cow dung, biological factor etc. because the use of artificial fertilizers destroy the land and make the land barren. If farmers will use natural fertilizers the earthworms will not get harmed and they can perform their function of as they take nutrients from the soil and transfer to the roots of the plants. Earthworms help in to increase the soil fertility. If the soil fertility will increase then less land will become barren. As earthworm increase the air and water nutrients in soil which helps crops to grow more. And it will prevent water pollution.

As water pollution can cause from other medium such as agriculture, bathing of animal in rivers, ponds and lakes etc. People use that water for many purposes like cooking, drinking, bathing which causes a serious disease due to this many people, animals have to lose their life. As water pollution can be caused by waste released by factories. As they make channels which directly merge in river, ponds, lakes etc. people make factories mostly near the rivers. As by agriculture practice keeps a more impact on aquatic life. Due to this the water nutrients are absorbed and the water which has chemical fertilizers absorbed by soil which goes in ground water and then regulated to homes. This has a major impact on human beings and animals. We can control water pollution caused by agriculture as we can stop to store dirty water across the farms, use of chemical fertilizers etc. Water pollution also caused by air pollution as many toxic gases are released in environment and these gases go upward in stratosphere and they cause acid rain which pollutes rivers, lakes, ponds etc. These gases also mix directly with water and make water dirty which causes health hazards. So we should not use chemical fertilizers. As chemical fertilizers mix with air and in the form of water droplets it causes water pollution.

Role of radioactive pollution in water quality deviation

Water quality deviation due to radioactive pollution is caused by the presence of atoms with unstable nuclei that we say radionuclides. In order to become the atom stable it emits energy in the form of rays or sometime high speed particles. These rays are known as ionizing radiations because these are formed by the displacement of electrons, which then results in ion formation. There are three types of ionizing radiations that are alpha rays, beta rays and gamma rays. Gamma rays are most harmful because of its high energy and high penetrating power. Penetration power order is the biggest difference in all these rays. Radionuclide's present in water and food results in greater health risk because it damages our cells and tissues. Now a day's radioactive ions are present in water in greater amount because of excessive development of industrialism or nuclear power plants or laboratories.

In whole earth water minute amount of radiations are always present. Water from wells, tube wells may also contain radioactive ions like uranium, thorium and radium. Water quality degradation due to radioactive substance became very serious issue after Fukushima Daiichi nuclear disaster,

which was occurred in 2011 in Japan. In a brief discovery it is estimated that about 20% of the radiation we come across are due to human activities. Radioactive nature present in the surface of water is mainly due to presence of radioactive ions in the earth's crust. Radionuclide's which are present in drinking water are the members of three radioactive series such as uranium, thorium, actinium and naturally appearing elements like radium, radioactive gas such as radon is also included in it. Radium ion can get concentrated in the bones and also can cause cancers. Uranium can have a toxic effect on kidney.

The radioactive substances contamination in aquatic ecosystem may cause health issues sometimes it may cause the reason of death. Uranium-238, Radon-222, Polonium-210, Lead-206, Radium-226 is the most common natural alpha particle in rocks. Very high amount of radioactive ions are found in ground water which is present near the areas where mining industries runs. When radioactive rays come in contact with water it mainly effects the equilibrium state in water. When radioactive rays are absent water does not spontaneously decomposed and the equilibrium is reached near the far to the right. But when radiation fall on the water this does not happens because of large activation energy is required to reach the condition of equilibrium mentioned above. That is why radioactive rays increase the rate of both the forward and backward reactions.

Radioactive rays are very harmful to living organisms. These rays damages living cells or stop functioning or work or might be not able to reproduce cancer caused in living being is also due to radioactive rays. In cancer suffering organisms the uncontrolled division of cells takes place. When radiation falls on cells, bronchogenic cells are converted into oncogenic cells and cells also start showing the property of contact inhibition means the cells which are present near the cancer causing cells also due to natural contact starts to divide.

Radiation also causes the impact on reproductive property of living beings. It may also causes sterility that is unable to reproduce an organism. When radiations fall on offspring it causes mutations in it which is usually uncurable or sometimes even fatal. Radiations have more harmful effect on animal than plants. When these radiation falls on cornea it may cause cataract, snow blindness, radiations also cause skin cancer in human beings. There are some types of microbes are also present in the world which are highly resistant to these radiations. These radiations cause mutations which causes speciation which results in evolution. It means because of radioactive rays evolution process also takes place. But recessive mutations only results in evolution, if the mutation is dominant it results in death.

Radiations effect plant growth and development in various ways like UV rays gradually stop seed growth and sprouting of seeds depend on what types of radiations falls on it. Radioactive elements in soil make soil unfertile or lose its nutrients that are needed to plants for growth. Radioactive rays also effects stomata functioning in plants. UV rays damages plant cells. These rays damage the reproductive ability of plants. These rays are sometimes so harmful for plant that it results in death. Effect of radioactive rays on aquatic life is same as that of living organisms. It causes various types of diseases, mutation & dominant mutations leads to death. Radioactive rays effects aquatic food chain.

Conclusion

After the detailed study of water resources we get informations that the water of the field is quality less with respect to drinking purpose. Since the physio-chemical parameters of water shows deviation with their desirable range. After the deep study of the field we get knowledge that the people suffering from physical disorder likes knee pain, body weakness, Diarrhoea, Blue baby syndrome, paleness of teeth, Hair loss (Alopecia), weakness in backbone, osteoporosis, heavyness stomach, malnourishment or malnutrition, impotence etc is caused by the deviation in phyco-chemical parameters of water. Beside this the other qualities of water such as lacking in sweetness, lacking in transparency, stink in water, lacking in digestion capacity etc also created by deviation in water quality.

When the qualities of water undergoes divergence due to the mixing of waste product in water than it is known as water pollution. There are many types of waste product like sewage, industrial waste, agricultural waste etc. Beside this there are some additional pollutants such as insoluble solid particles, soluble salts, garbage, low level of radioactive substances, algae, bacteria etc which play a major role in water quality deviation. So it is necessary to minimized water quality deviation. The deviation in water parameters can be minimized by the following methods:-

- a) The excessive use of fertilizers containing nitrate and phosphate salts should be avoided because both have high toxicity level.
- b) Despite the use of non-degradable synthetic detergents, bio degradable detergents such as washing soda, soap should be used. Because the bio-degradable detergents can be easily destroyed via decomposition by the microorganism like bacteria.
- c) Before releasing the industrial wastes from industry it should be chemically treated to make chargeless the harmful material present in it then it released into the rivers and lakes.
- d) The water of sewage should be dumped into the rivers and other water bodies after the removing of organic compounds from it.
- e) Since the radioactive waste products are used in hospitals and scientific laboratories which are highly toxic. So there should be proper management of enclosing these radioactive materials. So the containers which are prepared by the use of concrete are used for this purpose.
- f) The farmers should be used bio- fertilizers instead of chemical fertilizers because the decomposition rate of bio fertilizers is higher than chemical fertilizers. So bio-fertilizers can be easily decomposed.
- g) The population of the area should be controlled because all type of problems are creates due to the dense population.

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