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Pollution of soil and rocks caused by chemical discharge of Industries

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Abstract-

Chemical pollution is caused by the release of chemicals from both industrial and domestic origins. It can result from the use of pesticides, detergents or heavy metals. Today, chemical pollution is not considered in the bathing water quality controls. However, it represents an important risk to human and marine life.

Soil pollution comprises the pollution of soils with materials, mostly chemicals, that are out of place or are present at concentrations higher than normal which may have adverse effects on humans or other organisms. It is difficult to define soil pollution exactly because different opinions exist on how to characterize a pollutant; while some consider the use of pesticides acceptable if their effect does not exceed the intended result, others do not consider any use of pesticides or even chemical fertilizers acceptable. However, soil pollution is also caused by means other than the direct addition of xenobiotic (man-made) chemicals such as agricultural runoff waters, industrial waste materials, acidic precipitates, and radioactive fallout.

Both organic (those that contain carbon) and inorganic (those that don't) contaminants are important in soil. The most prominent chemical groups of organic contaminants are fuel hydrocarbons, polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), chlorinated aromatic compounds, detergents, and pesticides.

Keywords- Soil, discharge, pollution , rivers.

Introduction-

The increasing industrialization has led to the pollution of soil through the discharge of effluents by the industrial units. Each kind of soil has its own individuality. The distinctive feature of this individuality is the soil profile, which consists of series of layers different from one of percolation of the waste water discharged into the land and the subsequent washing down of the pollutants to the successive horizons. The effluents discharged by the industrial units onto land contain many toxic chemicals, mineral acids, bases etc. which over a period of time get deposited in the soil due to their retention and adsorption on the soil particles. The mineral constituents present in trace amounts in the discharged effluent favor the growth of some algal, fungal and bacterial colonies which in turn change the texture of the soil. The micronutrients discharged into the soil through effluents reduce the porosity of the soil resulting in poor yields. Also some of the deposited chemicals may be taken up by the plants/ crops growing in such contaminated soils. Organic effluent with high concentration of biodegradable organic matter discharged into the soil attract the saprophytic soil and air micro flora and thus could proliferate resulting in poor yields or fungal diseases in many cases.

Chemical pollution includes a long list of chemical products used in daily life, mainly in three sectors: agriculture (pesticides, nitrates etc.), industry (heavy metals) and medicine (pharmaceutical products, medicated residues). All domestic products such as cosmetics and household products are included as well.Those chemical pollutants, from treated water of not, industrial effluents and agricultural run-off infiltrates rivers, lakes and coastal waters. And what are the results? Appearance of foam in the rivers and seas, eutrophication (the presence of nitrates and phosphates stimulates algae bloom) that kills the waterways and suffocates aquatic life, disturbance of growth and reproduction of the marine fauna, etc.Toxic substances contained in polluted water can be stored by aquatic plants. Their consumption can provoke digestive diseases. More generally, the harmful products are all absorbed (in different measures) by the marine organisms.

Chemical pollution, mostly invisible, can be found in the food that we eat and in the water where we drink and bathe.Some of these pollutants act like endocrine disruptors, others enter through our skin. They are also found in the food chains, from microorganisms to the big fishes that we eat.

Physicochemical Analysis- Analysis was carried out for various water quality parameters such as pH, Electrical conductivity (EC), Dissolved oxygen (DO), Total alkalinity (TA), Total hardness (TH), Calcium hardness, Magnesium hardness, Chloride (Cl^-), Nitrate, Sulphate, Ortho Phosphate and TDS using standard methods laid down by APHA 1998

Electrical conductivity- Electrical conductivity is a measure of water capability to transmit electric current and also it is a tool to assess the purity of water. Its value depends on the concentration and degree of dissociation of the ions as well as the temperature and migration velocity of the ions in the electric field. Thus, as concentration of dissolved salts increases conductivity also increases. It depends upon the presence of ions, their total concentration, mobility, valence and temperature

Total dissolved solids TDS originate from dissolution or weathering of the rocks and soil, including dissolution of lime, gypsum and other slowly dissolved soil minerals. Dissolved mineral gases and organic constituents may produce aesthetically displeasing color, taste and odour (Figure 5). According to WHO and Indian standard, T.D.S. value should be less than 500 mg/L for drinking water which can be extended up to 1500 mg/l in case of non-availability of any other alternate source, and value of TDS in our water sample range from 151.8-245.8 mg/l. TDS concentration in water vary considerably in different geological regions owing to differences in solubility in minerals (WHO, 2006).

Turbidity is the cloudiness of a fluid caused by individual particles that are generally invisible to the naked eyes. The measurement of turbidity is key test of water quality. Turbidity measures of light on the suspended particles in waters using nephlometric turbidity unit (NTU) and 5 NTU is usually acceptable for drinking (WHO, 2006). In surface waters, the turbidity depends on the type of steam bed, velocity of waters, channel depth, type of bank and shape of channel [2]. In the present study the turbidity value ranges between 72-95

Dissolved oxygen is an important water quality parameter in assessing water pollution. Oxygen is fixed in water either due to the direct dissolution from the atmosphere or a result of primary production Dissolved oxygen of our water samples ranges between 3.2-9.0.

Groundwater contamination occurs when man-made products such as gasoline, oil, road salts and chemicals get into the groundwater and cause it to become unsafe and unfit for human use.

Materials from the land's surface can move through the soil and end up in the groundwater. For example, pesticides and fertilizers can find their way into groundwater supplies over time. Road salt, toxic substances from mining sites, and used motor oil also may seep into groundwater. In addition, it is possible for untreated waste from septic tanks and toxic chemicals from underground storage tanks and leaky landfills to contaminate groundwater.

Contamination from Industrial Wastes

A study was conducted of industrial pollution in lowland rice areas in the district of Rancaekek, West Java. These areas are being polluted by heavy metals from sewage sludge produced by the textile industry. This waste is disposed of directly into three rivers, all of which are used to irrigate lowland rice. About 720 ha of lowland rice fields were polluted in this way.

Soil surveys by Kurnia (1999) revealed that there were very high concentrations of boron, cadmium and lead in three villages in the Rancaekek district. Falling soil productivity in these areas caused a reduction in rice yields and farmers' incomes. After 20 years of contamination, the average rice yield had decreased by about 80%. The initial rice yield of about 4-6 mt/ha had become 1 mt/ha. However, the heavy metal content in the soil had increased by about 18% - 98%, compared to unpolluted soil.

A greenhouse study using polluted soil from this area showed that high concentrations of lead, cadmium, copper, chromium and boron were found in the plant tissue, roots and grain of rice. Most of the pollutants had accumulated in the root system.

Contamination from Agricultural Wastes

A study carried out by Adiningsih et al. (1998) in an area of intensive lowland rice farming in West Java found that the levels of lead and cadmium in the soil were fairly low. Lead was present in soil samples in a range of 10 - 43 ppm, while the levels of cadmium were 0.19 - 0.49 ppm.

The content of lead and cadmium which were present may have originated in applications of phosphate fertilizer. The cadmium content of phosphate fertilizer in Indonesia is 35 - 255 g/mt (Alloway 1995).

Phosphate fertilizer is essential in intensive agriculture, especially in Indonesia with its high rainfall and rapid leaching. These conditions result in a low soil pH and high levels of iron and aluminum oxide. These in turn immobilize the phosphorus in the soil solution, and hinder its uptake by plants.

Based on the levels of lead and cadmium in rice, Kasno et al. (2000) found that intensive lowland rice areas in two districts of West Java could be divided into three categories: Highly polluted soils, soils with medium pollution, and unpolluted soils (Table 1(1087)). Only 7% of the total lowland areas studied were polluted by lead, and about 4% by cadmium. These results indicate that after 30 - 40 years of phosphate application, the productivity of these soils could still be sustained.

Another study was conducted in tea plantations in an area of West Java which is important for agroforestry and tourism (Sofyan et al. 1997). The aim of the study was to see the effect of air pollution by automobiles on soil quality. The result of the soil survey showed that the lead content of the soil in the plantations increased near main roads (Table 2(1038)). The level of soil pollution by lead, most of which was produced by petrol combustion, depended on the distance from the main road. However, the cadmium content in soils was not influenced by the distance from the main road. This indicates that the cadmium content in the soil was not the result of air pollution, but may have resulted from the application of high levels of phosphate fertilizer in these areas.

Contamination from Gold Mining and Smelting

Gold mining is carried out by individuals rather than companies in Junung Pongkor, West Java. They use traditional methods for separating the gold from the raw material. The main waste product from this process is mud and rubble which contain a high concentration of mercury. These wastes are disposed of directly in the Cikaniki river, which is also used as a source of irrigation water in the lowland rice areas around the mining areas.

A soil survey conducted by Kurnia et al. (2000) in this area found that the soil surrounding the traditional mining was polluted by mercury. The pollution covered the land around six villages (Table 3(1279)). The concentration of mercury in soil near the mining was higher than in more distant soils. A high concentration of mercury was found in rice straw and rice grain. All of the values were higher than the maximum permitted level of mercury in soils (0.5 ppm).

Remediation and Rehabilitation of Soils Contaminated by Heavy Metals

Soil contaminated by heavy metals may pose a threat to human health if the heavy metals enter the food chain. Remediation should be carried out to ensure that agricultural produce from such areas can safely be eaten.

Remediation can be achieved in several ways: physical, chemical and biological. A study has been carried out by Roechan et al. (2000) on the use of vetiver grass (Vetiveria zizanioides) and zeolite to remediate contaminated soils in Bekasi, West Java.

The results showed that vetiver grass could grow well on soils contaminated with high concentrations of lead and cadmium. By concentrating the contaminants in its roots, the vetiver grass reduced the concentration of lead in soil by as much as 38 - 60%, and cadmium by 35 - 42%

The application of 500 kg/ha zeolite increased the growth and yield of rice growing in contaminated soils, and decreased the total concentration of lead and cadmium by up to 1.5 times. Zeolite reduced the level of available lead and cadmium by half. In addition, the application of zeolite reduced the lead content of rice straw by 56%, and of rice grain by 69%. It reduced the cadmium content of the rice grain by up to 67%, compared to the control.

Review

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