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Analysis of Physio-Chemical Characteristic of the Roadside Polluted water of National Highway at Berhampur City, Odisha

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ABSTRACT

Physiochemical analysis of polluted water samples collected from vicinity of National Highway was carried out. Different parameters like pH, TDS, BOD, COD, DO and different heavy metals were determined by standard analytical methods. The result observed that the waste water pollution load is decreased when the distance increased from NH. Polluted water besides NH indicates high pollutant load. Polluted water with more pollutants not treated properly is act as source for other pollution like soil, air and water through leaching, percolation, weathering and downstream flow. Hence, proper management and amendment of polluted water bodies caused by vehicular emission on the both side and around National Highway is essential for human health and environmental protection.

Key words: Heavy metals, Waste water, BOD, COD, vehicular emission.

INTRODUCTION

The history of Human civilisation reveals that water supply and civilisation are almost synonymous. Water plays a vital role in our life. It is most abundant and useful solvent in nature, 80 % of the earth crust is covered with water. The quantity available for actual use in the form of rivers, lakes, and wells pond is hardly 0.5 % of the world water resources. Rapid industrialisation and urbanisation requires transport through vehicle as an essential part for development and progress. But this vehicular dependent progress of life process emitted a huge amount of pollutant which modify our most essential part i,e, environment. The primary products of vehicular emission viz, smoke, heavy metals and other oxidised products interact with component of environment and produced secondary pollutant and particulate matter of different size. Hydrodynamics of pollutant in the water bodies changes the quality of water and soil through percolation, leaching and by formation of organic complexes and legends. An understanding of polluted water chemistry is the basis of knowledge of the multidimensional aspects of aquatic environment chemistry which involves the sources, composition, reaction and transport. Polluted water bodies beside road and vicinity with different pollutant enters in aquatic animal and other plants either directly or indirectly through food chain and creates health hazard and even death. Industrialisation and urbanisation resulted in successful pollution of water resources available on the earth, which caused significant effects in the aquatic ecosystem, plant and animal [1].Certain traffic centres of some of the major cities of the world have been reported to have severe pollution levels caused by automobiles and the exhaust pollutants include hydrocarbons, oxides of nitrogen, oxides of sulphur, carbon monoxide, carbon dioxide and evaporative emissions of fuel [2-3]. Heavy metal enrichment in road dust and surface soil causes negative consequences on environment and human health [4].

Basing on above facts an attempt was made to study the quality of road side and vicinity area's polluted water mostly caused by vehicular emission in city of Berhampur, Dist.-Ganjam, Odisha.

MATERIAL AND METHOD

Investigation was conducted at Berhampur city. National Highway-59 is connected between Gopalpur and Raipur. About 15 Kms of NH-59 connected and surrounded by Berhampur central city area which is the major polluting source for pollution of water bodies. The samples of polluted waters were collected from beside of the road and at a distance of 5, 50, 100,150 and 200 M. The samples were stored at room temperature and an immediate analysis was made using standard methods [5].

pH of the waste water samples were determined by using pH meter (Elico). Total dissolved solids were determined gravimetrically after filtering 200 ml water through 42 mm filter, BOD by winkler's method, COD by titrimetric method. Heavy metal in polluted water was determined by standard analytical methods.

RESULT AND DISCUSSION

In present investigation the pH values of polluted waters were ranges from 6.11 to 7.43. The results indicate that beside of NH polluted water was more acidic and its value shifted towards neutral or alkalinity when distance increased from NH. Total dissolved solids of polluted water exhibited more or less as in pH values. TSD of polluted water decreased with increased distance from NH and values ranges from 1680 to 1015. Dissolved oxygen of polluted water samples near NH side were found very low content, its content exhibited a positive correlation with source and sink distance and the values ranges from 4.30 – 8.85 (Table-1). These findings corroborate with the findings of other workers [6] .High value of TSD and acidic pH of the polluted water are due to addition of impurities like dust, particulate matter of different size, oxidised form of heavy metals. These impurities concentration in water bodies of NH vicinity is inversely proportional to distance.

In natural and polluted water, DO levels depend on the physical, chemical and biological activities of the water bodies. Oxygen presence in water may be due to direct diffusion from air and photosynthetic activities of aquatic autographs. The dissolved oxygen content directly correlated to distance of NH because impurities load is maximum on water bodies at lesser distance in compare to more distance. The BOD values ranges 1015-1680 and COD values ranges 740-1020 are extremely high indicating excess of pollution load. The pollution

Table 1: Physiochemical characteristic of the road side polluted water samples collected from National highway 59

Parameters	Polluted water samples sites basing on distance from National Highway				
	Site-15 M	Site-150 M	Site-1100 M	Site-1150 M	Site-1200 M
pH	6.11 ± 0.11	6.28 ± 0.09	6.78 ± 0.08	7.12 ± 0.12	7.43 ± 0.16
TDS (mg/l)	1680 ± 0.49	1410 ± 0.47	1270 ± 0.44	1140 ± 0.37	1015 ± 0.31
BOD (mg/l)	1020 ± 0.31	960 ± 0.31	815 ± 0.31	716 ± 0.31	695 ± 0.31
COD (mg/l)	1440 ± 0.29	1235 ± 0.26	1120 ± 0.25	1002 ± 0.23	898 ± 0.21
DO (mg/l)	4.3 ± 0.16	5.8 ± 0.17	6.9 ± 0.19	7.6 ± 0.21	8.4 ± 0.22
Lead(mg/l)	6.9 ± 0.19	5.3 ± 0.18	3.8 ± 0.19	2.9 ± 0.13	1.6 ± 0.14
Cadmium (mg/l)	0.38 ± 0.08	0.32 ± 0.06	0.24 ± 0.05	0.18 ± 0.02	0.11 ± 0.02
Zinc (mg/l)	412 ± 0.28	342 ± 0.23	293 ± 0.29	205 ± 0.25	157 ± 0.19
Copper (mg/l)	218 ± 0.21	179 ± 0.19	138 ± 0.17	97 ± 0.14	62 ± 0.13
Chromium (mg/l)	1.42 ± 0.13	1.23 ± 0.11	1.11 ± 0.07	0.9 ± 0.06	0.74 ± 0.05
Nickel (mg/l)	106 ± 0.17	82 ± 0.15	68 ± 0.14	59 ± 0.12	36 ± 0.11

load, DO, BOD and COD values were exhibited more or less similar trend of results basing on polluting water bodies and distance of pollutant source. The pollution load may be changed the physical quality of water by redox reaction with impurities and biological process.

Heavy metals of the polluted water samples were analysed and found that zinc is the highest and cadmium is the lowest in all tested samples. Other heavy metals showed intermediate values. This result is consonance with other workers [7] in suspended dust of NH, [8] in the dust sample of residential area. All heavy metals were found higher concentration in compared with its standard values in the vicinity of highway. The heavy metal concentration is inversely proportional to distance between NH and collected samples. The metal concentration in samples of beside NH were exceed average standard of natural soil. Vehicular emitted large sized lead particle deposited vicinity to the road [9].

The highest concentration values were observed with Lead, because of tetraethyl lead emission through the exhaust pipe, a common ingredient in motor vehicles. Similar results have been reported by some authors in street dust and urban soil [10]. Zinc and chromium concentration were moderately high in the traffic related street dust [11].Traffic density of urban area resulting in occurrence of slow traffic, repeated stoppage of vehicles, more abrasion of asphalt, tire and brake lent which lead to discharge of Zn, Ni, Pb, Cd, and Cr metals in the environment. These metal produced secondary compounds and ultimately added or sediment in water bodies. Heavy metals were mostly found in different solution phase.

Cadmium originates mainly from petroleum combustion and it is also a component of brake lining and tire rubber. Cadmium is mainly bound to the organic substances of the samples and to be Fe-oxide fraction of the material. The major source of chromium is air conditioning coolants, engine parts, brake emissions, wear and tear of chrome plated vehicular parts, yellow paints on the road used for marking and metallic products. Copper and zinc originates mainly from brake lining, engine decay and oil fraction and combustion. Cupper is almost entirely in its bioavailable form, mainly bound to the organic fraction of the dust samples, easily resealed under oxidative conditions.

It can be concluded from this experimental studies that traffic related heavy metal mobility and deposition in the water bodies of beside NH and vicinity area is highly polluted and exceed from normal standard limits. High concentrations of heavy metals through vehicular emissions act as a direct source of potential toxins in the urban water environments. These heavy metals may be bio transmitted to human body directly through drinking water and in food chain. Management of traffic related heavy metal pollution can be curtailed in shape of alternate fuel i.e. natural gas instead of liquid and solid fuel which produced more heavy metal pollution. This findings will facilitate the characterization of vehicular emissions and are significant from an environmental management perspective, especially for the control of urban water pollution.

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