Dissolution characteristics of heavy metals in Swarnarekha River

By

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ABSTRACT-

The reams of gold originating from Piska Nagri near Ranchi, called Swarnarekha River which inspires many reasearchers, poets and film makers to explore its beauty and work on it. The riverwater acts a source for municipal water supply, as well as for industries and agriculture. Several mining and metal extracting industries are found along its bank like H.C.L situatedat Ghatsila,UCIL at Jadugora and Tisco plant in Jamshedpur. The river water is rich in heavy metals like Copper, Iron , Zinc , Uranium , Gold , Silver, Nickel , Lead , Selenium , Antimony , Arsenic and Mercury . Quantitative analysis of heavy metals in river water has been carried out by using Atomic Absorption Spectrophotometry. The heavy metal pollution in river water is a serious concern as it affects the life of aquatic organism, as well as the human population of the nearby areas. The heavy metal contamination has detoriated the quality of water its pH as well as its taste. The aquatic organism assimilate these heavy metals resulting accumulation of these metals in their body ,Cu ,Zn and Fe are important metals which are required by our body and acts as micro nutrition but it becomes toxic at high concentration .
My work is to analyse and study the dissolution characteristic of heavy metals which are present in swarnarekha river and its effects on the aquatic as well human population .By using Sequential extraction procedure (acid soluble, reducible and residual)the trace metals present in river water is identified and metal determination is done by AAS .(Atomic Absorption Spectrophotometer)

Key words –Sequential extraction, AtomicAbsorptionSpectrophotometer, contamination, trace, accumulation.

INTRODUCTION

Rivers plays a vital role in our life rivers is a stream of water that flows through a channel, riversare considered as purest form of water as it come from rain or snow and it can be used as drinking purpose unless it is polluted .India is considered as a land of rivers, river water is used for many purposes like its acts as a home for many aquatic life also river water is used for drinking, bathing, washing for generating electricity etc. .

River swarnarekha which is situated in the east Singhbhum originating from Nagri Piska Ranchi and flows through Jharkhand ,west Bengal and Odisha and ultimately meet at bay of Bengal at Talsari .

A large number of industries are situated near the bank of this river ,so it acts as a sink for industrial discharge .Domestic waste ,urbanization and industrial activities all contribute to the heavy metal pollution of river .these heavy metals effects the life of aquatic organism .Although Fe,Cu,Zn are such metals which are required by aquatic animals but at the same time Cd ,Cr,Pb like metals are harmful and causes bladder cancer ,lung cancer ,this affects the reproductive,immunological ,gene tonic mutation etc.it is very important for managing the metal pollution in order to save the aquatic life .

The main objective of this study is to

1. To analyse and evaluate dissolve heavy metals in river water.

2. Identifying the factors responsible for heavy metal pollution.

3To identify the health risk due to heavy metal contamination.

STUDY AREA.

The swarnarekha river is situated in east Singhbhum Jharkhand Ghatsila ,this region have copper mines ,Rakha mines Kendadih mines uranium mines bagjata mines ,turamdih mines ,narwah mines and gurabhandha mines so its acts as a rich source of minerals which by any geogenic or anthropogenic activities results in the accumulation of these heavy metals in river water .

The toxicity of water increases to a high level of metal contamination ,these heavy metals which are discharge in river water due to industrlization activities detoriate the quality of water the heavy metals gets accumulated in the body of aquatic animals leads to mortality it's also affect the body of human by entering it by food chain . These are the metal generally found in river and its effect on human body. Zinc: Zinc is responsible for maintaining a healthy immune system and is required for the normal growth and development. Long-term exposure to Zinc may result in the decreased absorption of Copper inside the body resulting in Copper deficiency. Excess Zinc may also trigger neuronal death. Copper: Long term copper exposure can produce many disorders like irritation of nose, mouth and eyes, stomach ache, dizziness, vomiting and diarrhea, and in severe exposure it may also cause endocrine disruption. Lead: Lead poisoning may cause development of anemia, disrupt functioning of kidneys, effect gastro intestinal tract. Iron metal percentage is high in water although normal adequate quantity of Iron is necessary for erythropoiesis, synthesis of haemoglobin, in human body but myoglobin and cytochromes, its presence in large quantities can cause haemochromatosis, which is a condition of excessive deposition of Iron causing damage of organs, leading to fibrosis. Increased Iron concentration in body can cause cardio-vascular diseases

SAMPLE COLLECTION

Water is collected from various Ghats of Swarnarekha River, in order to monitor the heavy metal concentrations water samples from various Ghats were collected in 2 litres Acid cleaned, dried polythene bottles and labelled properly.  

After collection ph. was measured by titration method .The filtered water samples were acidified by concentrated HNO_3 which avoid microbial activities this also prevent the precipitation of metals .The concentration of Fe, Mn, Co, Ni, Cu, Zn, Cr, Pb, and Cd were determined by Atomic absorption spectrophotometer .It has been found that Fe is in high concentration where as the concentration of cr and cd and co is in least concentration.

The analysis of water samples from various Ghats of Ghatsila shows that the river water is pale yellow in colour .The colour of the soil in this region is also red in colour which shows the presence of iron the metal contamination is more in areas which are close to copper industry i.e H.C.L (Hindustan copper limited) the analysis of metal concentration is shown in tabular form.

Analytical result of Heavy Metal in Swarnarekha River in different Ghats like Moubhandar, Amaynagar, Galudih, DigriGhat, Panchpandav, Banalopapampughat .it has been found that the concentration of lead, copper, iron and zinc in concentration of ppm varies from 0.3 to 3.3.

Based on concentration range it has been found that the water is rich in iron and copper .Copper which is an important element for life but its high concentration leads to irritation of eye ,it cause endocrine disturbance. Methods

Sequential extraction method

The theory of sequential extractions is at first the mobile metals are removed and then based on their ease of mobility they were removed thereafter .Tessie et al. named these fractions exchangeable, carbonate bound ,Fe and Mn oxide bound ,organic matter bound ,and lattice bound .By changing the ionic composition of water the exchangeable fraction is removed and the metals which are sorbet to the surface are removed easily .salt solution is used to remove the exchangeable fraction .The carbonate bounded fraction are detected by pH test .metal bounded oxides are detected by using reducing agents .sequential extraction methods is similar to fractional degradation but there is a little variations between the two .

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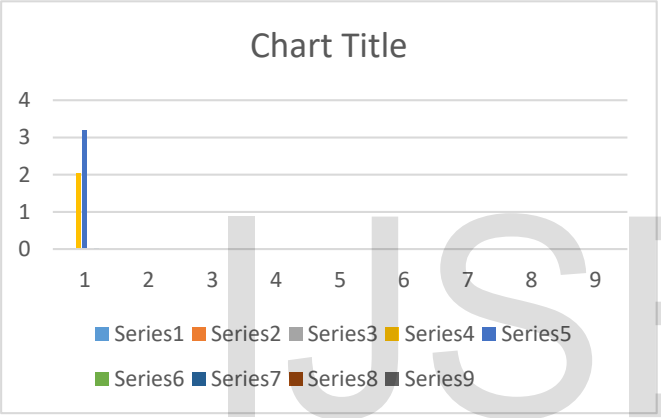

Based on concentration range it has been found that the water is rich in Iron and copper, Copper which is an important element for life but its high concentration leads to irritation of eye ,it cause endocrine disturbance. Iron is a very useful metal for human but its high concentration may damage the protein content .heavy metals may induce cancer in body .it cause Parkinson diseases this heavy metals also effects the life of fishes ,aquatic plants it has a large effect on the growth of zooplankton ,phytoplankton etc. reproductive system. Therefore, determination of heavy metal concentration has been given due importance in this study. The presence of different heavy metals in moderately high concentration in the water sample from both sites indicate that the river water can have hazardous effects on the water and soil ecosystem and also on the human population nearby. Hence, continual assessment and enlightenment in this context is essential. Besides, it is really important that the Government should make policies for conservation of soil and water in this industrial belt of Jharkhand and measures should be taken for proper disposal of wastes from the industries. Industrialisation will not benefit the mankind unless it follows the path of sustainable development.

Conclusion

The presence of heavy metals in large amount affects soil, air as well as water bodies, its enter through food chain in our body .Heavy metal pollution effects liver as well kidney. High concentration of Chromium and Lead leads to serious health problems and leads to death too. The presence of different heavy metals in higher concentrations in the aquatic ecosystems has many far reaching implications directly on the ecosystem of the water bodies and also indirectly on the

population residing in the nearby areas. Heavy metals severely affect the vital organs such as kidneys and liver. The significance of heavy metals in ecotoxicology is due to the fact that they are highly toxic and persistent. Many studies show that heavy metals like Iron, Manganese, Chromium and Silver are phytotoxic at higher concentrations and may cause considerable amount of ecological damage to water, air and soil. Lead in particular, is toxic to the vital organs like brain, kidneys, heart and reproductive system. The presence of different heavy metals in moderately high concentration in the water sample from both sites indicate that the river water can have hazardous effects on the water and soil ecosystem and also on the human population nearby. Hence, continual assessment and enlightenment in this context is essential. for conservation of soil and water in this industrial belt of Jharkhand and measures should be taken for proper disposal of wastes from the industries.

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