

# A Geological Study on Some Heavy Metals Pollution of the River in Bihar

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**Abstract:** The present investigation manages a regular examination of residue pollution of the River Gandak by overwhelming metals. It goes through the some little, medium and huge urban communities of Uttar Pradesh and Bihar in Indian Territory. To investigate the geochemical state of the streambed residue of the waterway, seven overwhelming metals, in particular Co, Cu, Cr, Ni, Cd, Zn and Pb were dissected. The recently kept stream bed silt tests assembled on an occasional premise from five stations for the years 2013-14 and 2014-15. Level of overwhelming metals in the residue of the stream was estimated in the range between 10.54-16.78mg/kg for Co, 6.78-23.97mg/kg for Cu, 16.56-23.17mg/kg for Cr, 9.71-18.11mg/kg for Ni, 0.364-1.068mg/kg for Cd, 30.54-51.09mg/kg for Zn, 12.21-17.01mg/kg for Pb. Anthropogenic expansion of overwhelming metals into the stream was constrained by using metal Contamination Factor. Geo-amassing values were found between (0-1) which shows that dregs was uncontaminated to reasonably polluted, and can unfavorably impact the freshwater biological system of the waterway. A Good connection was noted between Co, Zn, Pb, Ni, and Cu. Bunch examination exhibited three group gatherings of destinations, which show that the metals start from a similar source fundamentally because of common enduring of rocks, barometrical affidavit, human settlement and agribusiness movement and is furthermore affirmed by relationship investigation. Notwithstanding, based on pollution markers, it was discovered that the stream bed dregs is somewhat defiled with harmful metals. The conditions may destructive later on account of the quick populace development in the waterway bowl which may realize unsalvageable organic mischief eventually.

**Keywords:** Sediment contamination; Heavy metals; Geo-accumulation Index; Contamination Factor; Pollution Load Index; Aquatic Ecosystem

## INTRODUCTION

Streams are skilled normal assets on earth. They assume a significant job in watershed biological systems and fills in as water stockpiling, cleansing, giving natural surroundings to creatures, keeping up the biodiversity, shipping, and the scene [1]. Waterways transport about 37000 km<sup>3</sup> of water [2] and 13.5 x 10<sup>9</sup> tons of buildup particles [3] from a land locale of the seas. By and by, over 99% of substantial metals going into a stream can be taken care of in stream dregs by different ways, for example, common methods, for example enduring of rocks, soil disintegration by rain and air and through the anthropogenic exercises for example mechanical effluents, horticultural exercises, development works and so forth [4]. Be that as it may, overwhelming metals can't fix in residue for extensive stretches. With the assortment of the physico-compound characteristics of water conditions, some bit of these settled metals will return the overlying water body and become accessible to living biota. As such, sediment goes about as the two transporters and potential wellsprings of metals in an earthbound natural framework [5]. Substantial metals, for the most part toxically affect oceanic biota and a while later, impact human prosperity through the common lifestyle. In this manner, researching the change and dispersion components of overwhelming metals in dregs become important.

In India, a pace of dangerous substantial metal amassing in angles, shellfish, residue and various segments of oceanic organic frameworks have been represented normally by [6,7]. These poisonous follow metals entering in oceanic conditions are adsorbed onto particulate issue, in spite of the fact that they can frame free metal particles and dissolvable edifices that are accessible for take-up by amphibian organisms [8].

These destructive follow metals entering in waterways are adsorbed onto particulate substances, regardless of the way that they can outline free metal particles and dissolvable buildings that are open for take-up by sea-going living creatures [8]. Untreated or professedly treated current effluents routinely contain variable proportions of generous metals like arsenic, lead, nickel, cadmium, copper, mercury, zinc and chromium [9], which can pollute crops creating under such water framework. These staggering metals exceptionally impact the maritime vegetation which through bio-enhancement enters the propelled way of life and at any appraising effect the all inclusive community. These metals in this manner discover passage into the human evolved way of life either legitimately or in a roundabout way, which makes issues to the amphibian bodies.

Over the range of the last 3 - 4 decades, examination of sea-going dregs have legitimately been practiced for contemplating the geochemical transport of segment, particularly supplements and take after metals from the terrestrial condition of stream bodies and finally in the sea. Enduring of minerals, modern effluents, air, precipitation and non-point discharges are the major wellsprings of substantial metal fixation in waterway structures. Additionally, geologic developments typically contain distinctive overwhelming metals in nature and many follow metals might be going into close by water frameworks through disintegration. Right when all is said in done, to survey the metal tainting in stream sediment, diverse sully pointers like Contamination Factors (CF), Contamination Degree (CD), Pollution Load Index (PLI), the Geo-collection Index (Igeo), and the Enrichment Factors (EF) are reliably utilized [10,11,12,13,14,15]. Since huge parts of these tainting pointers are incredibly common wherever all through the world, in evaluating the residue defilement posed by substantial metals, we intend to give the first and important information about the usage of these markers for Gandak waterway silt.

The destinations of the ebb and flow study is (i) to examine the ebb and flow status of the substantial metal contamination enrolled in the residue of the stream Gandak, a significant tributary of the River Ganga in Northern India (ii) to evaluate the regular varieties in the water and silt nature of the river. (iii) to investigate the level of sullying and contamination impacts by utilizing the accompanying contamination pointers like: defilement factor (CF), Contamination Degree (CD), contamination load list (PLI), geo-gathering record (Igeo) and Cluster examination (iv) to set up standard information on the present status of the waterways that can be utilized by pertinent specialists and analysts.

#### Examining stations

There were five examining locales have been decided for the examination behind the stream Gandak in Indian Territory from Bagaha in West Champaran (Bihar) to Sonpur Bridge in region Saran, Bihar (table 1).

TABLE 1. Examining locales of the River Gandak with their topographical directions

Study sites	Latitude	Longitude	Elevation(ft)	District	State
Bagaha	26°06'36"N	84°04'34"E	314	West Champaran	Bihar
Sangrampur	26°29'30"N	84°41'03"E	227	East Champaran	Bihar
Sahibganj	26°18'01"N	84°55'50"E	206	Muzaffarpur	Bihar
Maker	25°57'35"N	85°01'50"E	186	Maker	Bihar
Sonpur Bridge	25°41'30"N	85°11'24"E	160	Saran	Bihar

#### MATERIAL AND METHOD

The occasional samplings were finished in blustery (August), winter (January) and summer (May) with three repeats in two constant years 2015-2017 and 2017-2018. The waterway locales of examining were chosen arbitrarily. The naturally stored streambed-residue tests were taken from 5-10 cm profundity of the center waterway or the bank of the dynamic waterway channel. The example mass gathered for each situation was around 500 gm with the assistance of 'bed material sampler' and immediately pressed in impenetrable polythene sacks. Reviewing instruments were washed with water and dried before the going with outline was collected.

All synthetic compounds utilized in the analysis were of scientific evaluation and acquired from E. Merck, Mumbai, India. Twofold refined water was utilized all through the examination. All the dish sets and other example holders were out and out cleaned at last washed with twofold refined water before use. An all out assimilation procedure was used to decide the overwhelming metal fixation in the stream residue [25] balanced by [26]. A 2 gm dregs test was warmed with a 20 ml of a tri-corrosive blend (HNO<sub>3</sub>, H<sub>2</sub>SO<sub>4</sub> and HClO<sub>4</sub>) in the extent of 5:1:1 in a Teflon compartment at 80 C for 4-5 h, until a straightforward arrangement was gotten. Exactly when the dregs gets the opportunity to be particularly straightforward and no store was seen at the base of the estimating glass, cool it to room temperature and thereafter the example was sifted through Whatman No.42 channel paper into pre-cleaned 100 ml volumetric jar. These examples were especially utilized for the assessment of Co, Cu, Cr, Cd, Ni, Zn and Pb by nuclear ingestion spectrophotometer (ICE 3000 Series, show 3500 AAS, Thermo logi, UK), fitted with a particular light of each metal utilizing proper buoy clear. The instrument was adjusted by utilizing a self-orchestrated standard game plan of As and drift clear. The standard stock arrangement of 1000 ppm was gained from Sisco Research Laboratories Pvt.Ltd., India. This arrangement was weakened to wanted focuses to adjust the instrument. Exactness and precision of investigation were brought out through rehashed examination of tests against Standard Reference Material (National Institute of standard and innovation; SRM1570). The outcomes were found inside 72% of the guaranteed worth. Quality control measures were taken to break down the pollution level of the silt and unwavering quality of the information. The coefficients of variety of reproducing the investigation were resolved for various conclusions for the accuracy of the examination and varieties beneath 10% were viewed as right.

#### RESULTS AND DISCUSSION

The expansion of different sorts of poisons into the waterway, change the properties of water and its residue. The waterway bed silt has a soluble pH between (7.4-8.2) for the River Ganga and its tributaries. The silt of these waterways is poor in regard of accessible supplements. Nitrate (NO<sub>3</sub>) was estimated between 0.53-8.00mg/100gm. The measure of phosphate PO<sub>4</sub> was estimated between 0.06-2.20 mg/100 gm and natural carbon was noted between 0.014-0.23%. The sandy bed contributes next to no to sea-going efficiency in term of supplements. Be that as it may, supplements stream in from surface overflow and the catchments.

##### Cobalt (Co<sup>++</sup>)

In present examination grouping of Co in the dregs of the stream Gandak shows an alternate degree of changeability at various locales in various seasons. In the conduit residue, the greatest grouping of Co was noted as 16.78 mg/kg at the Sonpur Bridge in the year 2014-15 while the base worth was recorded as 10.54 mg/l at Bagaha (2013-14). Co fixation in dregs of the stream Gandak at better places is shown in Fig 2. At Bagaha (Bihar) the normal gauge of Co was recorded 10.54 ± 6.070 mg/kg in the year 2013-14 and 11.50 ± 4.48 mg/kg in 2014-15. At Sangrampur (Bihar) the normal estimation of Co was recorded 16.14 ± 4.19 mg/kg in the year 2013-14 and 15.15 ± 5.69 mg/kg in 2014-15. At Sahibganj (Bihar) the normal gauge of Co was recorded 12.65 ± 5.38 mg/kg in the year 2013-14 and 10.82 ± 5.89 mg/kg in 2014-15. At Maker (Bihar) the normal estimation of Co was recorded 13.2 ± 4.96 mg/kg in the year 2013-14 and 14.41 ± 5.25 mg/kg in 2014-15. At Sonpur Bridge (Bihar) the normal estimation of Co was

recorded  $16.78 \pm 5.82$  mg/kg in the year 2013-14 and  $14.35 \pm 0.012$  mg/kg in 2014-15. The Co fixation in the residue of the River Gandak at various goals is appeared in table 2. In the present examination the general centralization of Cobalt as got from the investigation of water tests gathered from waterways, fluctuated from 10.54 mg/kg to 16.78 mg/kg. According to water, residue screening benchmark developed by the USEPA[36] is 50 mg/kg for Co. Comes about exhibiting that the Co focus found in the present examination was a lot of lower than the benchmark set up by the [36]. This shows the stream residue for Co isn't hazardous to the living creatures of the waterway. In past examinations [13] it was 16.5 mg/kg at Ghazipur and 23.5 mg/kg at Buxar, in 20  $\mu$ m size silt. Comparable outcomes were likewise recorded by [37].

#### Copper (Cu<sup>++</sup>)

The convergence of Cu in the silt of the waterway Gandak shows the distinctive degree of fluctuation at various destinations in various seasons. At Bagaha (Bihar) the normal estimation of Cu was recorded  $7.58 \pm 3.567$  mg/kg in the year 2013-14 and  $6.78 \pm 3.43$  mg/kg in 2014-15. At Sangrampur (Bihar) the normal estimation of Cu was recorded  $10.54 \pm 4.09$  mg/kg in the year 2013-14 and  $9.85 \pm 4.79$  mg/kg in 2014-15. At Sahibganj (Bihar) the normal estimation of Cu was recorded  $9.80 \pm 3.50$  mg/kg in the year 2013-14 and  $9.09 \pm 4.68$  mg/kg in 2014-15. At Maker (Bihar) the normal gauge of Cu was recorded  $10.01 \pm 5.01$  mg/kg in the year 2013-14 and  $11.51 \pm 4.84$  mg/kg in 2014-15. At Sonpur Bridge (Bihar) the ordinary estimation of Cu was recorded  $17.97 \pm 9.20$  mg/kg in the year 2013-14 and  $15.38 \pm 4.61$  mg/kg in 2014-15. The Cu fixation in the buildup of the River Gandak at various objectives is shown in table 2. In the present investigation examination of substantial metals in silt shows various degrees of regular variety during the time from site to site for the stream Gandak. In the stream Gandak, the most extreme convergence of Cu was noted as 16.78 mg/kg at the Sonpur Bridge in the year 2014-15 though the base worth was recorded as 10.54 mg/kg at Bagaha (2013-14). A scope of Cu obsessions in dregs is shown freely in the River Gandak Table 2. Cu fixation in the residue of the stream Gandak at better places is displayed in the Fig: 2. In the present examination dregs, the general convergence of Cu ran between 06.78 mg/kg to 23.97 mg/kg for the stream Gandak (Table 3). As per United Nations Environment Program thinks about (UNEP)[38] most extreme passable degree of copper in waterway residue is 45-50mg/kg (Table) and TRV (Toxicity Reference Value) set according to USEPA is 16 mg/kg (Table 3) [36]. The watched an incentive for Cu was found underneath as far as possible set up by UNEP rule at most extreme destinations aside from few while it was somewhat higher than the TRV esteem. In past studies,[13] it was 49 mg/kg at Ghazipur and 58 mg/kg at Buxar for the stream Ganga. Comparative outcomes were likewise recorded by [37]. This exhibited the waterway residue is sullied by copper all things considered of the destinations of the stream Gandak yet it was underneath beyond what many would consider possible.

Copper in the dissolvable structure is presumably moving through the earth. It is fundamental here to take note of that Cu is extremely harmful to most fishes, spineless creatures and amphibian plants than whatever other overwhelming metal beside mercury. Most delicate creatures were discovered missing from the destinations where silt copper levels surpass 200 mg/kg. It lessens the improvement and the pace of proliferation in plants and creatures. Oceanic plants retain multiple times more Cu than plants on drylands [39]. Over the top Cu substance can make hurt roots, by assaulting the cell film and decimating the layer structure; controlled root advancement and course of action of different short, earthy optional roots. Cu gets the opportunity to be particularly harmful to living creatures when the pace of maintenance is more vital than the pace of release, and as Cu is instantly collected by plants and creatures, it is basic to restrict its level in the stream.

## CONCLUSIONS

The examination has discovered that the vast majority of the anthropogenic metals indicated a practically standard example of conveyance. The file like Igeo, CF and CD used to evaluate the metals enhancement in the silt which devils trates that the stream bed residue has a low degree of contamination all through the examination area. While Sonpur Bridge has the most elevated metals tainting degree (C D) conceivably because of expanding anthropogenic exercises in this district. In any case, Pollution Load Index indicated that the degree of in general silt contamination is most elevated at Sonpur Bridge. In any case, there is no huge scale industry in the investigation locale beside some little scale, so the all wellsprings of defilements are not anthropogenic, but instead the ordinary enduring and breaking down may similarly add to the present collection. The nearness of common and anthropogenic farming based wellsprings of substantial metals input was affirmed by the connection and group investigation of metals. The contents of some substantial metals are higher than ASV and TRV. These more significant levels are probably not going to cause extra unfavorable wellbeing dangers to the sea-going biological system related with this stream. Notwithstanding the perceptions of the test discoveries show that the Gandak waterway dregs isn't exceptionally polluted, however it might be disturbing with the expanding populace load in the Middle Ganga Plain. The results can help make organization frameworks for sully control and residue remediation in a general sense in the agrarian locales encompassing of the stream bowl with genuine pollution and it is exceedingly proposed that further assessments should be directed to assess long stretch effects of anthropogenic commitments to the waterway condition.

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