

# Detection of Heavy Metals (Cr, Co, Ni, Cu) through Atomic Absorption Spectroscopy from Water Samples of the River Yamuna at Different Locations in the NCT of Delhi, India

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**Abstract**— This study was done to detect heavy metal traces such as Chromium, Cobalt, Nickel and Cadmium in water samples collected from different sites of Yamuna in the NCT of Delhi. The water samples were collected from Rajghat, Nigambhodh Ghat and Nizamuddin respectively. Chromium, Cobalt, Nickel and Copper were analyzed in water samples with Atomic Absorption Spectrometer. The average concentrations of Cr, Co, Ni and Cd in water samples were found 0.0073 mg/L, 0.0266 mg/L, 0.0026 mg/L, and 0.033 mg/L respectively. The concentration of Cadmium was found higher than other three groups of metals. However, concentration of heavy metals found in the water samples of all three locations except Rajghat was within the permissible limits of World Health Organization (WHO) and safe to consume for irrigation. But the Cd in water sample of Rajghat was found to be ten times more than the permissible limit of WHO.

**Key words:** Heavy metals, Atomic Absorption Spectrophotometer, Permissible Limits

## I. INTRODUCTION

Water pollution is a matter of great concern and has been accepted as a global problem because of its adverse effect on human health, plants, animals and all exposed materials. As we know that the vegetables are rich source of vitamins minerals, fibers and antioxidant respectively. A literature survey shows that certain heavy metals such as (Fe, Cu, Mn, Zn) are essential in a trace amount for a healthy life But intake of heavy metals beyond the safety limits by contaminated vegetables may pose a risk to the human health. The effect of heavy metal toxicity has been studied even at a very low concentration by Sathawara et al in 2004 [1]. Prolonged accumulation of heavy metals food stuff may lead to chronic effect in the kidney and liver of humans and bone diseases [2]. Modern analytical techniques and ultra-sensitive instruments analyzing metal contents even at ppb levels have recently resolved several health disorders associated with intake of toxic metals. Physico-chemical studies of pollutants have been done by A. S. Irsad [3]. Impact of contaminated vegetables, Fruits and Fodders on human health has been studied in Karachi [4]. Determinations of Zn, Cd, Pb and Cu in vegetables have been investigated by Stripping Voltammetry [5]. Cd, Pb, Hg and As have been detected in crops and corresponding soil in Netherland [6]. Some heavy metals have been detected from vegetable samples of North Eastern Nigeria and from drinking water of Balochistan using Atomic ion Absorption Spectroscopy [7,8]. The uptake of these heavy by plants grown in polluted soil has been studied to a considerable extent [9,10]. The effect of Arsenic contaminated irrigation water on the cultivation of Red Amaranth has been done by Choudhary et al [11]. The heavy metals considered to human poisoning are lead, mercury, arsenic and Cadmium. Other heavy metals copper, zinc and chromium are actually required by the body in trace amount [12]

The potential toxic effect of metal contamination in North Western Gulf of Thailand and their ability to bio-accumulate in ecosystem has been investigated by Censi- et al, 2006 [13]. The determination of heavy metals in the surface water of Oke-Afa canal has been done by A. Yahaya [14] The industrial activities such as textile, paint, battery, mining and chemical industries introduce heavy metals into the soil [15]. The leafy vegetables grown in heavy metals contaminated water accumulate higher amounts of metals compare to those grown in uncontaminated water.

The goal of this study was to detect the concentration of heavy metals (Cr, Co, Ni, Cu, Cd) in water samples collected from different site of Yamuna river in NCT of Delhi and to compare the value of these contents with prescribed limits of the World Health Organization (WHO). The concentrations of these heavy metals have been determined by atomic absorption spectroscopy.

## II. METHODOLOGY

### A. Sample Collection:

Water samples were collected from different sites of Yamuna river in Delhi during 2014-2015.

- Rajghat
- Nigambodh Ghat
- Nizamuddin

**B. Sample Analysis**

The concentration of heavy metals were analyzed in all three samples of water using (AAAnalyst Model 100 ) Atomic Absorption Spectrometer by Flame method with the help of Acetylene gas.

**C. Standard Reagent Preparation**

Three different reagents (Cr, Ni, Co, Cd) of standard stock solution of 1000 ppm were prepared in deionised water for detection of each metal. The solutions of 2 ppm, 3 ppm and 4 ppm were made with 1000 ppm stock solution by dilution in 25 ml standard volumetric flask. With the help of standard solution a calibration curve was auto-established in quantitative mode of spectrophotometer and concentration of each metal was determined in the sample solution directly.

S. No.	Sites	mg/L
1	Rajghat	0.009
2	Nizamuddin	0.004
3	Nigambhodh Ghat	0.009

Table 1: Chromium content determined through atomic absorption Spectroscopy, with standard of Cr (4 ppm) 25 ml.

S.No.	Sites	mg/L
1	Rajghat	0.029
2	Nizamuddin	0.028
3	Nigambhodh Ghat	0.023

Table 2: Cobalt content determined through atomic absorption Spectroscopy, with standard of Co (3 ppm) 25 ml.

S.No.	Sites	mg/L
1	Rajghat	0.001
2	Nizamuddin	0.006
3	Nigambhodh Ghat	0.001

Table 3: Nicel content determined through atomic absorption Spectroscopy, with standard of Ni (4 ppm) 25 ml.

S.No.	Sites	mg/L
1	Rajghat	0.06
2	Nizamuddin	0.02
3	Nigambhodh Ghat	0.019

Table 4: Cadmium content determined through atomic absorption Spectroscopy, with standard of Cd (4 ppm) 25ml.

S.No.	Metal contents	mg/L
1	Cr	0.0073
2	Co	0.026
3	Ni	0.0026
4	Cd	0.033

Table 5: Average values of metal contents determined through atomic absorption Spectroscopy for different sites of Yamuna river.

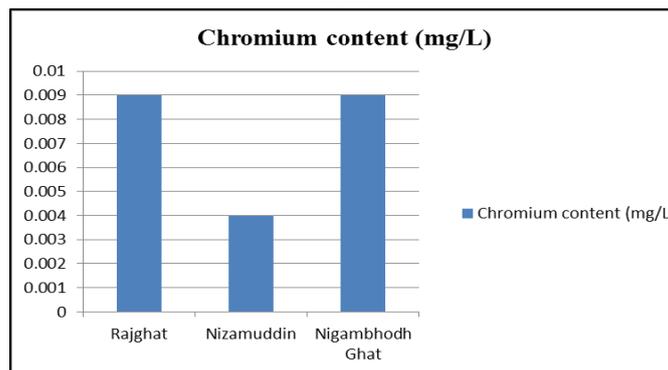


Fig. 1: Concentration of Chromiun in water samples of different sites by Atomic Absorption Spectroscopy

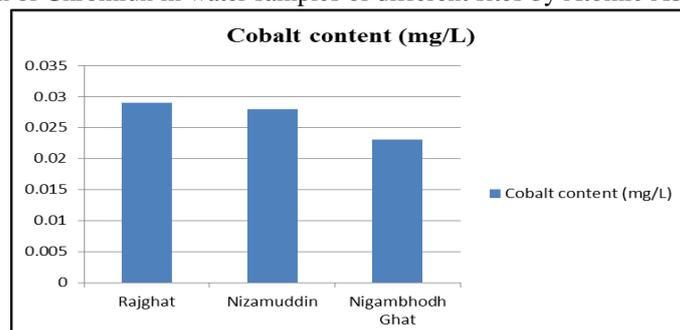


Fig. 2: Concentration of Cobalt in water samples of different sites by Atomic Absorption Spectroscopy.

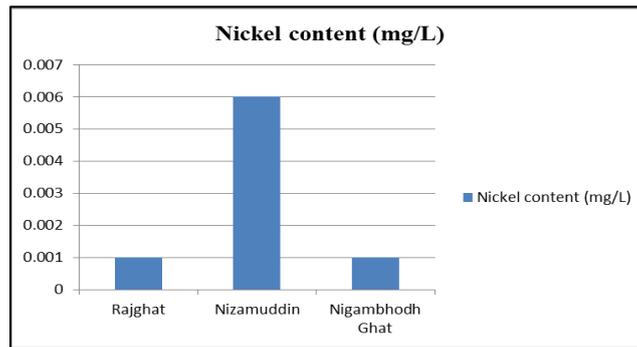


Fig. 3: Concentration of Nickel in water samples of different sites by Atomic Absorption Spectroscopy

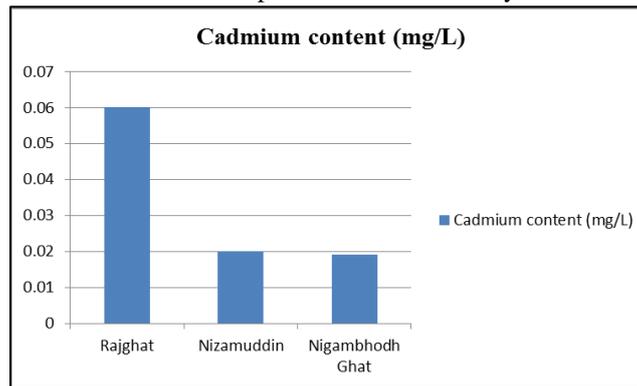


Fig. 4: Concentration of Cadmium in water samples of different sites by Atomic Absorption Spectroscopy

### III. RESULT AND DISCUSSION

It is clear from data tables 1,2,3, and 5 that the heavy metals ( Cr, Co, Ni, Cd ) were found in all the water samples of river. According to World Health Organization (WHO) the acceptable amount of heavy metals such as for Cr, Co, Ni and Cd in drinking water has been found 0.001-0.05 mg/L, 100Bq/L , 0.005-.02 mg/L, and 0.0005-0.003 mg/L respectively [16]. The Cr, Ni and Co were found within safety limit given by WHO but the amount of Cd was not found to be in permissible limit of WHO in the water sample of Rajghat. The amount of Cd in water sample of Rajghat was found to be ten times more than the permissible limit of FAO and WHO/ EU.

The excess use of fertilizers, insecticides and pesticides are also main cause of contamination by metals in water of Yamuna river. Water sample of Rajghat is found to be more contaminated by Cadmium because the coolant over there which treats the water discharge from industries is not working efficiently.

Cadmium poses very high risk to the local ecosystem according to grades of ecological risk factor. Because it has higher mobility and less retention power in the soil than other toxic metal. As we know that Cobalt is a radionuclide. It is very harmful for brain and nervous system. On the basis of concentration of metal contents the overall risks levels of heavy metals have been found in order of Cd > Co > Cr > Ni .

### IV. CONCLUSION

Present study shows that the concentration of Cadmium has been found comparatively high in water sample of Rajghat than other studied sites of river. The average concentration has been found in order of Cd > Co > Cr > Ni. This is due to presence of phosphatic fertilizers in water which is being main source of Cadmium impurity. It means this the water is fit not for drinking, all other households purpose and irrigation.

There are number of studies on the pollution load of the river Yamuna however there is a need for generation of data periodically to monitor the pollution load of the river. There is also requirement for more research studies on the river bed and its impact on the flora and fauna along the river. Public awareness is an important aspect to save the river from pollution. So efforts should be taken to involve citizens in building the campaign for clean Yamuna. It means the contamination can be control by preventing untreated sewage and effluents from being dumped into the river. The increment in water volume reduces the pollution load hence if less water is diverted during the dry season, it will help in controlling pollution.

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