

# ANALYSIS OF HEAVY METAL POLLUTION ON PARVATHY PUTHANAR, AN ARTIFICIAL RIVER CANAL IN SOUTH KERALA

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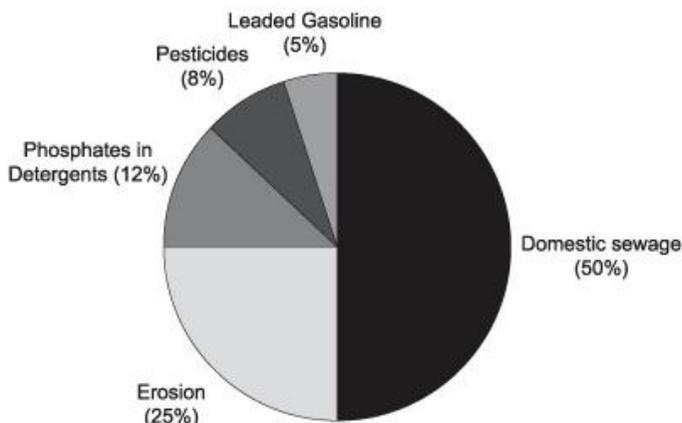
## ABSTRACT

The aim of this study was to determine the heavy metals (Nickel, Cadmium, lead, Fluoride) in different water samples collected from different sites in Parvathy puthanar canal and nearby ground water sources. Parvathy puthanar is an artificial canal that runs through Thiruvananthapuram District, South Kerala. At first its water was clear and fresher than any river in India. But today this place is covered with water hyacinth. The water is black and polluted. Drains at several places empties into this canal. Also dark drainage water enters into the canal from nearby hospitals, industries, airport and all nearby houses. The concentration of heavy metal was determined by Atomic Absorption Spectrometry (AAS). The obtained result shows that heavy metal concentration is very high in both canal water and nearby ground water.

**Keywords:** Heavy metals, Parvathy puthanar, Pollution

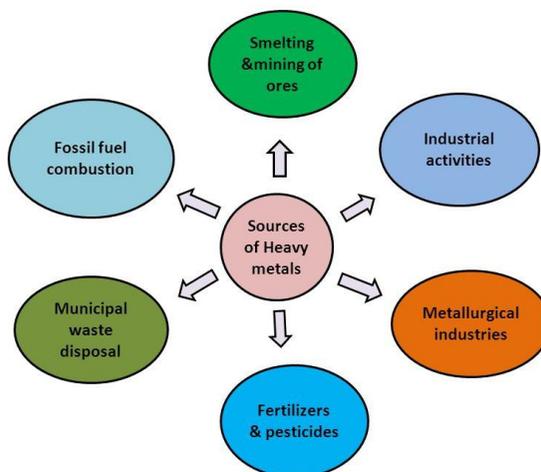
## 1. INTRODUCTION

Water is a precious asset, a prime natural resource and it is a basic human need, in the absence of water no social and economical developmental activities can sustain. Water covers 71% of the earth surface, mostly in oceans and other large water bodies, with 1.6% of water below ground in aquifers and 0.001% in the air as vapour, clouds & precipitation. Water is the most important plant nutrient and constitutes the greater part of the plant weight. So a small change in the aquatic environment affects the whole system. Water pollution is any undesirable change in the state of water, contaminated with harmful substances. It's the second most important issue next to air pollution. Today water pollution is a serious problem.



**Figure 1:** shows the 50 % of the water pollution is contributed by domestic sewage

Among the different types of pollutants, heavy metals are the major one which contaminates the soil and water due to the disposal of domestic wastes and industrial effluents. This cause changes in the physical, chemical and biological properties of water body. Heavy metals are any metallic chemical element that has a relatively high density and is toxic or poisonous at low concentration. Heavy metal pollution is increasing in the environment due to mining, industrialization and other anthropogenic activities. Heavy metal contaminated soil have poor water holding capacity and high evaporation rate. Heavy metals also contaminate the soil and water due to the disposal of domestic wastes and industrial effluents (figure 2). Many studies reported that heavy metals inhibit photosynthesis (Clijsters and Van Assche, 1985) and increase the enzymatic activities (Weigel and Jager, 1980). Lead, chromium, Cadmium, Zinc, Aluminium, Nickel, Copper and mercury are the major heavy metals seen in the effluents. Heavy metals are conservative pollutants, that is they are not broken down by bacteria and are effectively permanent. They are highly toxic when bonded to short chain of carbon atoms.



**Figure 2:** shows sources of heavy metals that accumulates in water bodies.

### Study area

Parvathy puthanar is a man made canal that runs through the west coast of Trivandrum district. It is a 560 km waterway and has an average width of about 10 m and has a depth of 3m and has an altitude mean sea level. It starts from the Kadinamkulam lake in the North and flows south east parallel to the Trivandrum coast. It finally ends near Poonthura and empties into the Indian Ocean. The intention behind a canal was to connect the backwater of Travancore coast, and thereby establishing an inland waterway, which would promote the trade and industry of Travancore. The work was started in 1825 and completed in 1828. Later the canal was extended to the south up to Thiruvallam, where the Karamana River joins the sea.

The location of the Parvathy Puthanar is a very complex geo-physical region. It gets closer to the southernmost tip of the sub-continent need special attention. The Western Ghats gradually submerges into the sea in this region leaving behind highly complex wetland system, rivers and vast canals. In fact, though these regions are highly developed and thickly populated, it needs special protection in the interest of the environment. Parvathy Puthanar is linked to Karamana River and Kadinamkulam Kayal and also to the veli-Akkulam Kayal, which again is a famous tourist spot. At first its water was clear and fresher than any river in India. But today this place is covered with water hyacinth. The water is black and polluted. Drains at several places empties into this canal. Also dark drainage water emptying into this canal from nearby hospitals, industries, airport and all nearby houses.

### Materials and Methods

This work was done to study the water quality analysis of four different sites of parvathy puthanar and two nearby ground water sources. Canal samples for investigation were taken from the sites near karikkakom bridge, Vayyamoola, near airport and Vallakadavu boat house. Ground water collected from nearby wells. Samples were collected during Premonsoon, Monsoon and post monsoon season. For heavy metal analysis all the collected samples were prepared. For this digestion of water samples with aqua regia ( $\text{HNO}_3$  67% :  $\text{HCl}$  37% in 3:1 ) was prepared. Mineralization of samples was performed by using Berghot MWS-2 microwave digester. Atomic Absorption Spectroscopy (AAS) is a very common and reliable technique for detecting metals and metalloids in environmental samples. The total metal content of water was performed by Flame Atomic Absorption spectrometry (FAAS). Blank and standard solutions for device calibration were used as well.

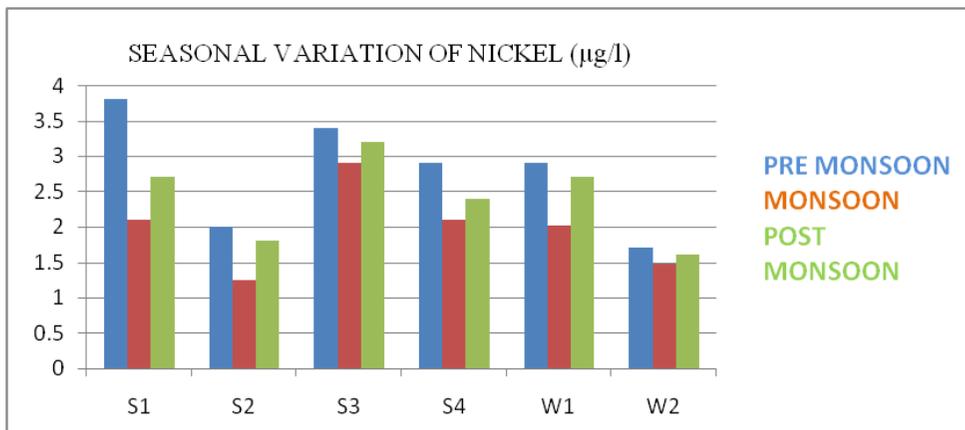
### Results and Discussion

The analyzed value of heavy metal concentration illustrated in the table: 1. The table shows the concentrations according to the seasonal variations i.e; during pre-monsoon, monsoon and post-monsoon. All stations shows high concentration of heavy metals during pre-monsoon period due to the low concentration of water in the canal and high evaporation rate. During rain the water content in the canal increases and dilution of minerals occur. So the value of heavy metal concentration shows decreasing during AAS. During Post monsoon season the evaporation rate slightly increases so that the concentration of metals also increases. The level of fluoride is very high in all stations. Among them station 1 show very high concentration during pre-monsoon period ( $355\mu\text{g/l}$ ). Graph 1, 2, 3 and 4 shows the seasonal variation of Ni, Cd, Pb and F respectively. These high concentrations of toxic metal in the water also leads to contaminate

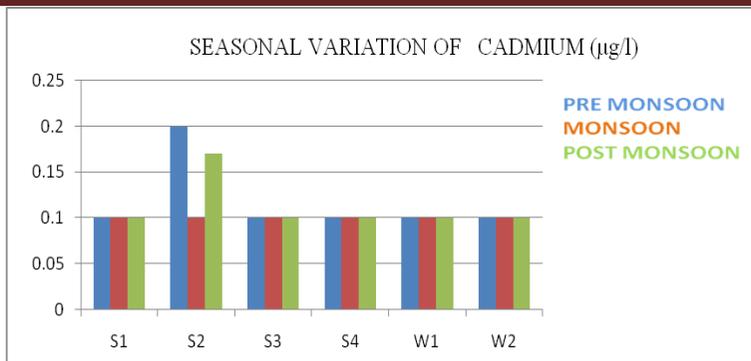
the soil. When soil and water become polluted, these metals taken by plants and accumulates in their bodies. If animals consume this it will enter into their body tissues and thus the ecosystem is contaminated through the food chain. The long term exposure of Cadmium results in kidney dysfunction and tubular proteinuria. Also high exposure leads to lung disorders, Osteomalacia, osteoporosis etc. The Pd content will inhibit the Haemoglobin production in human body and also affects kidney and joints. The high level of heavy metals can cause cancer, replace the calcium ions in the bones and dysfunctional sperm in males.

Sample	Ni(µg/l)	Cd(µg/l)	Pb(µg/l)	F(µg/l)
S1 Pre-monsoon	3.8	0.1	2.0	355
S1 Monsoon	2.1	0.1	1.2	217
S1 Post-monsoon	2.7	0.1	1.6	270
S2 Pre-monsoon	2	0.2	1.7	297
S2 Monsoon	1.25	0.1	1.2	220
S2 Post-monsoon	1.8	0.17	1.6	285
S3 Pre-monsoon	3.4	0.1	2.9	342
S3 Monsoon	2.9	0.1	1.7	297
S3 Post-monsoon	3.2	0.1	2	320
S4 Pre-monsoon	2.9	0.1	2.5	328
S4 Monsoon	2.1	0.1	1.1	277
S4 Post-monsoon	2.4	0.1	1.5	297
W1 Pre-monsoon	2.9	0.1	2.4	314
W1 Monsoon	2.01	0.1	1.2	229
W1 Post-monsoon	2.7	0.1	1.9	294
W2 Pre-monsoon	1.7	0.1	2.5	325
W2 Monsoon	1.47	0.1	1.9	307
W2 Post-monsoon	1.6	0.1	2.05	311

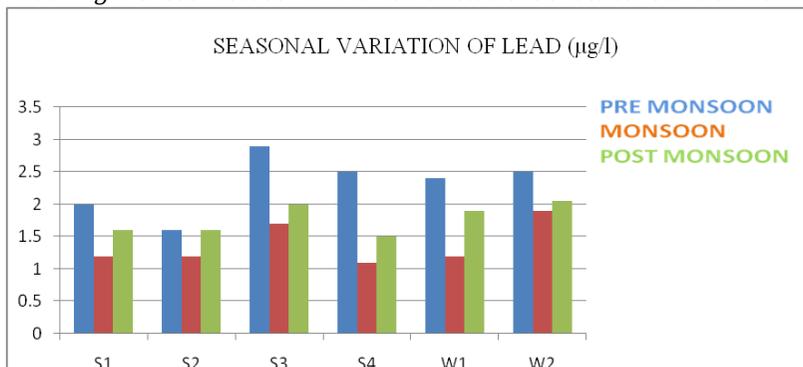
**Table 1.** Shows the seasonal variation of heavy metal content in collected water samples from sampling sites. 'S' shows the canal water and 'W' shows the well water



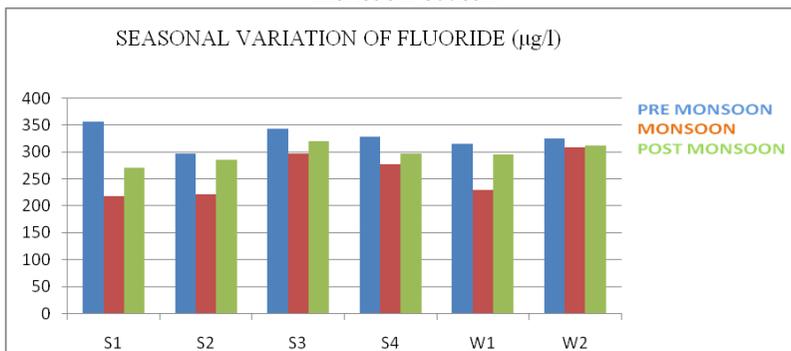
**Graph 1:** Nickel shows high concentration during pre-monsoon season and low concentration during monsoon season



**Graph 2 :** Station 2 shows high concentration during pre-monsoon season and low concentration during monsoon season and all other stations show constant value.



**Graph 3:** Lead shows high concentration during pre-monsoon season and low concentration during monsoon season



**Graph 4:** Fluoride shows high concentration during pre-monsoon season and low concentration during monsoon season

**Conclusion**

Our study indicates that the concentration of all heavy metals are very high water collected from sampling stations. The water from nearby ground water are not suitable for human consumption. So those diversified anthropogenic activities must be urgently controlled otherwise long term exposure of these poisonous chemicals leads to harmful diseases like osteomalacia, Osteoporosis, pulmonary epithelium necrosis etc. So we must inform the local population about the risks of exposure to contaminants by consuming groundwater from their wells.

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