ASSESMENT OF URANIUM IN ADYAR RIVER AND COOUM RIVER WATER, CHENNAI, TAMIL NADU, INDIA.

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Abstract - *Radioisotopes, which contribute in a significant way to the overall effective dose received by members of the public due to the exposure of surface water originating from industrial effluents. The concentration of radioelements present in the soil, underground water, and surface water had been studies in various parts of the world. The issue of radioactivity and concentration of uranium in water of different places of India had been reviewed in this paper*

Key Words: Uranium, radioisotopes, river water, contamination, health risk.

1. INTRODUCTION

Radioactive contamination of industrial effluents is a matter of concerns in long term, as it could lead to ingestion dose in humans. Uranium, a naturally occurring radioactive element, which emits alpha particles, is important from a point of view of environmental radioactivity, as it contributes a number of radioactive elements through its decay chain. It is found in nature in different types of rocks such as granites, sand stones and other mineral deposits [1]. Through the process of leaching from natural deposits, ^{238}Un enters the ground water and ultimately reaches the food chain through plants and drinking water. Though the normal concentration of uranium in ground water is reported to be in the range 0.1 to 10mg m^{-3}[2], higher concentrations are possible in areas having elevated levels of uranium in rocks and soil. Health risks to humans from ^{238}Un are of different ways, they are: ^{238}Un is a radioactive substance, which emits alpha particles and a small amount of gamma particles, which are harmful to humans as well as animals [3]. The major contribution of radiation dose in uranium decay series comes from Radon (^{222}Rn) and its short-lived progenies, which is the largest single source of radiation exposure to humans. Of the total radiation received by humans, radon and its decay products contributes 51% through inhalation and 0.21% through ingestion. Now a day's various uranium isotopes are used in medical diagnosis [4]. Normally ^{238}Un is available in oxidized stage; to use it further it is deoxidized. Which will lead to radioactive exposure. Therefore, a proper assessment of uranium in industrial effluents is also essential to assess the radiation dose and the associated health risk to public if any.

2. STUDY AREA

All the previous studies had shown the concentration of radioelements present in soil, underground water and surface water in India and among the world. This data helps us to estimate the probable radiation dose human beings get by both inhalation and ingestion, in day-to-day life. Therefore, a study was conducted to find the concentration of uranium present in water of 'Adyar River' and 'Cooum River' (Chennai, Tamil Nadu, India) as they are mostly surrounded by industries.

3. SAMPLING LOCATIONS

Table -1: sampling locations

Sl.no	River	Location	Co ordinates
1	Cooum River	Dr. Radhakrishnan nagar	13°4'35.5"N 80°12'50.4" E
2	Cooum River	Karnanidi Nagar	13°4'04.8"N 80°13'43.0" E
3	Cooum River	Logambal street	13°4'06.7"N 80°14'35.4" E
4	Cooum River	Appasami Street	13°3'58.8"N 80°14'15.7" E
5	Cooum River	Palavan Nagar	13°4'24.5"N 80°1'29.2" E
6	Adyar River	Thiru Vi Ka Bridge	13°0'40.3"N 80°15'29.4" E
7	Adyar River	Kottupuram Bridge	13°01'31.6"N 80°14'37.6" E

4. SAMPLING

Water samples are collected along the river stream where the industries are releasing their effluents as well as the place where there is no presence of any industry along the stream. Water is collected in the pre-processed bottles.

Manufacturing residues must be removed from bottles. Dust and any other foreign substances must be removed from bottles and equipment that has been in storage or transport.

Clean equipment at the sampling site if equipment is still wet, before leaving for the next site. The sample needs to be as fresh as possible. It takes time to get the sample from the drop off location to the lab. Collect the sample just before you leave for the drop off location. This is important because the sample should be analysed with in a day or two.

5. Uranium Analysis By Led Fluorimeter:

Quantalase has developed Fluorimeters, which use banks of pulsed LEDs to excite fluorescence in sample under study. The wavelength, pulse duration and peak power of the LED output can be set to match the excitation requirements of the sample. The fluorescence is detected by a pulsed photomultiplier. Suitable filters after the LEDs and before the photomultiplier tube prevent LED light from reaching the photomultiplier tube directly. The filters can be broadband colored glass filters or multilayer narrow band filters. The instrument is controlled by a microcontroller, which pulses the LEDs and photomultiplier tube. The microcontroller also controls the ADC, which convert the fluorescence signal from photomultiplier to digital form for further processing. A single board computer averages the photomultiplier output over 2000 pulses and carries out any calculations necessary. A touch screen display permits the operator to set necessary parameters and display the fluorescence measurement.

5.1 Calibration of Fluorimeter

Standard solution of Uranium is used to calibrate LED Fluorimeter. The instrument was calibrated in the range of 1-100 PPB using a stock solution of standard which was prepared by dissolving 1.78g uranyl acetate dehydrate (CH_3 COO) UO_2.2H_2O) in 1 L of Millipore elix-3 water containing 1 ml of HNO_3 . The blank sample containing the same amount of fluorescing reagent was also measured for the uranium concentration. 5% phosphoric acid in ultrapure water was used as fluorescence reagent. All reagents used for experimental work were of analytical grade.

5.2 Preparation of FLUREN (Buffer Solution)

Weight 5gms of Sodium Pyrophosphate powder and add it to a flask/plastic bottle. Add 100ml. of double distilled water and shake well to dissolve the Sodium Pyrophosphate powder. Add Ortho-phosphoric acid drop by drop while monitoring the pH of solution until a pH of 7 is reached. This is the desired buffer solution, also called FLUREN. Adding buffer solution to a uranium sample increases the fluorescence yield by orders of magnitude. It is recommended that 1 part of buffer solution be added to 10 parts of uranium sample solution and this mixture be used for measurements.

5.3 Analytical Procedure

A water sample of quantity 6ml is used to find its uranium content. The water sample is taken in the clean and dry quartz cuvette made up of ultrapure fused silica. The instrument was calibrated with the standard uranium solution of known activity. The water sample of quantity 6 ml is mixed with 10% of the buffer solution. Buffer solution is made from sodium pyrophosphate and orthophosphoric acid of pH 7. Buffer solution is used to have the same fluorescence yield of all the uranium complexes present in the water.

6. RESULTS

Table -2: Uranium concentration

Sl.no	Location	Uranium concentration in ppb
1	Dr. Radhakrishnan nagar	2.552
2	Karnanidi Nagar	2.186
3	Logambal street	1.823
4	Appasami Street	0.689
5	Palavan Nagar	1.084
6	Thiru Vi Ka Bridge	2.068
7	Kottupuram Bridge	1.654

Uranium concentration in surface water of Cooum River varies from 0.669 PPB to 2.552 PPB. The uranium concentration in surface water of Adyar River varies from 1.654 PPB to 2.068 PPB.

7. DISCUSSION:

Uranium concentration in the river water and sediments is varying from place to place.

7.1 Cooum River:

In Cooum River, concentration of uranium at Dr. Radhakrishnan nager is 2.552 PPB and moving along the river stream, it kept decreasing until Appasami Street with a concentration of 0.689 PPB.

Which shows the gradual decrease of uranium concentration in river water. From this, we can observe that the uranium concentration in water is decreasing in the direction of flow.

As we move along Cooum River from Appasami Street to Logambal street uranium concentration is increasing from 0.689 PPB to 1.823 PPB. Concentration of uranium in water is increasing at this particular area of stream.

Further, along Cooum River, from logambal Street to Palavan Nagar uranium concentration is decreasing from 1.823 PPB to 1.084 PPB.

From this, we can see that concentration of uranium in water is decreasing gradually along the stream from Logambal Street to Palavan Nagar.

Concentration of uranium along the Cooum River is varying with no particular order. First concentration in water is decreasing from Dr. Radhakrishnan Nagar to Appasami Street and from Appasami Street to Logambal Street concentration of uranium in water is increasing along the river stream.

7.2 Adyar River:

In Adyar River, uranium concentration in water from Kottupuram Bridge to Thiru-Vi-Ka Bridge is increasing from 1.654 PPB to 2.068 PPB.

8. CONCLUSIONS

Concentration of uranium in both the River water seems to be with in permissible limit, but it is varying from place to place. Highest level of uranium in Cooum River is noticed at Dr. Radhakrishnan Nagar.

River water is mostly polluted with cations, which are having a higher concentration in it. Total hardness of water is very high in this River. Domestic users cannot create such a huge amount of dissolved magnesium and calcium. There are industries which are leaving their effluents directly in to River and polluting it.

In Adyar River, uranium concentration in water is decreasing along stream.

Since there is no previous data of uranium concentration in both Rivers, we cannot estimate harm to human beings. But if it continues to increase in river water, then it would be a great danger to human beings with in few years.

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