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Sampling and Pellet making process for elemental analysis of some fish samples by PIXE technique at VDG Accelerator Laboratory, Dhaka

Md. Atiqur Rahman¹, Md. Obaidur Rahman², Md. Joynal Abedin³, Md. Zakir Hossain⁴, Laila Zaman⁵
^{1,2,4,5}Department of Physics, Jahangirnagar University, Savar, Dhaka-1342, Bangladesh
³Principal Scientific Officer, Accelerator Facilities Division, Atomic Energy Centre, Dhaka, Bangladesh

Abstract-- Dhaka, one of the most densely populated city of the world that has not built with proper planning. Huge wastages from unplanned industries, residences and different sources are daily being poured into the lakes and rivers causing them polluted. Fishes are being collected and sold in local markets; people are buying them to meet their daily needs. As a result toxicity is spreading rapidly in human being resulting different disease. For the toxicity assessment of fishes 10 different fishes were collected from Gulshan Lake. Winter season was chosen for collection. Fishes were cut and middle part of each fish were taken as samples. Samples were dried, grinded and made as pellet.

Index Terms: PIXE, Accelerator, Oven, Pellet.

I. INTRODUCTION

Dhaka is the 8th largest city in the world according to the number of population. Huge number of buildings, industries and many other construction works were built within a small region without necessary planning. Besides, many low lying natural water reservoirs, like canals, lakes, ponds, ditches etc. have been filled to develop different constructions. As a result, city waste management became extremely inadequate. Huge wastages, including heavy metal are being poured directly nearby lakes, causing them polluted. Fishermen collect fishes from these polluted lakes and sell them to different markets. People are taking them for daily needs and getting sick. Trace elements presence in fishes, play vital roles for human beings. Any fluctuation, like deficiency or excess in their normal level in living cells may lead to physiological disorders causing various diseases like hypertension, dental caries, goiter, cancer, heart diseases, gallstones, obesity, osteoporosis, osteomalacia, arthritis, anemia, etc.[1, 7]. Our research purpose is the elemental analysis these polluted fishes and lake sediments of Gulshan Lake of Dhaka city. Proton Induced X-ray Emission (PIXE) technique is a widely used tool for such types of research works. All other IBA experimental facilities needed for sample preparation to data analysis are available in the VDG Accelerator Laboratory of Atomic Energy Centre, Dhaka. We collected fishes from the Gulshan Lake at the mid December of 2014 with the help of local people. Winter season was chosen for collection, as at that time, fishing was comparatively easier.

II. SITE SELECTION AND SAMPLING

Considering the pollution probability, Gulshan Lake was selected for this research work. The drainage system of Gulshan and adjacent areas are not well planned. The people around the Lake are pouring huge including daily wastages into the lake making polluted continuously.

Ten different fishes were collected from different sites of Gulshan Lake for this research work. The fishes were bagged with separate identification. Winter season of 2014, was chosen due to the low water level which made fish collection easier. The local name of the collected fishes are Katol, Shol, Koi, Taki, Puti, Telapia, Rui, Pangas, Sorputi, Tatkini. The fishes were carefully cut into pieces and different parts of each fish had been taken as sample for this research work.

Then the fish samples were kept in the sunlight as the primary drying process. Lake sediments also collected from four different places for the research purpose. Continuous fifteen days were spent for primary drying Location for the sample collection process. Then the half dried fishes were kept in Mommert Oven at 60⁰C for final drying.



Fig 1: Location Map of sampling site of Gulshan Lake, Dhaka.

★ Sampling spots of Gulshan Lake

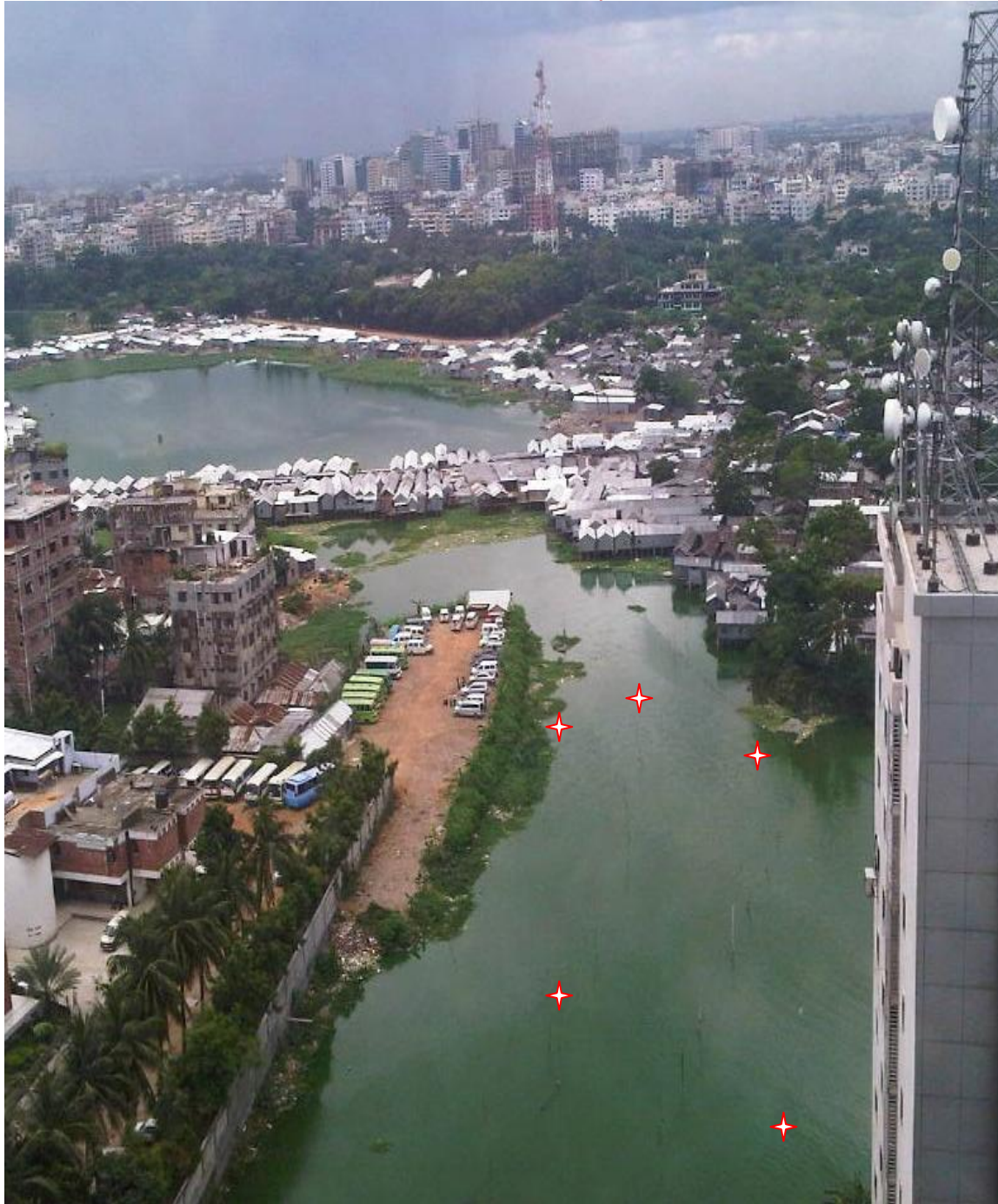


Fig 2: Location photograph of sampling site of Gulshan Lake, Dhaka

✦ Sampling spots of Gulshan Lake

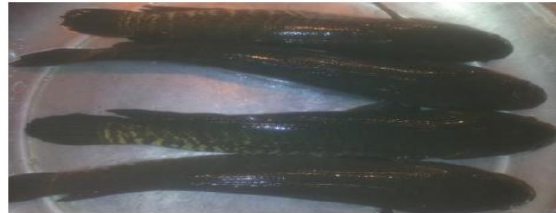
Table 1: Local and scientific name of fish selected for the experiment

Sampling Site	Place	Local name of the fishes	Scientific name of the fishes	Part taken
Gulshan lake	Northern side of the lake	Katol	Catla catla	Middle part
Gulshan lake	Northern side of the lake	Shol	Channa striata	Middle part
Gulshan lake	Northern side of the lake	Koi	Anabas tetudineus	Middle part

Gulshan lake	Northern side of the lake	Taki	Chana punctatus	Middle part
Gulshan lake	Northern side of the lake	Puti	Puntias chola	Middle part
Gulshan lake	Northern side of the lake	Telapia	Telapia congica	Middle part
Gulshan lake	Northern side of the lake	Rui	Labeo rohita	Middle part
Gulshan lake	Northern side of the lake	Pangas	Pangasius bacourti	Middle part
Gulshan lake	Northern side of the lake	Sorputi	Puntius sarana	Middle part
Gulshan lake	Northern side of the lake	Tatkini	Cirrinus reba	Middle part



Katol (*Catla catla*)



Shol (*Channa striata*)



Koi (*Anabas testudineus*)



Taki (*Chana punctatus*)



Telapia (*Tilapia congica*)



Puti (*Puntius chola*)



Rui (*Labeo rohita*)



Pangas (*Pangasius bacourti*)



Sorputi (*Puntius sarana*)



Tatkini (*Cirrinus reba*)

Figure 3: Photographs of collected fish samples from Gulshan Lake, Dhaka.

A. Sunlight Drying

For elemental analysis, the fish samples should be dried dry fully. The dried samples were cut and grind to make fine powder for pellet making. Fishes were dried in the sunlight primarily. Although there is a contamination probability at sun drying period, we tried to minimize the contamination on the samples. The samples were dried on roof of a high rise building.

The curtailed of each fish was first dried in the sunlight as direct drying in the oven at the beginning of drying process because several problems, including severe odor spreads and make the oven almost inactive. Though sunlight drying is not scientific, different gas molecules can be absorbed during this process and the samples may be contaminated. The sunlight drying had been continuing for 15 days. After realizing that sunlight was no longer required, we took the fishes to laboratory for oven drying.

B. Oven Drying

After completing sunlight drying, we had taken the samples to oven by wrapping each sample with clean white tissue papers. Each type of sample had been bagged with properly marked paper container and had put them into the oven. The temperature is set at 60°C. Oven drying had been maintained for 15 days to make them oil and moisture free. Our technique was to dry the fish samples with lower temperature and to avoid long duration to reduce burning probability. By the measurement before and after 3 days continuous running the Oven, we conclude whether the samples have moisture or fully dried. If the sample weight shows the same value, then it may be taken for grinding to make fine powder. At the laboratory, we used a MOMMERT Electric Oven (Model: Schutzart DIN 40050-IP 20)

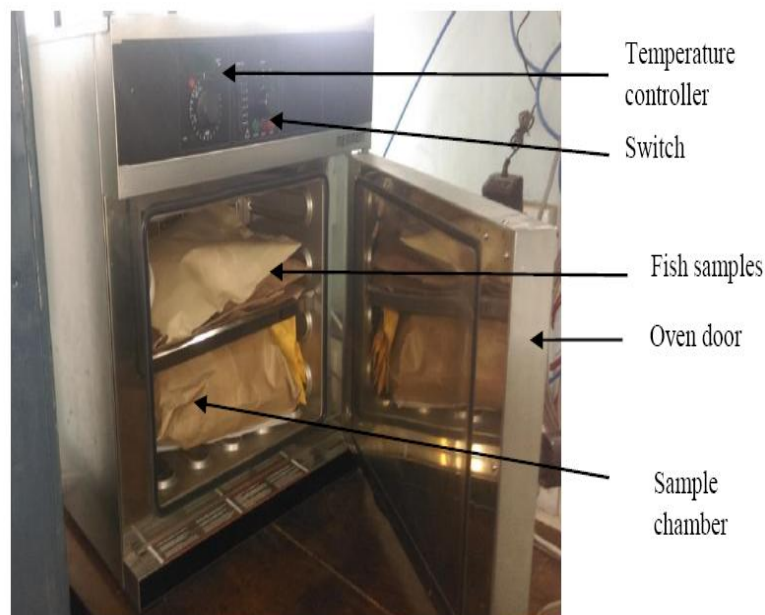


Figure 4: Photograph of the Oven used for fish samples drying

C. Freeze Drying

The third drying process is microprocessor controlled freeze drying. In μ -processor controlled drying system, three main portions are involved; one is compressor for cooling purpose second is for vacuum pumping and the third is vacuum desiccators for holding samples in vacuum. These desiccators are connected with the freezer chamber by control valves and tubes. The whole system is run and controlled by the micro-processor controller and this one is mounted on the upper-front side of the system. The freeze drying works at -85°C that absorbs the water molecules of the samples and drain out of the system making the samples dry. The photograph of the dryer is given below.



Figure 5: Photograph of the micro-processor controlled Freeze Drier.

IV. THE GRINDING PROCESS

The research work using PIXE technique needs to make the fish samples as pellet for setting them on the sample wheeler inside the scattering chamber. For making high quality pellet, the dried fish samples were ground using Mortar-Pester as fine powder and kept each of the sample powder separately with its ID number in the airtight pot. Then the pellets were made for the hydraulic press pellet maker. We tried to minimize the contamination probability.

V. THE WEIGHING PROCESS

Making a pellet of fixed diameter and thickness, measurement is the essential part. All the equipment's needed for sample drying to pellet making are available in the Accelerator laboratory of AECD. For each pellet of 7mm dia and 2mm thick, 0.025gm fine powder were taken. In our weighing process, Mettler Teledo(AB:265-S) electronic balance was used. The range of the balance is 0.01mg to 61gm. The electronic balance and its different parts are indicated below.

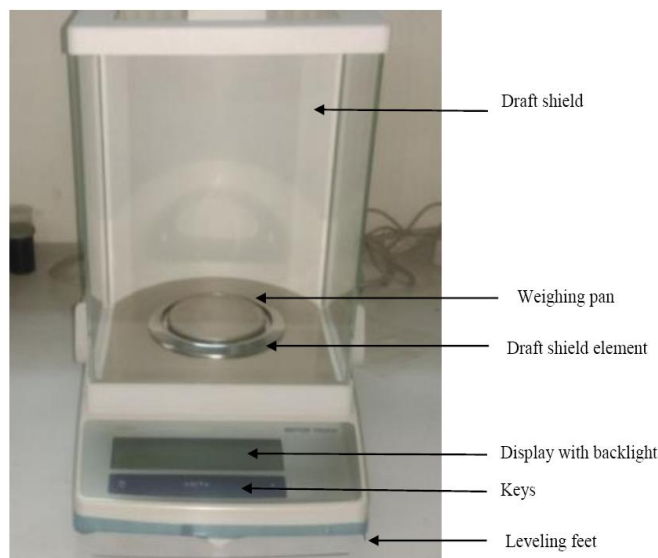


Figure 6: Photograph of the Electronic Balance used for sample weighing



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VI. PELLET MAKING PROCESS

The powder form of the each sample is now ready to make pellet. The specific amount of powder for each sample was placed in the inner side of the hydraulic press. We have used the hydraulic press that can make a pressure of 0-to3500psi on the powder for making desired pellet. The pressure range was different for each sample. Our main purpose is to make almost solid pellet that would not be fragile at normal atmospheric pressure. After making pellet from each sample, they were ready to irradiate by the 3MV Van De Graaff accelerator that is available at the Atomic Energy Centre, Dhaka.

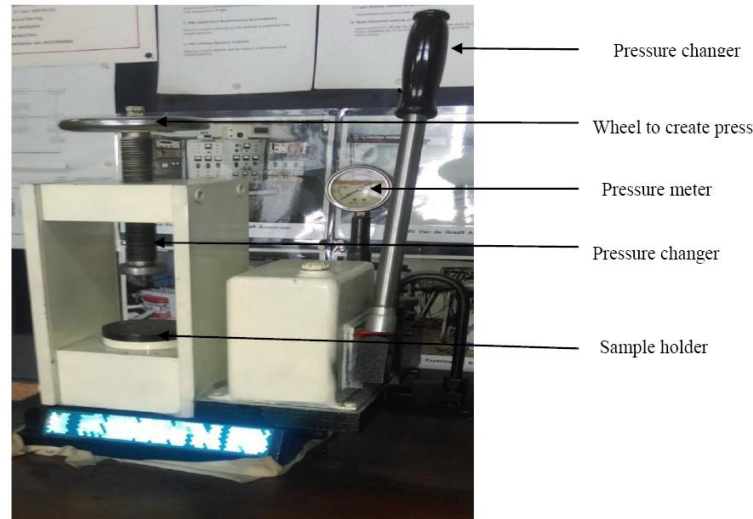


Figure 7: Photograph of the hydraulic press used for making pellet

VII. CONCLUSION

As fish is one of the most important food stuff and protein suppliers of our daily necessities, we should more careful about their freshness and pollution free. Our rivers, lakes and water sources which provide fish are getting polluted day by day. We have chosen Gulshan Lake as an example for this research work and used laboratory facilities that are available in our country. Before going to irradiation process, we have made the collected fishes sample to pellet for testing their level of pollution. At this stage, we are ready to further examination of the fish samples that can reveal the real picture of the pollution level in fishes of Gulshan Lake.

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AUTHOR BIOGRAPHY

Md. Atiqur Rahman, Jahangirnagar University, Savar, Dhaka.

E-mail: arahman1970@gmail.com, Mob: 01817584451