Accumulation of Polonium-210 in different species of fish in Lake Mead

Dr. Vernon F Hodge, Suraj Ghevarghese John and Shunmugam Nallaperumal
University of Nevada Las Vegas
College of Sciences

ABSTRACT

Discovered by Pierre Curie and Marie Sklodowska-Curie in 1898, Polonium is a chemical element with an atomic number of 84. This rare naturally occurring radioactive element is chemically similar to bismuth and tellurium, and forms in uranium ores. Polonium-210 is an naturally occurring radioactive element with a half-life of 138.376 days. This element is found in trace amounts in most organisms. Our research is focused on the accumulation of polonium-210 in fish that occupy in Lake Mead.

The sample species is chosen based on varying lake stratification (layers of the lake). This gives us a good idea of the difference in polonium-210 amounts, based on diet since it tends to change with lake stratification. This research will be based on a previous research that concluded that the polonium 210 is found generally in the internal organs especially the Gastro-intestinal tract of the fish and 97% of polonium acquired by fish is from food intake. The results from our research will help identify the causes for accumulation and compare the level of polonium 210 accumulation in different species based on the strata they are found in.

INTRODUCTION

Research on marine organisms, especially in fishes have shown that the internal organs retain different chemical compounds of nature that are not particularly utilized by the organism. Naturally occurring radioactive materials are retained in the internal organs of fishes (2). Among several naturally occurring radioactive elements, Polonium 210 is the fifteenth nuclide in the chain produced from the decay of Uranium found in earth. The decay of uranium produces different radioactive elements. Among several of those include Polonium 210.

Previous research has shown that polonium accumulates in higher levels in the GI tract of the fish indicating that the polonium 210 came from their diet. Our research will focus on difference in polonium-210 accumulation between species and why the organs retain Polonium-210. The results will be useful in trying to find ways to eliminate polonium-210 from our system (which is accumulated from pollution and smoking). It has been identified that polonium 208-210 is an ingredient of tobacco and that human lungs retain traces of different radioactive elements which might be a contributing cause to lung cancer(4). If polonium-210 can be removed from organisms early in the food chain, its propagation and accumulation in the higher order organisms will be avoided.

METHODS ADMINISTERED

It is important to test different species from the lake. Different habitat and feeding habits affect the retention of polonium 210. Fishes are captured from different location and strata. Once captured, the internal organs of the captured fishes are removed and stored separately in pre-weighted and numbered beakers. The organs are placed on hot plates to dry after the wet weights of each of the organs are noted. Then the dry weight of the samples is noted. The samples are then dissolved in nitric acid. They are then spiked with 1 picocurie of polonium-209 to act as a reference tracer for the polonium 210. Once the sample is dissolved by the nitric acid along with the tracer, we then dilute it with Hydrochloric acid. A silver disc is then brought in contact with the solution which causes all the radioactive material from the sample to transfer to the silver plate. The silver disc is placed in an alpha spectrometer and left overnight. There will be spikes at two different areas in the scale, one for polonium-210 and one for the tracer polonium-209. The data will show the proper energy and the number of counts on each sample. This is then divided by the deterioration per minute after correcting for efficiency of the detector. The result is then divided by the dry sample weight. The answer is then compared with the results from the polonium-209 spike to check for flaws when we plugged in the numbers.

DISCUSSION

This alpha particle (two protons and two neutrons) emitting element contributes ionizing radiation to many organisms on earth. Since alpha particles are much slower than beta particles, giving rise to greater impulses(6). The penetration depth of alpha particles is very small compared to the other radiations.(I) In minute amounts, the radiation is harmless to organisms. But in high amounts, the energy released by the decay can potentially cause irreversible damage to the organism. 0.03-0.04 microCi is the maximum amount of polonium a human body can endure before damage is introduced.

RESULTS

Since there is not enough data yet on the research, we are not able to provide any concrete results, rather we hypothesize on what can be expected. The initial finding from the research will be the concentration of polonium-210 in fishes from different species and strata. This will help us focus our efforts on a particular strata and then find the species found in those strata. For example: If the results show that the fishes found in the Hypolimnion have a higher accumulation of polonium-210, the bottom feeding species found in lake mead such as carp, bass and catfish will be looked at for further research on the cause of the retention of polonium-210 in their system.

CONTACT

Dr. Vernon Hodge
Department of Chemistry
702-895-3845

Shunmugam Nallaperumal
shun_mug@yahoo.com
702-556-6543

Suraj Ghevarghese John
surajjohn29@yahoo.com
702-202-5164

REFERENCES