STUDIES ON $^{226}$Ra AND $^{210}$Pb ACTIVITIES AND 
THE CONCENTRATION FACTORS OF $^{226}$Ra IN 
THE SURFACE ORGANIC LAYERS OF THE 
ESTUARINE SEDIMENTS OF MINDOLA AND 
PURNA RIVERS IN INDIA 

L. U. JOSHI,* M. D. ZINGDE,** B. N. DESAI** 

*Air Monitoring Section, Division of Radiological Protection, 
Bhabha Atomic Research Centre, Trombay, Bombay-400085 (India) 
**National Institute of Oceanography Bombay Regional Centre, 
Versova, Bombay-400061 (India) 

(Received June 15, 1983) 

The sediment samples have been collected from estuarine regions of Mindola and Purna of Gujarat State. These samples are found to contain less than 3% of organic matter which scavenge and carry most of the activity of $^{226}$Ra, etc., to the sediment floor. The activities of $^{226}$Ra are found to vary from 0.1 to 0.5 pCi/g, while $^{210}$Pb activities lie in the range of 3 to 8 pCi/g. These activities find their way into the organisms present in sea water and then into fish which is finally consumed by humans. This paper gives in detail the sampling techniques, experimental procedures and the distribution of the isotopes of $^{226}$Ra and $^{210}$Pb in the estuarine regions and the concentration factors of $^{226}$Ra in the region.

Introduction 

The densely populated regions of the world are found in a strip of about 250 miles wide around Pacific, Atlantic and Indian Oceans. The major industrialized cities are situated near the rivers which are navigable to sea. Naturally, man’s activities in the ocean will continue to be in the areas close to the coastline particularly in the estuarine regions. The major fraction of naturally occurring and artificially produced radionuclides which find their way into the estuaries will never reach the open sea but will accumulate in the estuaries. These areas are important to fisheries because they serve as nursery areas for larval and immature forms. It has been estimated that more than 65% of fish harvested occupy estuarine areas during some phase of their life cycle. The organisms present in such areas accumulate radionuclides and transport them from
shallow water areas to man. This distribution of radionuclides may not be significant as compared to the total amount of these radionuclides released into marine environment but this will result in the ingestion of undesirable concentrations of the radionuclides by persons consuming large amounts of sea food from limited regions over long periods of time.

Sample collection

The sediment samples were collected from top layers (<15 cm deep) at each location in the estuarine region. In the sampling procedure, a number of sediment samples was collected from nearby places at each sampling station.

These sediments were pooled together and then used as representative sample of the respective stations. Fig. 1 gives the locations of sampling stations of Mindola and Purna estuaries from Gujarat State. The sediment samples were air-dried in aluminium trays.

Experimental procedures

Dissolution of the sediment sample

5 g of the sediment sample is heated with 60 ml of aqua regia. 2 ml of Pb carrier (15 mg of Pb/ml) and 1 ml of Ba carrier (400 µg of Ba/ml) is added and the residue is again heated with 60 ml of aqua regia. The dried mass is treated with 10 ml of concentrated hydrochloric acid and evaporated to dryness. The dried residue is finally dissolved in 200 ml of 1.5N hydrochloric acid.

Radiochemical separation of lead and radium

Ion-exchange columns. The anion-exchange resin, Dowex-1 X 8% (50–100 mesh) is washed with running distilled water to remove the fine particles. 15 g of the resin is then loaded in a pyrex glass column (1 X 45 cm).

Column operations. 1. 150 ml of 1.5N HCl is passed through the column at a flow rate of 1.0 ml/min and the effluent is rejected.
2. The sample containing Pb which was dissolved in 200 ml of 1.5N HCl is passed through the column at a flow rate 0.5 ml/min. The Pb is adsorbed on the column. The effluent is collected in a separate beaker for the separation of radium.
3. The ion-exchange column is washed with 100 ml of 1.5N HCl at a flow rate of 0.5 ml/min and the effluent is collected.

370