A Survey of Seawater Quality in Putian Coastal Region, Fujian, China

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0.702

0.46

metals, and mg/L for others)

2.02

0.06 0.26 0.63 0.54

0.42

0.3

heavy metals and mg/L for others)

Total 0.78

Total

s COD

ds

Table 1: Concentrations of seawater samples (unit: ug/L for oil and heavy

Table 2: Concentrations of groundwater samples (unit: ug/L for

338 335

Jiangkou Dongba Bridge Dam

0.02

03

0.04

0.61 0.087

502 0.08

438 297 0938



Introduction

Perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS) are synthetic compounds with hydrophilic and hydrophobic properties commercially used and produced since the 1950's. Some of the commercial uses include oil repellents, waxes, lubricants, firefighting foam, photolithography, and the production of coatings. The wide range of production consequently led to the release of PFOA and PFOS into the environment through waste, disposal and degradation. Concern has been brought due to the persistent, toxic and bio accumulative effects these compounds have in the environment. In 1999, the United States Environmental Protection Agency (EPA) ordered a further examination on PFOA and PFOS due to raising concerns on possible identification in human blood. Upon further research, the EPA listed PFOA and PFOS as emergent contaminants in 2014. This action led to a regulatory action and voluntary industrial phase-outs. In consequence of previous wide usages of PFOA and PFOS, these compounds have been detected worldwide in all kinds of bodies of water. Surveying efforts have been taken into account in coastal areas along northern China for PFOA and PFOS, but studies have been limited in Southern China. In May 2019, more than 180 countries agreed to ban the production and use of PFOA, its salts, and PFOA-related compounds under the international Stockholm Convention on Persistent Organic Pollutants (POPs). The present study focuses on establishing a baseline for PFOA and PFOS concentrations and the continued monitoring of other contaminations of seawater in southeast china in the city of Putian

Methodology

A total of 57 locations were analyzed throughout the Putian coastal region Figures 1 and 2 show the regions and the spatial distribution of the samples analyzed. Instruments used in the study include the ultrasonic cleaner KQ3200E from Kunshan Ultrasonic, electronic balances (Sartorius BSA224S 0.0001g and Sartorius TE612-L 610g/0.01g), Rotary evaporator (Buchi R-210), Agilent 6410 Triple Quadrupole LC/MS, Mini-Q Direct8 water purification system, and C18 Solid Phase extraction Cartridges (500 mg/6 mL, BESEP, Beijing Zhenxiang). The seawater extractions were filtered and collected through a 0.45 µm glass fiber membrane. Then, the samples were stored and sealed in glass containers to be shipped to the lab for analysis. In the lab, 500 mL of filtered water sample would get mixed with a 0.5 mL of a 5.0 µg / L of an internal standard mixed solution. After, a C18 Solid-phase extraction column was used for target enrichment and matrix separation. Following the flow of the samples, the solid-phase extraction column was dried using vacuum for 45 minutes. The dried sample would be then eluted with 15 mL of methanol-ethyl acetate eluent with a 4 to 1 ratio. The effluent would be collected and concentrated to the point of dryness. Methanol was added to reach the 1.0 mL needed for testing with the Afilent 6410 Triple Quadrupole LC/MS to which the stated limit of qualification (LOQ) is 0.5-1.5 ng/L. The samples being tested for PFOA and PFOS were analyzed using the Solid Phase Extraction (SPE) Enrichment with Ultra High-Performance Liquid Chromatography-Tandem Mass Spectrometry. Groundwater samples were tested using the atomic absorption spectroscopy for the detection of Cu, Zn, Pb, and Cd. The cold vapor atomic fluorescence spectroscopy was used for the detection of Hg and As. Spectroscopy was used for the detection of fluoride. Infrared spectroscopy was used for the detection of petroleum compounds. Dichromate oxidation method was used for the chemical oxygen demand (COD). Nesslet's reagent colorimetry was used for the detection of ammonia nitrogen. Alkaline potassium persulfate digestion-UV spectrophotometric method was used for total nitrogen and the ammonium molybdate spectroscopy was used for the total phosphorus content. For seawater samples the atomic absorption spectroscopy was used for the detections of Pb, Cd, and Cu. The cold caport atomic fluorescence spectroscopy was used for As and Hg detections. The spectrophotometry was used for the detections of nitrogen and phosphorus. Potassium permanganate oxidation method was used for the detection of COD, and the UV-visible spectrophotometry was used for the detection of petroleum compounds.

esults



Figure 1: Geographical location of the studies



Figure 2: Locations of 57 sampling sites along the Putian coastal region as well as the surrounding rivers.

	Jiangkou Bridge:	Sanjiangkou:	Shima Bridge:	Yuantou Bridge:	Dongzhen Reservoir:	Laix:	Shima Bridge:	Xitai Bridge:	
Ammonia nitrogen:	Slightly Polluted	Polluted	Slightly Polluted	Sightly Polluted					
Chemical Oxygen Demand		2.0.0							
(COD).	signly Poluted	Politied							
Total Nitrogen:	Beyond Severely Polluted	Beyond Severly Polluted	Beyond Severly Polluted	Beyond Severly Polluter	d Slightly Polluted	Beyond Severely Polluted	Beyond Severly Polluted	Beyond Severly Pollu	ited
Total Phosphones	Severely Polluted	Rewood Severily Polluted	Severily Polluted	Severely Polluted		Severily Polluted		Severally Polluted	
Table 3: Conta	aminated area	s for <mark>ground w</mark>	ater	,					



Results

Figure 1 shows the geographical location of where the survey took place. The geographical location shown by the arrow is in the coastal region of Putian, China. Figure 2 shows a closer look of the different testing areas involving ground and seawater. The types of chemicals being tested involve heavy metals such as Copper (Cu), Zinc (Zn), Cadnium (Cd), Lead (Pb), Mercury (Hg), Arsenic (As), perfluorinated compounds such as Perfluorooctanesulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA), and other chemicals such as Chemical Oxygen Demand (COD), Inorganic Phosphorus, Inorganic Nitrogen, Ammonia Nitrogen, Fluoride, Petroleum Compounds, and Oil. Tables 1 and 2 show the amounts of the different environmental contaminants that were found at the different tested locations. Tables 3 and 4 show the exceeding contaminants in all the tested areas. The exceeding chemicals include Chemical Oxygen Demand (COD), Inorganic

Conclusion

Several environmental contaminants were tested and compared to the national standards in the coastal regions of Putian, China. A total of 57 sampling sites were tested with 23 sites containing some type of chemical contamination. It was reported that out of the 23 contaminated sites, 8 were from ground water and 15 from seawater. The chemicals that were found to be exceeding the national standards included the Chemical Oxygen Demand (COD), Inorganic Phosphorus, Inorganic Nitrogen, and Armonia Nitrogen. The reported environmental contaminants in the several locations will let the people living in Putian to be aware of what areas need more attention. In addition, the reporting of the survey done in the coastal regions of Putian City contributes to new testing conducted in Southern China. Hopefully, this research will encourage more future testing for environmental contaminants in more parts of southern China.

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