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Interpretation FTIR Spectrum of Seawater and Sediment in The Ambon Bay (TAD)

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Abstract. Research has done to interpretated FTIR spectrum of seawaters and sediment of the Ambon Bay (TAD). Analysis of samples of sediment and seawater using FTIR spectroscopy. The results showed the sand sediment samples identified Stretch bond OH group (3600-3500 cm^{-1}), N-H Stretch (3400-3300 cm^{-1}), C≡N (2250 cm^{-1}), and NH bending (1640 to 1550 cm^{-1}). And for seawater samples identified bonding group that is N-H Stretch (3400- 3350 cm^{-1}), N-H bending (1640 to 1550 cm^{-1}) and C = O (1670-1640 cm^{-1}).The existence of functional groups, carbonyl (C=O), alcohol (OH), carboxyl (COOH) can cause the complexation of metal cations. And the results showed analysis group N-O bond-containing compounds Nitro indicate heavy metal content of Lead (Pb) and group N-H bond-containing compound Amina indicate heavy metal content of Cadmium (Cd).

INTRODUCTION

Today the environment, especially water pollution by heavy metals is not only a national problem but also internationally. Heavy metal pollution can be derived from natural or industrial activities. Water pollution can be salts of heavy metals and heavy metals that form toxic compounds. Heavy metals are often found in water pollution is Hg, Pb, Cd, Cr, Cu, Ni, and Zn in the form of toxic compounds. factors that because heavy metals are grouped into contaminants are 1) a heavy metal cannot be decomposed through biodegradation such as organic pollutants, 2) heavy metals can accumulate in the environment, especially in the sediment of the river and the sea, because it can be bound with organic and inorganic compounds, through adsorption process and the formation of complex compounds [1]. Because heavy metals can accumulate in sediments, the levels of heavy metals in sediments is greater than water. Therefore, the observation of heavy metals need to be done in an effort to preserve the aquatic environment of the Ambon Bay.

Heavy metals can be toxic to living creature at certain levels. Although they occur naturally, they might also come from many different sources. These include some mining industries, burning of fossil fuels, like coal. Heavy metals are elements having atomic weights between 63.5 and 200.6, and a specific gravity greater than 5.0. Living organisms require trace amounts of some heavy metals, including cobalt, copper, iron, manganese, molybdenum, vanadium, strontium, and zinc. Heavy metals can enter human bodies via food, drinking water and air to a small extent. Although some heavy metals effects include reduced growth and development, cancer, organ damage, nervous system damage, are very important to maintain the metabolism of the human body as trace elements, they can lead to poisoning at higher concentrations. Heavy metals are among the normal constituents of the marine environmental but anthropogenic activities have contributed to the increase in metal contamination into marine environment and have directly influenced the coastal ecosystems. There are Considerable evidences in the scientific literature that contaminants such as trace metals can be taken up and concentrated by sediments and suspended matter in the Aquatic systems. The vertical and horizontal distributions of many trace elements in the ocean are determined by association with the cycle of growth, sinking and demineralization of marine phytoplankton. Metal pollution of the marine environment is less visible and direct than other types of marine pollution, but its effect on marine ecosystem and human are intensive and very extensive. Sediment contamination poses one of the worst environmental problems in

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marine ecosystem acting as sinks and source contaminations in aquatic systems. There is an evidence that in some coastal areas of the Mediterranean Sea the input of particularly phosphorus [3]. Mineral solids consisting of a chemical element or compound that is formed naturally by inorganic processes, has the properties of certain physical and chemical and placement have uniformly atoms therein, otherwise known as the crystal structure. sources of mineral deposits that can lead to substance pollutant is a heavy metal, which is expressed pollutants or contaminants are highly poisonous (toxic) because these metals are decomposed, so pollutant metals caused by the elements Mercury (Hg), Cadmium (Cd), copper (Cu), Lead (Pb), zinc (Zn), Iron (Fe) and nickel (Ni).

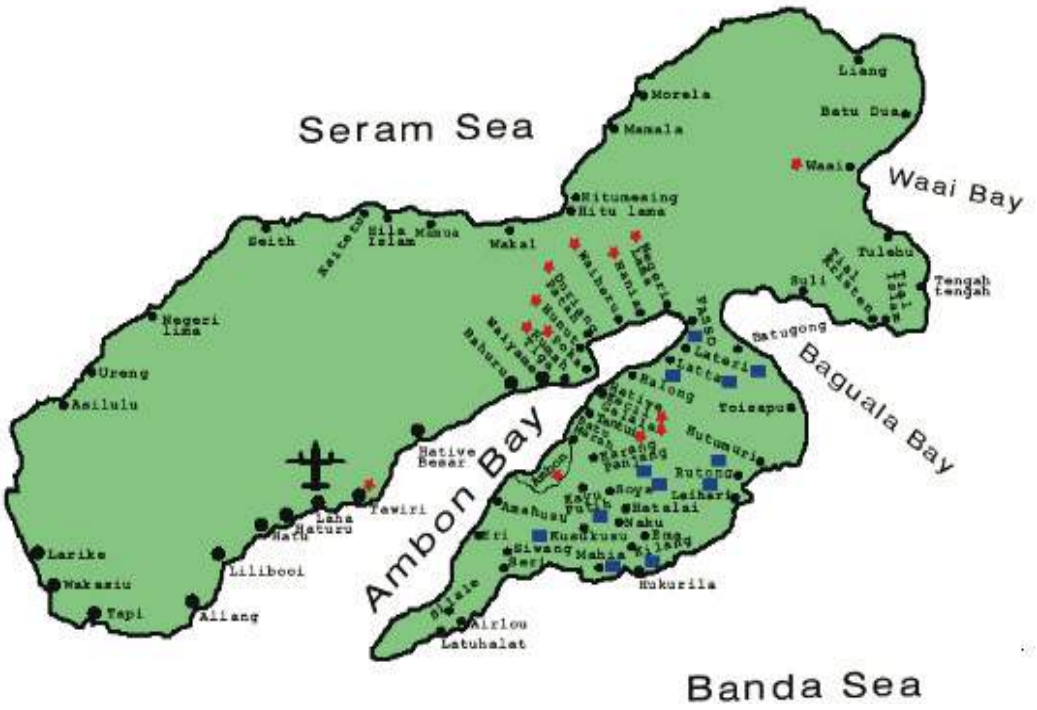


FIGURE 1. Map Location Research [2]

MATERIAL AND METHODS

This study was conducted to identify the allegedly heavy metals pollute the Ambon Bay in (TAD) by analysing samples of seawater and sediments of sand at some point in the bay. Analysis of samples was performed using FTIR spectroscopy method only for qualitative analysis. Materials used sea water (approximately 4 samples) and sand (approximately 8 samples) were taken at different locations in Ambon Bay in (TAD), and KBr powder. The effects of activities include an increase in the amount of sediment, changes in temperature and salinity and excessive eutrophication. Due to lack of landfills and the lack of public awareness. In addition, the oil spills from ships transport activities affect water quality in the Ambon Bay. Ambon Bay in becoming landfill waste from industry and waste household. In the bay there are lots of plastic garbage and many old ships were wrecked and damaged left to rot on the seaside. It triggers the occurrence of pollution in coastal waters and the sea, because of all the waste from the mainland, both from urban settlements as well as sourced from the industrial area, ultimately it comes down to the beach or the sea.

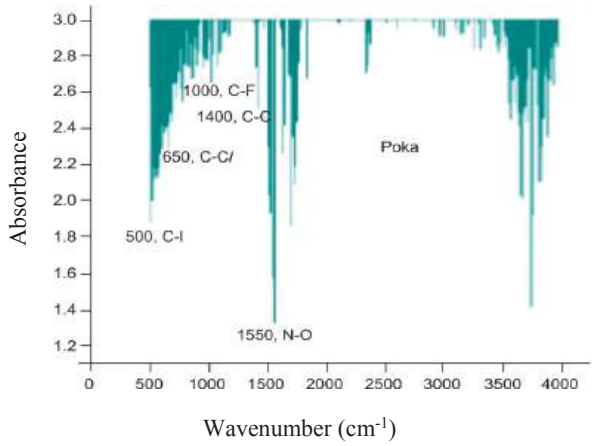
Spectrophotometry Infra-Red is a method of observing the interaction of molecules with electromagnetic radiation is in the wavelength range from 0.75 to 1000 μm, or at wave number 13000-10 cm^{-1} using a tool that is a infrared spectrometer. This method is widely used in industrial analysis laboratories and research laboratories because it can provide useful information for qualitative and quantitative analysis, as well as assisting the application of a compound of formula wake. Fourier transform infrared spectroscopy (FTIR) spectra were recorded between 4,000 and 500 cm^{-1} using FTIR (model MB 3000 ABB) with 1 cm^{-1} resolution. Pellets were prepared by mixing the samples with 100 mg KBr using absorbance spectroscopy accessory. FTIR spectra of seawater and sediment sorption were recorded.

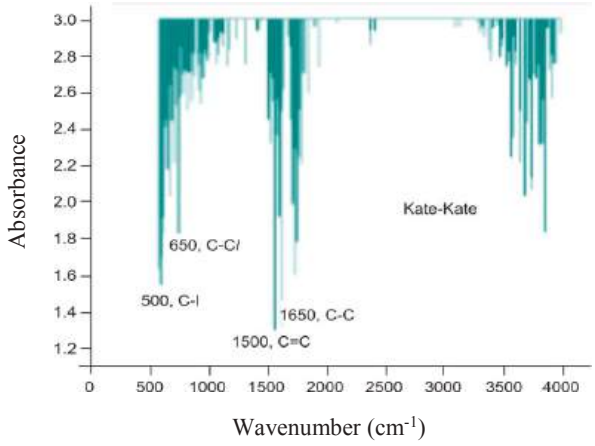
Potassium bromide (KBr) powder was used as a background reference and assumed to have a reflectance of 1 (100 %). Data in whole spectral range (4,000–400 cm^{-1}) were used for the principal component analysis (PCA). The tools used are spectroscopic FTIR (Fourier Transform Infrared) type to analyse the bonding group and compounds from seawater and sea-sediment samples.

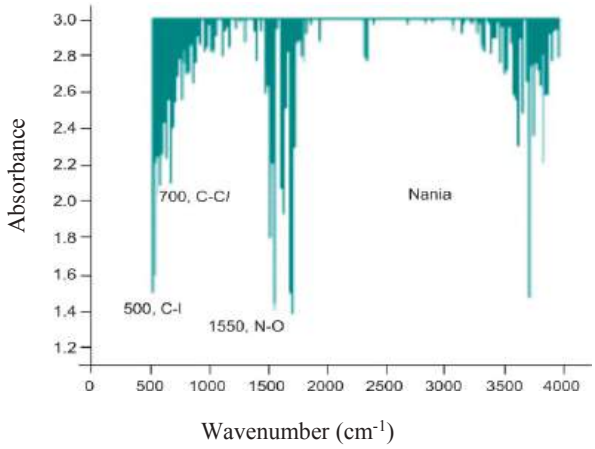
RESULTS

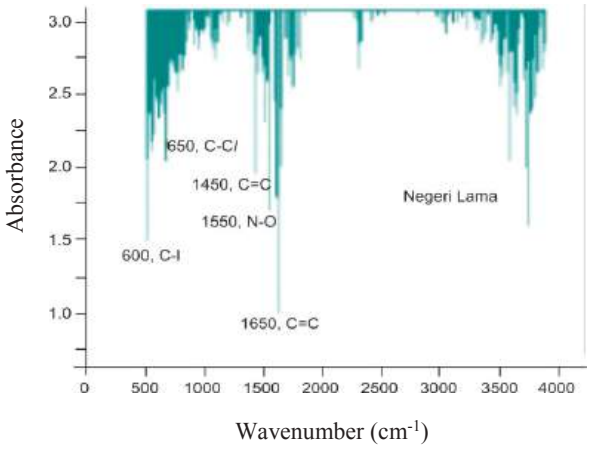
Infrared spectra of sediments

The results obtained from samples of sand were taken around the coast at eight different locations, which are Poka, Kate-kate, Nania, Negeri Lama, Passo, Lateri, Halong, Galala and identified by FTIR method. Eight points from sediment samples at the Ambon Bay in the region, can be summarized in the identification of its bond group in the following graph.









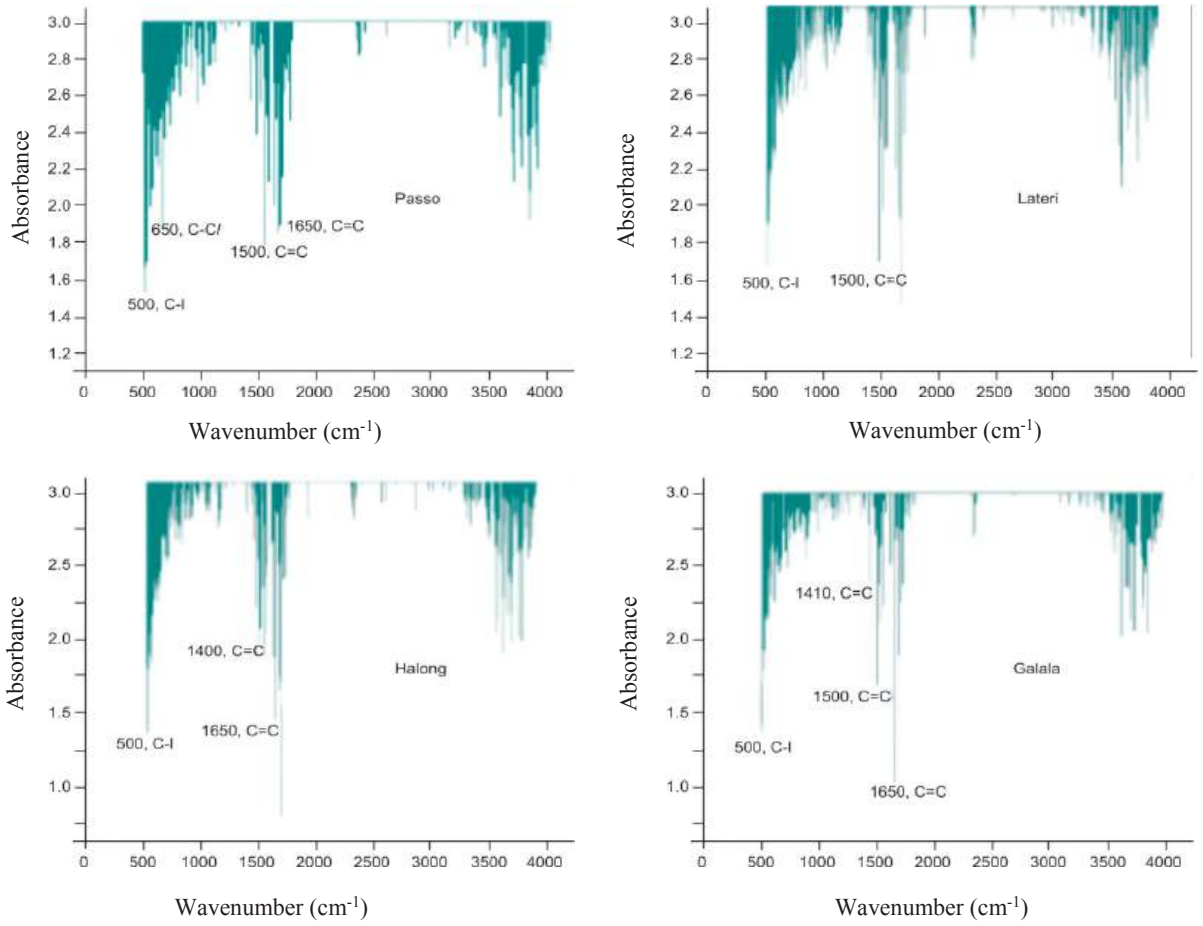


FIGURE 2. Infrared spectra of sea-sediment in the Ambon bay.

Figure 2. show the spectra FTIR of Sea Sediment. The peak at 1200-1400 cm^{-1} indicated functional group of C=O stretching. The peaks appeared in the 1500–1200 cm^{-1} for all the metals in the present study representing C-H bending vibrations of CH_3, CH_2 and CH functional groups [4]. A useful band in the infrared spectra of carbonyl ligands in metal complexes is that due to C–O stretching.

The peak at 2500 – 3000 indicated functional group of O-H (carboxylic acids) Very broad (over ~ 500 cm^{-1}), often looks like distorted baseline, can reach above 3000 cm^{-1}. Spectrum combined in some sediment samples of sand, it appears that, catchment area the largest in the region of wave number 3430 cm^{-1} compound Amine-bonded group NH Stretch intensity (medium) of 2.75, until the wave number 2911 cm^{-1} compound Alkyl with Stretch CH bonds with less intensity (strong to medium) by 2.95. In the area of wave number 2340 cm^{-1} compound with a carboxylic acid group O-H bond Stretch with an intensity of 2.79.

For amine group, there were changes in wave number for N–H stretching in the Cd^{2+} sorption's. The C–N stretching was found to disappear with the sorption's of Cd^{2+} and Pb^{2+}. The N–H bending group did not seem to change for both metals. These could be interpreted that N–H stretching in amine group was associated with Cd^{2+} sorption, and C–N stretching was for both metal sorption. On the other hand, N–H bending was thought not to involve in the metal binding. The observation for amide group revealed that N–H stretching was slightly shifted by Cd^{2+} sorption from 3410 to 3396 cm^{-1}. N–H stretching was also affected by the sorption of Pb^{2+} where the new peak occurred at a wave number of 3340 cm^{-1}. For this case, the new peak occurred while the old peak still existed. This could imply that this N–H stretching was available in excess quantity for the sorption of Pb^{2+}. The C–O stretching group in this amide group did not show shift in wavelength, which suggested that this was not involved with the sorption. In contrast, C–O in amino group seemed to play an important role for all metal sorption as a shift in the wavelength was always found. The N–H bending in this amino group, however, was not found to involve with the sorption of Cd^{2+}, and Pb^{2+} [5].

Infrared spectra of seawater

The FTIR spectrum of the results showed that in the area Lateri towards poka intensity Pb and Cd were quite large, ha is in line with the widespread construction of housing and industry in the region and a haven of many ships. For samples of sea water taken at four different locations, namely: the village of Poka, Negeri Lama, Lateri, Halong and Galala. The following is a combined spectrum of all 4 samples of sea water.

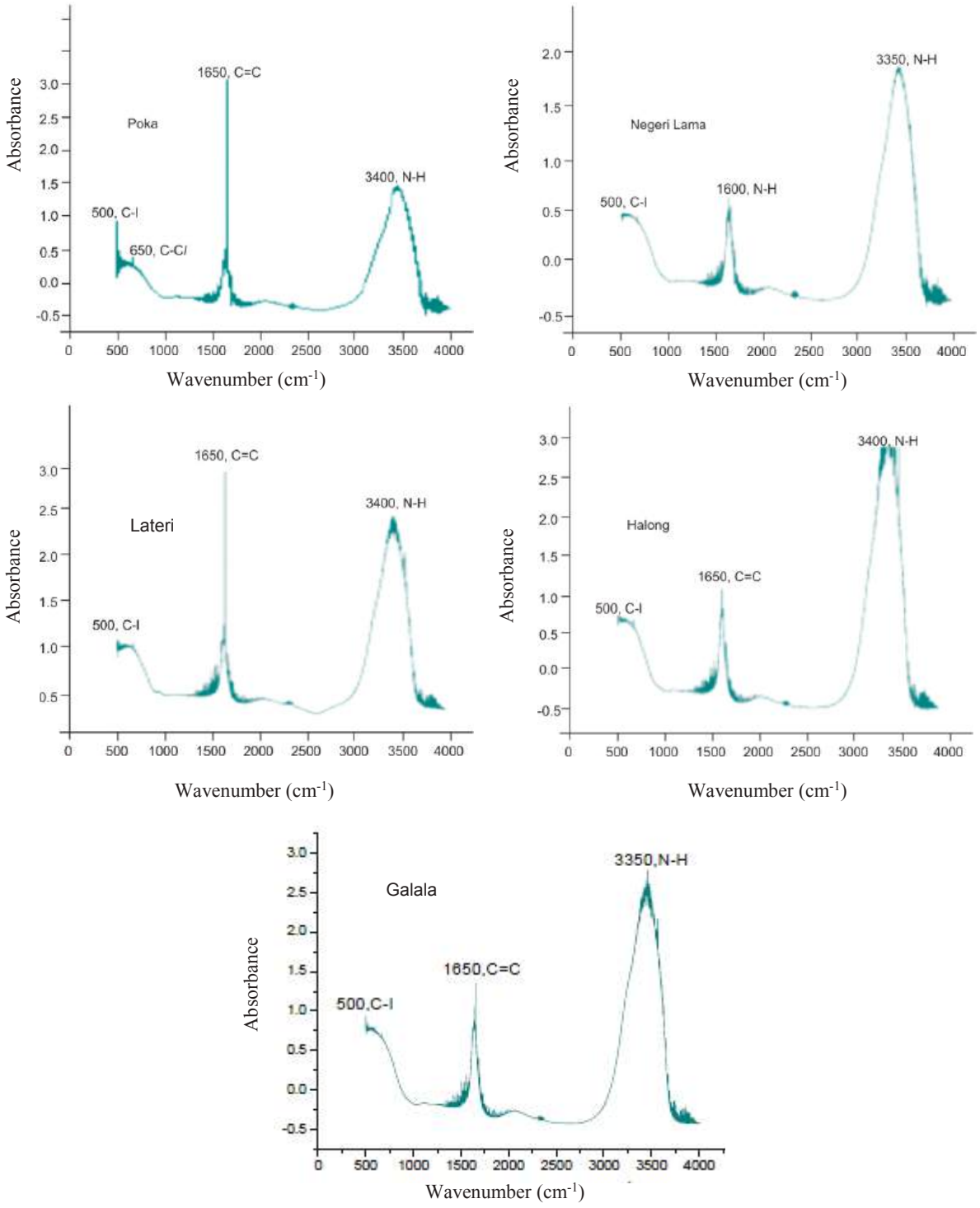


FIGURE 3. FTIR Spectrum (Absorbance Vs Wavenumber) of seawater

The study of the IR spectra is based on many studies. In the spectrum absorption peaks with strong intensity, are present in the area wavenumber 1600 =1650 cm^{-1}, indicated a functional group alkene, C=C and the intensity is weak to medium; sharp. And for regions 3300 – 3450 cm^{-1}, the functional group is alcohols, hydrogen bonded O-H and the peak intensity are Strong and broad. compound Amine NH Stretch intensity (weak) 1.49 on poka region, then the region with local Lateri wave number 3414 cm^{-1} compound Amine NH Stretch intensity (medium) by 2, 35. Later in the area of regional planes with wave number 3399 cm^{-1} Amine compound N-H Stretch with intensity (strong) of 2.75. And in the area of wave number 3370-3485 cm^{-1} has a peak width and intensity (strong) by 3 at halong area. Interpretation of the FTIR spectrum shows the Halong region and the plane has particularly sizeable intensity of compounds Amine N-H Stretch, which is in line with the identification of heavy metals contained in seawater, the metals Pb and Cd. It's evident because in both these areas are the construction and waste disposal industry and household running along rivers and on the edge of the Ambon Bay. The sea water is corrosive chemicals. In addition, sea water also contains ions metals which could result in a crust. The material selection process is crucial long-term durability and efficiency.

In this research was limited to qualitative analysis, to find a large concentration of heavy metals that can be followed by a quantitative analysis. But by looking at the intensity of the absorbance spectrum can be assumed with high intensity is directly proportional to the thickness and concentration of the presence of these metals.

CONCLUSION

Identification of heavy metals in the waters of the Ambon Bay in (TAD) using FTIR spectroscopy showed that in both types of samples, namely sediment sand and sea water are compounds Amine NH Stretch with intensity strong enough in the area of wave number 3430 cm^{-1} in the sediment and the area of wave number 3370-3485 cm^{-1} in the samples of sea water, where for amine group, there were changes in the wave number for the N-H stretching in the Cd sorption's. The N-H bending group did not seem to change for both metals. Reviews These could be interpreted that the N-H stretching in the amine group was associated with Cd sorption.

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