The Removal of Heavy Metal Using Biomaterial to Enhance the Quality of Life in Community.

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Abstract**—**This work is remove Co(II)ions by using biomaterial in community to enhance the quality of life in community. The result found that biomaterial could be absorbed Cobalt (Co(II)) in all experiments. The optimum adsorption capacity on the adsorption of Co(II) was obtain by used adsorbent 0.20 g, initial metal concentration 200 ppm, pH = 4 and $NaNO_3$ in solution, respectively. The results shown that this method could be reduced the amounts of Co(II) in contaminated waste water before release to the community by using biomaterial in community. Biomaterial is effective and inexpensive materials to remove high amounts of heavy metal from aqueous solution. This method could be application to eliminate heavy metals from waste water before release to the environment.

Keywords**—**Biomaterial, Co(II) adsorption, Community

I. INTRODUCTION

THE pollution from heavy metal is one of the most serious environmental problems. The less amount of heavy metal can cause a toxic to human body [1-3]. Recent environmental problem it is a problem that occur to become fiercer and more depending on the consequence of the Thailand has developed rapidly in the technology industry and part of the thriving as a result of the research in a laboratory to try to verify the quality of the product and the materials in a laboratory experiment the chemical and biological need to use many types of chemicals which cause of toxics waste in addition to the teaching in the university have tried to make the students understand the theory and content more experimental research has invented new cause of toxic [4].

The use of various chemicals and then let down to a scientific if it is proper to drain into the surrounding, including any negative effects many health impact on the amount of oxygen dissolved in the reduction of dissolved oxygen in the water will have a direct impact on aquatic life in general should be a natural source of water quantity of the dissolved oxygen is not lower than the 2.0 mg/l with a mineral or organic sources mixed in too much water will cause toxic [5-9]. If there are more weeds can cause a situation called Eutrophication caused the spread of the plant species in the water quickly (algae bloom) affect the lack of oxygen in the water that can cause aquatic death.

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From the current environment surrounding us in good condition and very lack communities, particularly in areas which are close, one of the most pay a lot of attention to the production of consumer goods and there are many types of toxics in the environment, particularly in some of the source of water, even though there is less difficult to analyze, but it is a danger to life and environmental specifications and increase the concentration of substances before the analysis is an important role for the analysis can be done with the tools that have been able to make their own, but it's not difficult to correct the results of technical and reliable. By the most crucial and popular techniques such as solidphase extraction by several groups of researchers have studied how to increase the intensity of this technique [10-11].

Removal of heavy metals from the surrounding is an important factor. Many methods for removal of metal ions from waste waters have been developed. A removal process must be easy, effective and inexpensive [12-14]. General processes have been suggested to adsorb heavy metals from wastewaters, such as ion exchange, chemical precipitation. However, most removal processes have restrict, such as continuous chemicals, expensive and even incomplete metal adsorption.

The other method used for the adsorption of heavy metals is ion exchange. Ion exchange may be defined as the exchange of ions between the sorbent and surrounding medium. Ion exchange is one of the most frequently studied and widely applied techniques for the removal of metal contaminated in wastewater and the renewal of solutions for reusing. Ion exchange resins are usable at various pH values and reach to high temperatures. Ion exchange is insoluble in most solutions. They contain bond between the cross linked polymer matrix and the charged functional groups. The cation and anion exchangers are categorized into strongly acidic, weakly acidic, strongly basic, weakly basic ion exchanger based on nature of functional groups.

K. A. Tony and researcher [15] study the amount of Fe (III), Ni (II), Mn (II) and Zn (II) in the water example above by virtue of a complex between metal compounds with 5, 7 dichlorooxine on micro column with C - 18 is a solid phase and a column in the result of the study found that FAAS substances in the sample, there are 4 types of metal quantities of 7.16×10^{-11}, 1.70×10^{-11}, 9.10×10^{-11}, and 9.10×10^{-11} mol/kg, respectively on the use of silica in the functions Salicylaldoxime Cu (II), Ni (II), Co (II) and Zn (II) from aqueous mixed both in the chapter, and a volume of the column, and then analyzed for both 4 types of metal AAS with technical study found that this type of silica can

juice Cu (II), Ni (II), Co (II) and Zn (II) to be 0.079, 0.040, 0.059 and 0.040 mol/kg, respectively. In addition they also proposed that the type of silica can be used in the analysis of amount of metal contamination in Real examples from industrial and terminal examples of biodiversity.

A. Tong and researcher [16] has been in the possession of metal juice Microsoft enough silica Square in a way that an impressionist finds in civilians. (impregnation) and found that it is prepared to absorb the juice in the Cu (II), Pb (II) and Mn (II) to be 7.21 X 10^{-9}, 3.73 X 10^{-5}, and 2.45 X 10^{-9} mol/kg respectively, but is not able to extract Pb (II), Fe (III) and Zn (II). It also silica that can be used to prepare for the amount of metal came from natural water samples and the environment.

In the work of research A. Boos [17] and the mission of the synthesis of silica using a square and reduce surface tension of a layout, and found that the silica solution was perfectly prepared for osteoporosis is a true 3.90 NM silica can be this type of juice Cu (II) to be 0.20 mol/kg in the NaOH solution $NaNO_3$, which make the situation for the right to extract Co (II) and Ni (II) with solutions, and it was found that the silica that can extract Co (II) and Ni (II) is 0.30 and 0.32 mol/kg, respectively.

Also experience low signal noise and high stability. Which currently has mineral analysis tools. High performance elemental analysis such as Inductively Couple Plasma-Optical Emission. Spectrometer (ICP-OES) is an analytical tool. Both qualitative and quantitative tests as well. Analysts have multiple elements at the same time. (Simultaneous Multielements Analysis) using ICP technique are two parts to produce high temperature plasma with argon gas emissions through torch attached to the transmitter frequency. When the frequency into a magnetic field is induced. The electric Spark with Tesla. A high-energy electrons collide with other electrons. A chain reaction A plasma fraction OES principle makes the transition from the ground state to the substance [18].

The substance is excited to emit light or spectrum analyzer out. For example, inIndian study heavy metal contamination in black tea leaves grown in the city in six areas.Valparai town in Nilgiris Vandiperiyar town of Munnar and Wayanad town of the city. Karnataka total of 100 samples using AAS analysis found that the volume. Of copper, chromium, nickel, cadmium and lead, in the amount of 24.07 ± 2.25, 4.76 ± 1.27, 2.53 ± 1.01, 0.14 ± 0.06 and 0.81 ± 0.32 mg per kg, respectively [19-21]. For Argentina it has used. Electrothermal Atomic Absorption Spectrometry (ETAAS) and Ultrasonic Nebulization System Coupled to Inductively Coupled Plasma Optical. Emission Spectrometry (USN-ICP-OES) Determination of Heavy Metals in the tea leaves. And tablets are made Herbs by random sampling from the market. The sample beverages and dry tea leaves. The analysis not found the amount of chromium and cobalt. Because the value is well below the detection limits as can be. Steel, aluminum, cadmium, lead and vanadium have. But the analysis has been lower than that acceptance by consumers each day (acceptable daily intake), the World Health Organization recommendations and the survey sample digestion with tea. Microwave (microwave digestion) and extracted with hot water (hot water extraction), then measure. Boron is in black tea, green tea, coffee, fruit juice. And roasted coffee beans found in large quantities. 3:21 to 9:25, 3:54 to 5:52, from 2.71 to 27.7, from 13.3 to 21.3, and from 7.57 to 17.5 mg per kg, respectively [19-20]. Studies on the absorption of Lead from soil into the tea found that soils with high acidity makes tea tree can absorb lead in soil. It was also found that increasing the alkalinity to the soil by adding calcium carbonate to pH. An increase of one unit can reduce the absorption of lead into the tea percent of 20-50.

In this experiment sorbent used for study the adsorption capacity from biomaterial synthesized from coconut (coconut carbon). The main objective of this study was to adsorb heavy metal ion from aqueous solution. The effect of pH, amount of adsorbent, metal concentration and ion interference were determined.

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1.To study the adsorption capacity of the Co(II) adsorption by used biomaterial in the community.
2.To study the optimum conditions in the Co(II) adsorption by used the biomaterial in the community.

II. MATERIALS AND METHODS

A. EQUIPMENT

Atomic Absorption Spectrophotometer, the company GBC model AVANTA (Australia)

- Micropipette
- Crucible
- Furnace model Nabertherm (Germany)
- filler paper No. 1 (Whatman)
- glassware basic in operation room

B. CHEMICALS SUBSTANCE

- Co(aq) 1000 ppm [Spectracer UK Ltd]
- Conc. HNO_3 (68-70 %) [BAKER ANALYZED]
- 0.01 M HNO_3

C. SAMPLE PREPARATION

1.The process of preparing aqueous standard metal ion.

Standard Co(II) concentration 200 ppm capacity 500 ml weigh $CoCl_2$ and adjust volume with 0.01 M HNO_3 500 ml in bottle size 500 ml

Prepare the standard aqueous stock solution (500 ml), a concentration of 0.5, 1.0, 3.0, 10.0, 15.0 ppm, using micropipette from stock solution 25, 50, 150, 250, 500, 750 micro liters, respectively. Adjust volume with 0.01 M HNO_3 in bottle volume size 10 ml use all aqueous solution to analysis for make standard graph.

2. Steps to prepare for an example

Take sample neht dnawash into ekat neht dna retaw raelc elpmas ain to erutarepmet a ta nevo of 60 suisleC seerged tsaelta rof yrd si elpmas a litnu1-2 sruohafter that take fine sample in to powder elttob eht ni derots neht

2.1 Effect o ht ni secnatsbus fo noitprosba laitini eht fe noitartnecnoc mpp 200 fo 0.01 M HNO_3. The sample weight, the scales are as follows:

Sample 0.05 g + Co(II) 200 ppm 25 ml
Sample 0.10 g + Co(II) 200 ppm 25 ml
Sample 0.15 g + Co(II) 200 ppm 25 ml
Sample 0.20 g + Co(II) 200 ppm 25 ml
Sample 0.25 g + Co(II) 200 ppm 25 ml
Sample 0.30 g + Co(II) 200 ppm 25 ml

dissolve 0.01 M HNO_3 and $CoCl_2$ is down to every 25 ml beaker with foil to shake with aqueous samples. Leave it for a long time 24 hours or 1 day, then take aqueous solution in the buchner funnel with filter paper to remove contaminants from the glass bottle size 30 CC, and then bring the sample to analyze with the AAS.

2.2 Effect of the initial concentration of the heavy metal at various concentrations as follows: 50, 100, 150, 200, 250 ppm in 0.1 M HNO_3.

:swollof sa era selacs eht ,thgiew elpmas ehT
Sample 0.2 g + Co(II) 50 ppm 25 ml
Sample 0.2 g + Co(II) 100 ppm 25 ml
Sample 0.2 g + Co(II) 150 ppm 25 ml
Sample 0.2 g + Co(II) 200 ppm 25 ml
Sample 0.2 g + Co(II) 250 ppm 25 ml

thgiew sample 0.2 g rekaeb ni 50 evlossid lm 50 with 0.01 M HNO_3 with various concentration of $CoCl_2$ 25 ml and emit gnol a rof ti evael24 ro sruoh1 ekat neht ,syad aqueous solution in the buchner funnel, filter with the retlif ezis elttob ssalg eht morf stnanimatnoc evomer ot repap30 CC, eht htiw ezylana ot elpmas eht gnirb neht dnaAAS.

2.3 Effect of the initial of various different pH, (pH 2-6)

:swollof sa era selacs eht ,thgiew elpmas ehT
Sample 0.2 g + 25 ml of Co(II) pH 2
Sample 0.2 g + 25 ml of Co(II) pH 3
Sample 0.2 g + 25 ml of Co(II) pH 4
Sample 0.2 g + 25 ml of Co(II) pH 5
Sample 0.2 g + 25 ml of Co(II) pH 6

weight sample 0.2 g in beaker 50 ml dissolve with 0.01 M HNO_3 with various difference of pH (2-6) 25 ml and emit gnol a rof ti evael24 ro sruoh1 ekat neht ,yad aqueous solution in the buchner funnel, filter with the ot repap retlif ezis elttob ssalg eht morf stnanimatnoc evomer30 CC, dna eht htiw ezylana ot elpmas eht gnirb neht AAS.

2.4 Effect of eht ion interference eht no tceffe na sah taht absorption.

:swollof sa era selacs eht ,hgiew elpmas ehT
Sample 0.2 g + 25 ml of Co(II) 50 ppm
Sample 0.2 g + 25 ml of Co(II) 100 ppm
Sample 0.2 g + 25 ml of Co(II) 150 ppm
Sample 0.2 g + 25 ml of Co(II) 200 ppm
Sample 0.2 g + 25 ml of Co(II) 250 ppm

weight samples 0.2 g in beaker with 50 ml dissolve 0.01 M HNO_3 and $CoCl_2$ contain of NaCl, $NaNO_3$, $CaNO_3$ and KNO_3 25 ml and emit gnol a rof ti evael24 ro sruoh1 ,yad ekat nehtaqueous solution in the buchner funnel, filter with the elttob ssalg eht morf stnanimatnoc evomer ot repap retlif ezis 30 CC, htiw ezylana ot elpmas eht gnirb neht dna ehtAAS.

III. RESULT AND DISCUSSION

The accepted value of the concentration of Co(II) as report in the World Health Organization (WHO) was 0.040 mg/L (ppm).

stluser ehT of the experiment were shown as follow:

1.Effect of the initial amount of absorbent.

Table I
The adsorption capacity of Co(II) in sample with various initial amount of adsorbent.

Amount of adsorbent (g)	Adsorption (M)
0.05	0.021
0.10	0.053
0.15	0.074
0.20	0.160
0.25	0.155
0.30	0.148

Table I showed that the amount of cobalt in adsorbent it was found that the adsorbent of Co(II) by using biomaterial at 0.20 g had the highest absorption concentration. It was found that when increase the amount of adsorbent from 0.05 to 0.02 the adsorption capacity was increase. When amount of adsorbent were 0.25 to 0.30 the adsorption capacity was decrease.

2. Effect of the initial concentration of heavy metal.

The experiment used the concentration of Co(II) is 50, 100, 150, 200, 250 ppm, respectively in 0.01 M HNO_3. The results show in Table II.

Table II
The adsorption capacity of Co(II) in sample with various initial concentration of heavy metal.

Concentration (ppm)	Adsorption (M)
50	0.073
100	0.104
150	0.125
200	0.164
250	0.143

The result from Table II showed that the Co(II) adsorption was highest when using the initial contration 200 ppm. The adsorption concentration of Co(II) was increase with the increasing value of initial concentration of heavy metal to 200 ppm. For the initial concentration of Co(II) as 50, 100, 150, 200 ppm, respectively. The adsorption

capacity when use initial concentration 250 ppm was decrease.

3. Effect of the initial various pH.

by the trial pH start 2 - 6 results of the trial show as in Table III.

The experiment used pH concentrate of solution between 2-6 the result shown in Table III.

Table III
The adsorption capacity of Co(II) in sample with various initial pH.

Initial pH	Adsorption (M)
2	0.058
3	0.126
4	0.169
5	0.157
6	0.155

Table III show the adsorption capacity with different pH. It was found that the adsorption capacity was increase with the increasing of pH (pH 2-6). When pH 5-6 the adsorption capacity was decrease.

4. Effect of the interference ion on the adsorption.

Table IV
The adsorption capacity of Co(II) in sample with various interference ion.

Interference ion	Adsorption (M)
NaCl	0.142
$NaNO_3$	0.158
$CaNO_3$	0.132
KNO_3	0.128

Table IV showed the amount of Co(II) adsorption on the different interference ion.

The results from Table IV show that the highest Co(II) adsorption was found when add $NaNO_3$ in solution. The adsorption capacity were 0.142 M, 0.132 M and 0.128 M by add NaCl, $CaNO_3$ and KNO_3, respectively.

5. Application to synthesis waste water.
Condition : Co(II) 200 ppm, biomaterial 0.20 g, pH = 4, $NaNO_3$

The result found that the adsorption capacity was 0.167 M. This result indicated that biomaterial synthesized from coconut (coconut carbon) was suitable for remove heavy metal from synthesized waste water and could be apply for use in community.

IV. CONCLUSION

The initial amount of adsorbent that has high capacity was 0.20 g. The suitable adsorption capacity of initial concentration of heavy metal was 200 ppm. The highest Co(II) adsorption capacity was obtain by using pH 4. The adsorption capacity by using various interference ions it was found that $NaNO_3$ had the highest adsorption value. This biomaterial (coconut carbon) could be application for the removal of heavy metal from waste water to reduce the amount of toxic metal ions in community before release to the environment. This application of adsorbent could be reduce the bio-waste from community and safe the energy to earth. More over this material could save the quality of life of people in community.

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