



## **Application for beam time at ESRF – Experimental Method**

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**Aims of the experiment and scientific background**

**Thesis tile:** Recovery of Nickel from rinse water of electroplating industry by coir pith

### **Introduction**

The increasing level of heavy metal in natural water that discharge from many factories such as electroplating, electronic. Especially, Thailand, more than 100 electroplating factories are located in Bangkok. Electroplating involves the deposition of a thin protective layer (usually metallic) onto a prepared metal surface, using electrochemical processes. Any or all of the substances used in electroplating (such as acidic solutions, toxic metals, solvents) can be found in the wastewater. The heavy metal in waste waters that including cadmium, chrome, lead, copper, zinc, and nickel. The high level of Ni(II) causes to respiratory damage to cancer. Therefore, it is necessary to recovery nickel and treat waste water before being discharge into the natural water.

The method employed for the removal of nickel from wastewater such as low-pressure nanofiltration (Kyu-Hong Ahn et al,1999) , supported liquid membrane (I. Van de Voorde et al, 2004), cation-exchange (A.H. Elshazly et al,2003), precipitation.

Thailand is agricultural country that has more product of coconut. By product of coconut such as, coconut husk, coconut coir pith, is large problem and low cost for sold. Hence, they should be used these by-product for increasing value. Coir pith is a waste from coir industry. This is a major industry, where coconut is produced on large scale. During the process of separating fibre from coconut husk, large volume of pith gets collected. The pith containing high lignin (53.3%) and cellulose (19.9%) (FAO Corporate document repository). Due to reason, they decided to use coir pith as adsorbent to investigate its potential for the removal of nickel. It is not only reducing cost for wastewater treatment, but also add value to waste.

### **Research Objectives**

- To investigate the mechanism of nickel adsorption by the coir pith.
- To investigate the model of nickel adsorption (coordinating and arrangement) by the coir pith.

### **Experimental method**

#### **The adsorbents preparation**

The coir pith was obtained from mattress factory. It was air dried at room temperature, sieved by U.S standard sieve and milling. Then, modified coir pith was mix between coir pith and 0.1 NaOH at ratio 1:10, after dry in the air.

The adsorbents were used in experiment such as the coir pith, modified coir pith, and the composition of the coir pith and modified coir pith. The compositions of the both form of coir piths were extracted by TAPPI method such as lignin, Holo-cellulose, Alpha-cellulose and Beta-cellulose for confirm the mechanism of nickel adsorption. The characteristic of the adsorbents were powder form.

### **Actual electroplating wastewater (Nickel rinse water)**

The Nickel rinse water was collected from electroplating factory, located in Samuthprakarn province (Thailand), containing concentration of Ni(II) about 145 mg/l.

### **The adsorption in batch experiment**

The experiments were carried out by the adsorbents and nickel rinse wastewater (Ni(II) ~ 145 mg/l) in flask and then shaking the mixtures at 150 rpm by 2 hours and temperature 30°C. After shaking the flasks, the reaction mixtures were separated by centrifugation at 4,500 rpm for 10 minutes. Then, the Ni(II) was adsorbed in the adsorbents. The saturated adsorbents were dry in the air and were collect in the desiccator for control the moisture. In addition, the mechanism of nickel removal by the coconut coir pith was analysed by FAME-BL30B.

### **Determination the mechanism of adsorption by FLUO and XAS**

Experiments were made at room temperature on the beam line (EXAFS, FAME-BM30B) of European Synchrotron Radiation Facility (ESRF), with a double crystal Si(111) for mono-chromator. FAME spectra at the Ni K edge (8.333 keV) of reference and catalyst samples were recorded in the energy range 2.3 to 25 keV.

Nickel K-edge spectra were obtained in transmission mode with two low-pressure air-filled ionisation chambers. The saturated adsorbents were collected in sample holder.

Reference materials used for EXAFS measurements included Ni foil, Nickel from rinse water of electroplating, NiSO<sub>4</sub>, Ni(OH)<sub>2</sub>, NiO, NiCl<sub>2</sub>, (NiCN)<sub>2</sub> and NiBr<sub>2</sub>

For experiment to measure nickel in sample at low concentration (ppm.) will use Fluorescence mode (FAME). I had been measure at National Synchrotron Research Center(Thailand) by XAS that can not measure at low concentration.

### **Analyze data**

The data from FAME-BL30B were analyzed by supported program.

### **Results expected**

From the data , these spectra shown the coordinating and arrangement between nickel ion and adsorbents that could be confirm the model of nickel adsorption by the coir pith. Then, the reseach could be use as model of divalent heavy metal adsorption by coir pith.

### **References**

1. Mathieu Soibinet ,2005, “Magnetic measurements, UV–Vis spectroscopy, and XAS of dinuclear nickel(II) complexes of bistetraazamacrocycles”, **Polyhedron** , Vol. 24,pp. 143–150.
2. K.V. Murthy, 2006, “An exploration of activity loss during hydrodechlorinationand hydrodebromination over Ni/SiO<sub>2</sub>”, **Journal of Catalysis**, Vol.223, pp. 74–85.

