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STUDY OF CYANIDE TREATMENT IN METAL PLATING WASTEWATER OF THANH THUY VILLAGE, THANH OAI DISTRICT, HANOI CITY BY WATER HYACINTH

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ABSTRACT

This paper presents the results of studies on the ability to handle cyanide in metal plating wastewater in the Thanh Thuy village of Thanh Oai district, Hanoi city. The results showed that water hyacinth plants are capable of well growing in the water of pH from 6.00 to 7.00. This plant can be applied for treat cyanide in metal plating wastewater with the concentration about 0.190 mg/L. The water hyacinth with the 2days of age can be applied in treating cyanide with the highest efficiency, reached 89.4 %.

INTRODUCTION

Today, the speed of industrialization and urbanization are increasingly putting pressure on water resources. Wastewater from industrial parks, manufacturing facilities and handicraft contain substances harmful to human health. One of the most dangerous contaminant present in this wastewater is cyanide. A certain amount of cyanide present in water could be very serious poisoning to humans. Cyanide poisoning such as dizziness, nausea, fatigue, convulsions and loss of consciousness can lead to death, if cyanide concentrations in blood are greater than 1 mg / L (Ministry of Science, Technology and Environment, 1999; QCVN, 2010; Điền Văn Hưng, 1964). Cyanide pollution is a problem that is receiving great attention of the society. Researching cyanide treatment in industrial wastewater is the top priority (Nusara Sinbuathong, 2000; Botz *et al.,* 1995; Prober and Kindon, 1976; Santz and Reich, 1978). The most methods used for cyanide treatment are chemical methods using oxidative agents. However, these methods are often applied, when the cyanide concentration is in enough high level. In practice, the low cyanide concentration in wastewater could be better treated by biological method. Hyacinth is a plant often living in any where such as ponds, lakes, rivers and creeks. Water hyacinth can quickly develop and adsorb contaminants present in wastewater (Phạm Hoàng Hộ, 1993; Điền Văn Hưng, 1964).

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Therefore, in this paper the water hyacinth was selected for studying treatment of cyanide in wastewater collected from same places in Thanh Thuy village belonging in Thanh Oai district, Hanoi city.

Experimental

Equipments and Chemicals

Equipments: The main eqiupments suc as pH meter with model HM 16S, TOA Japan. UV-Vis spectrophotometer Libra S60 British BIOCHROM were use in this study.

Chemicals: All chemicals used for were analytical grade. Chloraqmine -T solution, 1% in distillsted water: disssolve 1g chloramine –T in 100 mL distillsted water. Cyanide stadard solution 1000 mg/L: dissolve 2.500 g KCN in 0.1M NaOH and dilute to 1,000 mL with 0.1M NaOH. Discard after 3 months. Pyridine – barbituric acid solution: place 15g barbituric acid in a 1-L beaker and add enough distilled water (about 100 mL) then add 75 mL pyridine and mix. Add 15 mL concentrated HCl and mix. Dilute to about 900 mL with distilled water and mix until the barbituric has dissolved. Transfer the solution to a 1,000 mL volumetric flask and dilute to mark with distilletd water (Perkin Elmer Water, 1995).

Experimental procedure: 2.2.1. Sampling: the wastewater samples containing cyanide were collected at the outlet from a metal plating facility at Thanh Thuy village, Thanh Oai

district, Hanoi city based on the Vietnam standard such as TCVN 6663-1:2011:1995 (ISO 5667-2: 1991); TCVN 6663-2:2008 (ISO 5667-11: 1992); TCVN 5999:1995 and QCVN 10: 2009/BTNMT.

Anaslysis of cyanide in samples: Analysis of cyanide in water samples was carried out by spectrophotometric method using pyridine barbituric acid as suggested in (Perkin Elmer Water, 1995). Here cyanide compounds were oxidized by chloramine –T, converted into cyanogen chloride (NCCl) at pH <8 (to prevent hydrolysis reaction. Then cyanogen chloride combined with pyridine - barbituric reagents to form a red or pink complex having absorption maximum at a wavelength of 580 nanometers.

Treatment of cyanide by water hyacinth

The water hyacinth with the 5 or 14 days of age was taken from a pool, then was selected to obtain good one. The obtained good water hyacinth was used for studying treatment of cyanide as following:

- Studying pH-influence: use 3 boxes made of polystyrene foam in each containing 36L of cyanide contaminated wastewater and 1,0 kg of hyacinth with 14 days of age to treat cyanide. The pH of wastewater in every box was adjusted as following:

Box 1: pH = 9.00 ÷ 8.50.
Box 2: pH = 8.50 ÷ 7.00.
Box 3: pH = 7.00 ÷ 6.00.

All boxes were placed in natural condition. After an interval of time (days) the cyanide concentration was analyzed and the hyacinth growing was commended too.

- Studying influence of cyanide concentration on treatment efficiency by hyacinth
- Studying influence of hyacinth age

Use two kind of hyacinth of 5 days of age and 14 days of age cultivated in two boxes, B1 and B2 containing wastewater (36 L). B1 contains hyacinth of 5 day of age. B2 contains hyacinth of 14 days of age. Beside, a box (B3) containing only wastewater was used for comparison. pH in every box was adjusted to be 6.00 ÷ 7,00. After an interval of 7,14, 21, 28 days, the cyanide concentration in every box was analyzed.

- Efficiency of cyanide treatment was calculated by the expression

$$H = \frac{(C_0 - C)}{C_0}.100\%$$

Here: H efficiency (%).
C: cyanide concentration at time interval (mg/L).
C_0: cyanide concentration at beginning (mg/L).

Proposed method for treating cyanide by water hyacinth

RESULTS AND DISCUSION

Influence of pH

The influence of pH on treatment efficiency and the growth of hyacinth present in Table 3.1.

Table 3.1. Influence of pH on treatment efficiency and the growth of hyacinth, CN^- initial concentration of hyacinth = 0.190 mg/L and mass of fresh hyacinth =1.0 kg

Box number	Box 1	Box 2	Box 3
pH	9.00 ÷ 8.50	8.50 ÷ 7.00	7.00 ÷ 6.00
Life time of Hyacinth (day)	1	8	14
Increased mass of hyacinth, kg	1.0	1.05	1.32
CN^- conc. mg/L after treatment	0.190	0.162	0.104

The results from Table 3.1 showed that, the box 3 has exhibited the highest efficiency and the CN^- concentrations have reduced from 1.90 to 0.104 mg/L, corresponding 94,5%. This experiment could be selected as optimal condition used for cyanide treatment by hyacinth.

Influence of CN^- concentration

The experiments were carried out like in box 3 of the item 3.1, in, but the cyanide concentration varying such as 1.90, 0.380, 0.190 mg/L respectively. The influence of CN^- concentration on growth of hyacinth in the treatment process is present in Table 3.2.

Table 3.2. Influence of cyanide concentration on growth of hyacinth

Initial conc. CN^-, mg/L	1.90	0.380	0.190
Life time of hyacinth, day	0	6	14
Mass of hyacinth after treatment, kg	1.0	1.05	1.32
CN^- conc. mg/L after treatment	1.90	0.257	0.104

The experimental data (Table 3.2) showed that the wastewater containing cyanide concentration about 0.19 mg/L could be treated using water hyacinth reaching high efficiency.

Treatment of cyanide contaminated wastewater inThanh Thùy village belonging to Thanh Oai, Ha Noi

The wastewater was collected from Thanh Thuy metal plating. Before treatment, the waste water was filtered to remove garbage and sludge. The treatment of cyanide contaminated wastewater was carried out under conditions: pH = 6.0 -7.0, 1.0 kg hyacinth with 5 and 14 days of age for 36 L of wastewater. The experiments were implemented in three boxes, denoted such as B1 (without hyacinth) for comparison, B2 contained hyacinth of 5 days of age, B3 contained hyacinth of 14 days of age. The results showed in Table 3.3 and fig as follows

Table 3.3. The result of cyanide treatment by hyacinth, CN^-initial conc = 0.19 mg/L

Days	0	7	14	21	28
Efficiency (H) % (B1)	-	-	1.05	2.65	5.26
Efficiency (H) % (B2)	-	24.02	37.63	53.64	72.63
Efficiency (H) % (B3)	-	34.74	47.37	65.26	89.47

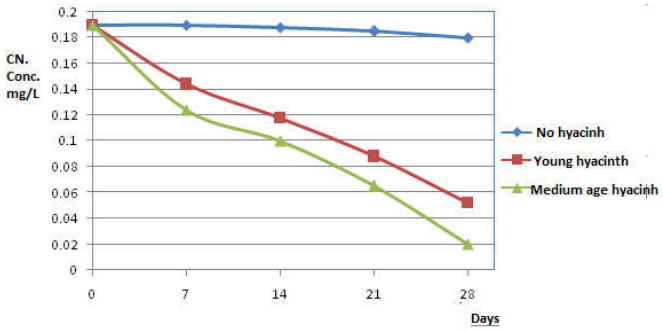

Fig. 1. Plots of of cyanide treatment by hyacinth, CN^- initial conc = 0.19 mg/L

The results showed that the water hyacinth with 14 days of age can be applied to treat cyanide contaminated wastewater reaching the highest efficiency after 28 days. The wastewater (CN =0.19 mg/L) after 28 days treated has met the standard disposing to environment.

Conclusion

An efficiency treatment method of cyanide in wastewater was studied using water hyacinth. Studying influence of pH, cyanide concentration, age of water hyacinth has indicated optimal condition for treatment of cyanide. The method was applied to treat cyanide in wastewater collected from Thanh Thuy village belonging to Thanh Oai, Hanoi. Under optimal condition, the treatment efficiency can reach 89.47% after 28 days fitted discharge criteria.

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