Application of Electro-Chemical process for dyeing wastewater treatment

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1. Introduction

The textile wastewater discharged form printing and dyeing processes is characterized by considerable amount of suspended solids and weakly biodegradable substances such as additives, detergents, surfactants and dyes (Alinsafi et al., 2006). It exhibits highly fluctuating pH, high temperature and COD concentration. Tightening government legislation is forcing textile industries to treat their waste effluent to satisfy increasingly high standards. Many attempts have been made to treat textile wastewater using conventional wastewater treatment methods such as chemical coagulation, eletrochemical oxidation, filtration and biological treatment. Several methods have been developed to treat dyeing wastewater, but most of them can not be used individually because they do not adequately treat the wastewater.

In this study, Electro-chemical process were applied for dyeing wastewater treatment. We are investigated to optimization of electro-chemical process condition such as pH, additives (NaCl), reaction time, current density.

The results of this study may offer a promising potential of the electro-chemical process for dyeing wastewater treatment.

2. Material and methods

Dyeing wastewater used in this study was taken from a synthetic textile dyeing factory located in DaeGu dyeing industrial complex, DaeGu, Korea. Its average COD, color, pH and temperature were 550 mg/L, 1,020 Color unit, 11.7 and 42 ℃, respectively (Table 1). The Electro-chemical process (Figure 1) for dying wastewater treatment consists of 250ml reactor(working volume), SnO_2(developed from DGIST, Korea) elctrode(Anthode), SS Plate(Cathods) and DC Power Supply(UP-3010S, 40V, 6A, Unocorn Co, Korea).

Samples were subjected to vacuum filtration by glass microfiber filter (Whatman, GF/C filter, 1.2 μm, 4.7 cm in diameter). COD and SS concentrations were measured using the procedures of standard methods (APHA, 1999). Color was measured by using PtCo method using a spectrophotometer (HACH Co., DR-890, USA). pH and Temperature was measured using an pH meter (Orion 290+, USA).

Table 1. Characteristics of dyeing wastewater used in this study

Parameter	Raw wastewater	Biological treated wastewater
COD (mg/L)	550	140
Color (PtCo.unit)	1,020	420
SS (mg/L)	64	30
pH	11.7	7.6
Temperature(℃)	42	30

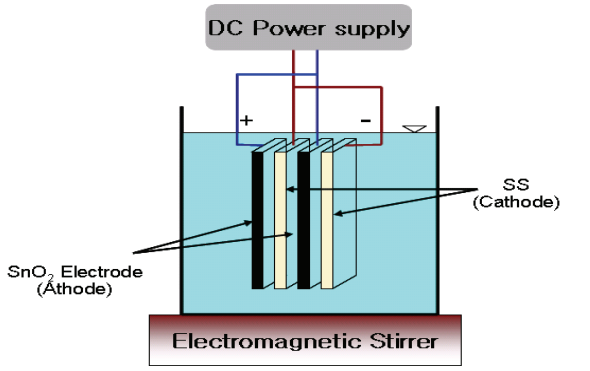

Fig.1. Flow diagram of elctro-Chemical process for dyeing wastewater treatment

3. Results and discussion

Lab-scale electro-chemical process was operated to treat dyeing wastewater. Optimum condition of electro-chemical process were pH 6.5~7.5, additives (NaCl) 4,000 mg/L, reaction time 30 min, current density 50 mA(1 mA/cm^2). respectively.

COD and Color reduction in the presence of

Additives (NaCl) during the Electro-Chemical treatment on batch-scale. 140 mg/L of COD and 420 PtCo of Color were reduced to 50 mg/L and 38 PtCo respectively. The removal rate was 65 % for COD and 91.5 % for color in Electro-chemical system. respectively. It is clear that Electro-chemical system has higher COD and color removal rate.

Table 2. Decision of Optimum current (mA) in electro-chemical process.

Distance (mm)	Voltage (V)	Current (mA)	Distance (mm)	Voltage (V)	Current (mA)
50	5	10*	10	5	40*
		10			20
	10	100*		10	320*
		100			210
	15	200*		15	640*
		160			390
	20	300*		20	900*
		240			720

※ * : Additives (NaCl) 2,000 mg/L

Table 3. Color removal from dyeing wastewater in Electro-Chemical process.

Time (min)	Color (PtCo)	Removal rate (%)
0	452.5	-
10	220.3	51.3
20	98.4	78.2
30	45.3	89.9
40	38.5	91.5
50	38.3	91.5

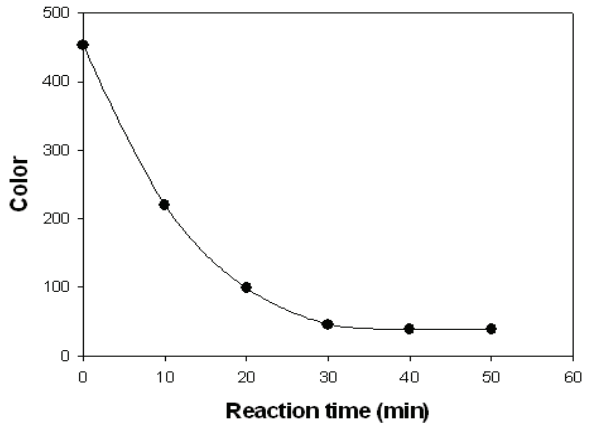

Fig. 2. Color removal from dyeing wastewater in Electro-Chemical process

4. Conclusion

The main objectives of this study are develop an Electro-Chemical process for dyeing wastewater treatment. In this work, We are investigated to optimization of electro-chemical process condition such as pH, additives(NaCl), reaction time, current density. As a result, About 89% of color (influent 452.5 ptco. unit) was removed by Electro-Chemical process using type C SnO_2 electrode. This results are promising potential for dyeing wastewater treatment.

5. Acknowledgements

The authors would like to acknowledge the DaeGu (DGIST), Korea for the financial support of this work.

6. Reference

[1] N. Guetti, and H. Amar, *Desalination*, 185: 427-437(2005)
[2] J. Weber, and V. Stickney, *Wet. Res.*, 27: 63-67 (1993)
[3] T. Bechtold, E. Burtscher, A. Turcanu, and O. Bobleter, *Textile Res. J.* 67(9), 635-642 (1997)