

z z z

# COD

m.malakootian@yahoo.com

y/y / : y/y / :

COD

Reactive Blue 19

reactive Blue 19

Fe<sup>2+</sup>

COD

COD

j Çimin

éçç mg/L

êç v

èçç mg/L

éçv

ñèçç

pH II

y# mg/L

COD

COD ñ

Reactive Blue19

Reactive Blue19

!  
!  
!

Anthraquinone (AQ) (1)

COD (2)

Fe<sup>2+</sup> (3)

pH (4)

H<sub>2</sub>O<sub>2</sub> (5)

CO<sub>2</sub> (6)

E<sup>0</sup> = 2.87 V (7)

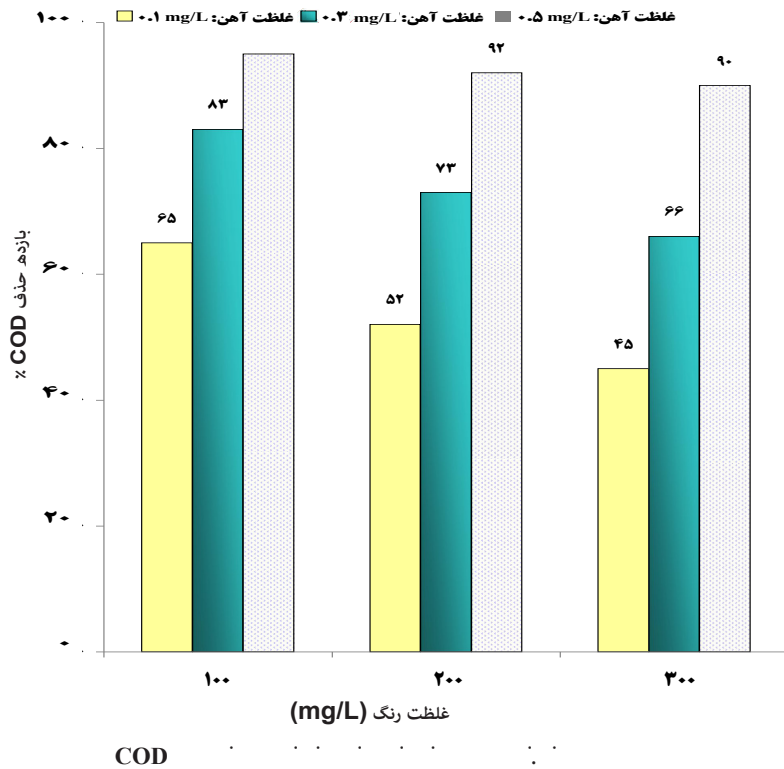
E<sup>0</sup> = 3.06 V (8)

(RB19) (9)

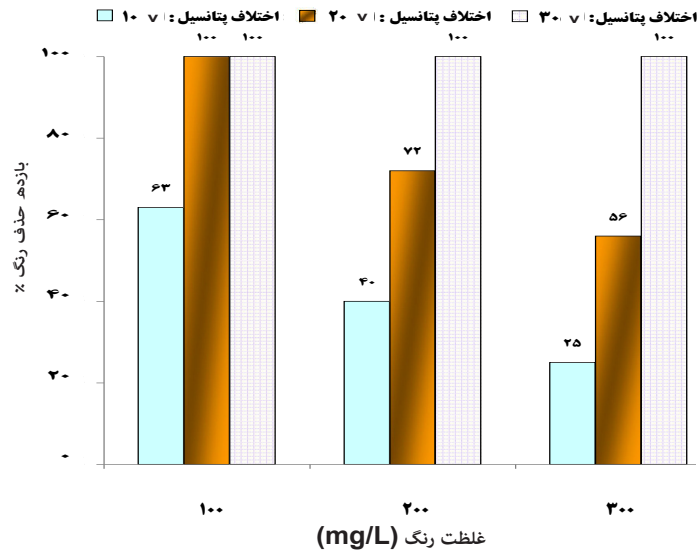
Methylene Blue	$\text{H}_2\text{O}_2$
	$\text{Fe}^{2+}$
	$\text{Fe}^{3+}$
( )	( )
" fl	$\text{O}_2\text{H}_2 \rightarrow \text{O}_2 + 4\text{H}^+ + 4\text{e}^-$ (è)
RB19	$\text{O}_2 + 2\text{H}^+ + 2\text{e}^- \rightarrow \text{O}_2\text{H}_2$ (è)
RB19	$\text{Fe}^{3+} + \text{e}^- \rightarrow \text{Fe}^{2+}$ (è)
RB19 fl	$\text{Fe}^{2+} + \text{O}_2\text{H}_2 \rightarrow \text{Fe}^{3+} + \text{OH}^0 + \text{OH}^-$ ( )
" fl	fl
	$\text{H}_2\text{O}_2$
COD	fl
" COD	fl
	$\text{Fe}^{2+}$ $\text{H}_2\text{O}_2$
	( )
ml	mercury pool
cm cm mm	(gas-diffusion electrode)
DC power	( ) $\text{H}_2\text{O}_2$
"	/ V
"	pH
(Philips Model) Spectrophotometer UV-Vis	"
pH pH PU 8740	$\text{Fe}^{2+}$
COD " fl	( )
(Hunna instrument) COD	
Excel	
$\text{NaOH}$ $\text{H}_2\text{SO}_4$ pH "	fl
" M	( ) Methyl Red ( ) Acid Yellow 36
Merck	fl ) Acid red 14 fl ) Reactive black 5
" Dystar	Chlobromuron
fl pH	TOC fl propham fl
	! fl
	" fl ) diuron fl



COD" nm  
 COD " nm  
 COD " nm  
 "H L  
 " Fe<sup>2+</sup> " nm  
 " Na<sub>2</sub>SO<sub>4</sub> L mol  
 " Fe<sup>2+</sup> nm  
 " pH= | min COD  
 " mg/L



COD (mg/L) | pH= | min



( $\bar{y}_1$   $\bar{y}_2$   $\bar{y}_3$  mg/L)  $\bar{y}$  mg/L  $pH = j$   $\bar{y}_{min}$   $\bar{y}$

$\bar{y}$  mg/L

$\bar{y}$  mg/L

COD

COD

$\bar{y}$  mg/L

$pH = j$   $\bar{y}_{min}$

$\bar{y}$  mg/L

"  $\bar{y}_1$   $\bar{y}_2$   $\bar{y}_3$  mg/L

$\bar{y}$  mg/L

COD

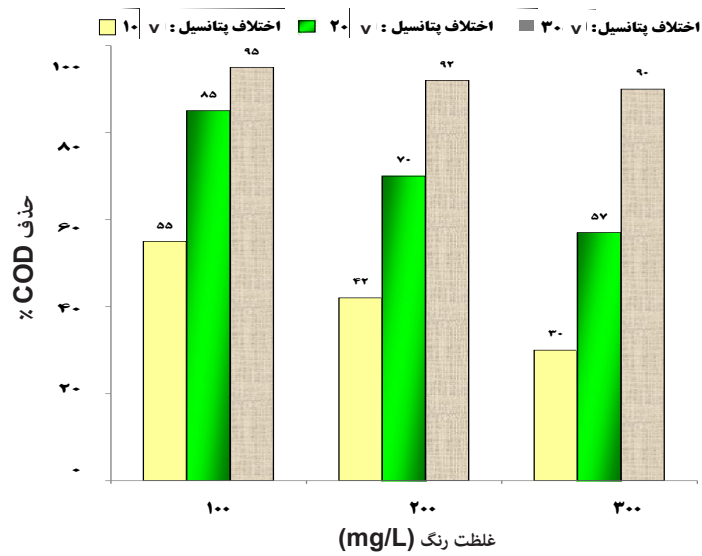
$\bar{y}$  mg/L

$\bar{y}_1$   $\bar{y}_2$  mg/L

COD

$\bar{y}$  mL

COD  $\bar{y}$



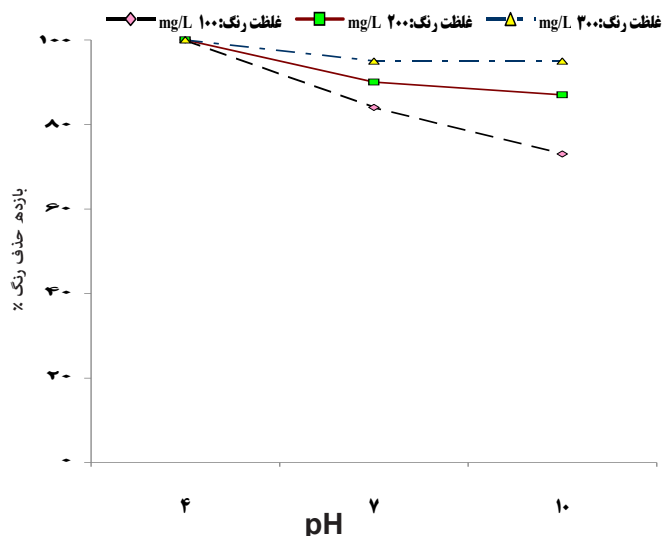
COD

( $\bar{y}_1$   $\bar{y}_2$   $\bar{y}_3$  mg/L)

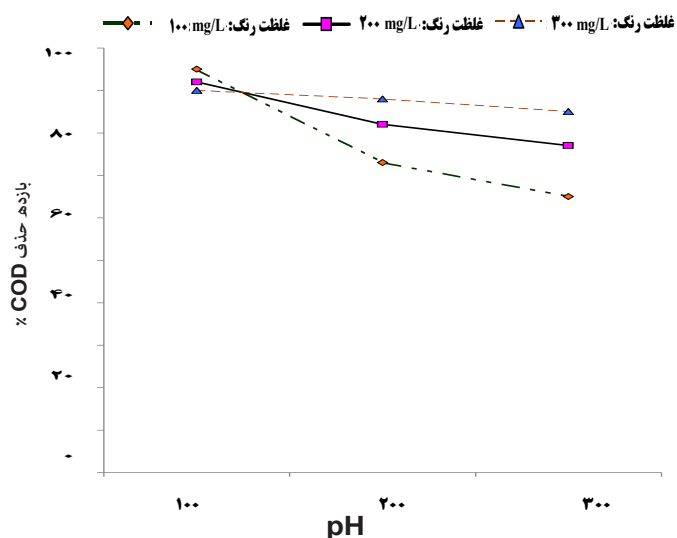
$\bar{y}$  mg/L

$pH = j$   $\bar{y}_{min}$

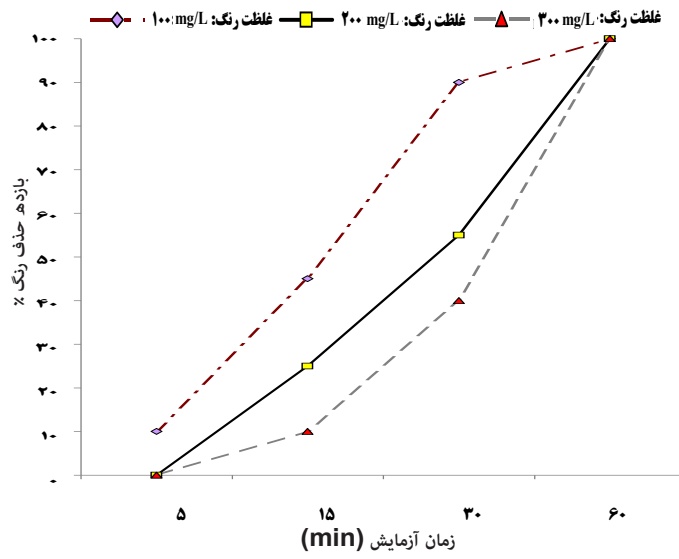
$\bar{y}$



(  $\bar{y}_1$   $\bar{y}_2$   $\bar{y}_3$  mg/L )  $\bar{y}$  mg/L  $\bar{y}_v$   $\bar{y}_{min}$   $\bar{L}$   
 pH COD pH COD  $\bar{y}_v$   $\bar{y}$  mg/L  $\bar{y}_{min}$   
 pH COD  $\bar{y}_v$   $\bar{y}_{min}$   
 pH COD pH COD  $\bar{y}_v$   $\bar{y}_{min}$   
 pH COD pH COD  $\bar{y}_v$   $\bar{y}_{min}$   
 pH COD  $\bar{y}_v$   $\bar{y}_{min}$   
 pH COD  $\bar{y}_v$   $\bar{y}_{min}$   
 pH COD  $\bar{y}_v$   $\bar{y}_{min}$



(  $\bar{y}_1$   $\bar{y}_2$   $\bar{y}_3$  mg/L )  $\bar{y}$  mg/L  $\bar{y}_v$   $\bar{y}_{min}$   $\bar{L}$   
 COD pH pH COD  $\bar{y}_v$   $\bar{y}_{min}$



(  $\bar{y}_i$   $\bar{y}_i$   $\bar{y}_i$  mg/L  $\bar{y}$  mg/L  $i$   $\bar{y}_v$  pH= )

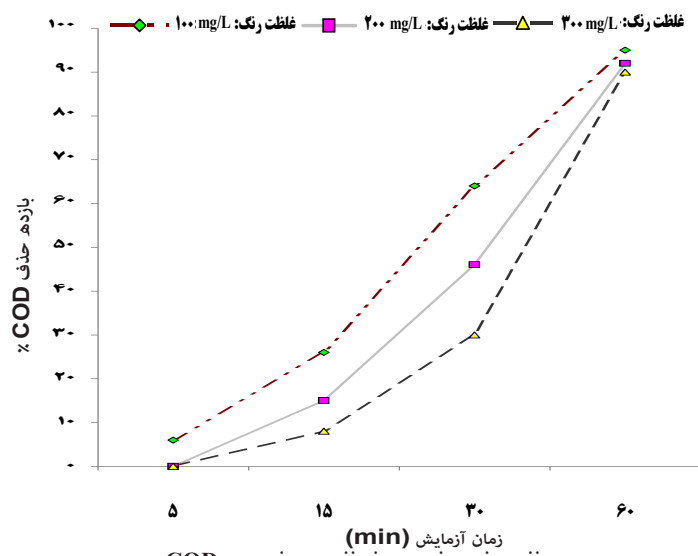
$\bar{n}$   $\bar{y}$   $\bar{y}_{min}$

$\bar{y}_{min}$  COD  $\bar{y}$  V pH=

"  $\bar{y}$  V pH=  $\bar{y}_i$   $\bar{y}_i$   $\bar{y}_i$  mg/L  $\bar{y}$  mg/L

" min

RB19



(  $\bar{y}_i$   $\bar{y}_i$   $\bar{y}_i$  mg/L  $\bar{y}$   $\bar{y}$ /mg/L  $i$   $\bar{y}_v$  pH= )

Reactive Black5	chiou		
pH			COD
	pH	"	COD
pH	pH		
"fl L			
	"fl L		
( ymg/L			
min			
n y	pH	"fl L	
y min	fl ymg/L)	pH	"
zhou	"		
Methyl Red			
"fl L		H <sub>2</sub> O <sub>2</sub>	Fe(OH) <sup>2+</sup> / pH
Acid Yellow 36	Gonzalez	"	OH <sup>0</sup>
"fl L	n min	(H <sub>3</sub> O <sub>2</sub> <sup>+</sup> L	fl L
	"	H <sub>2</sub> O <sub>2</sub>	
		OH <sup>0</sup>	
		pH	"fl L
		Fe(OH) <sub>3</sub>	Fe <sup>3+</sup> Fe <sup>2+</sup>
		"	
		H <sub>2</sub> O <sub>2</sub>	pH
"fl yL		( L	
COD		pH	pH
y min			"
"	n y! n y	pH	pH COD
	"		
Fe <sup>2+</sup> "		Reactive Blue 19	
"		Methyl Red	zhou" fl L



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## **Evaluation of Electro-Fenton Process Performance for COD and Reactive Blue 19 Removal from Aqueous Solution**

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### **ABSTRACT**

**Background and Objectives:** Synthetic dyes represent one of the largest groups of pollutants in wastewater of dyeing industries. Discharging these wastewaters into receiving streams not only affects the aesthetic but also reduces photosynthetic activity. Electrochemical advanced oxidation processes such as Electro-Fenton process are low operational and have high mineralization degree of pollutants. In this study, we investigated affective factors in this process to determine the optimum conditions for dye and COD removal from aqueous solutions containing Reactive Blue 19 dye.

**Materials and Methods:** Synthetic samples containing Reactive Blue 19 dye were prepared by dissolving dye powder in double distilled water. and the the solution prepared was transferred into pilot electrochemical cell having two anode and cathode electrode made of iron and carbon. Electro-Fenton process was began by adding of Fe<sup>2+</sup> ions and establishing electrical potential difference. After testing and at specified time intervals, each sample was collected from the pilot cell, and process performance was evaluated through measuring dye concentration and COD.

**Results:** Based on the results obtained, optimum conditions of Electro-Fenton process for dye and COD removal was determined. Accordingly, potential difference of 20 volt for dye concentration up to 100 mg/L and potential difference of 30 volt for dye concentration of more than 200 mg/L, reaction time 60 minutes, 0.5 mg/L of Fe<sup>2+</sup> concentration and suitable pH for the maximum dye removal efficiency equaled 4 respectively. Under such conditions, the dye and COD removal was 100 and 95% respectively.

**Conclusion:** Based on the results obtained, it was revealed that Electro-Fenton process has significant ability in not only dye removal but also in COD removal. Accordingly, it was found that the effective parameters in Electro-Fenton process for removal Reactive Blue19 dye are electric potential difference, concentration of iron ions and electrolysis time.

**Keywords:** Electro-Fenton process, Avanced oxidation, Reactive Blue19 dye, Electrical Potential difference

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