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*r-rezaei@tums.ac.ir*

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SP.

7100 CECIL UV/VIS

ProMAX Heidolph

2020

Most Probable Numer) MPN

7100 CECIL UV/VIS

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7100 CECIL UV/VIS

ProMAX Heidolph

2020

Most Probable Numer) MPN

Chen

C/N

Chaudhry

HPLC grade

R<sub>2</sub>A

NaCl

BIOMARK

Merck

Batch

°C

reactor

min

mg/Kg

pH

HACH 40d

pH

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Trace Elements	mg/L
EDTA-Sodium Salt	500
ZnSO <sub>4</sub> .7H <sub>2</sub> O	10
FeSO <sub>3</sub> .7H <sub>2</sub> O	200
MnCl <sub>2</sub> .4H <sub>2</sub> O	3
H <sub>3</sub> BO <sub>3</sub>	30
CoCl <sub>2</sub> .6H <sub>2</sub> O	20
CuSO <sub>4</sub> .2H <sub>2</sub> O	10
NiCl <sub>2</sub> .6H <sub>2</sub> O	6
Na <sub>2</sub> MoO <sub>4</sub> .2H <sub>2</sub> O	3

ماده مغذی	محلول ماده مغذی (mg/L)	محلول ماده مغذی (max)	محلول ماده مغذی (min)
Macro & Micro	K <sub>2</sub> HPO <sub>4</sub>	800	0/132
	KH <sub>2</sub> PO <sub>4</sub>	200	0/103
	KNO <sub>3</sub>	1000	1/7
	MgSO <sub>4</sub> .7H <sub>2</sub> O	200	200
	CaCl <sub>2</sub> .2H <sub>2</sub> O	100	100
Trace	NaCl	100	100
	FeCl <sub>3</sub> .6H <sub>2</sub> O	10	10
	Trace elements	1mL	1mL

..... Excel  
 fANOVA  
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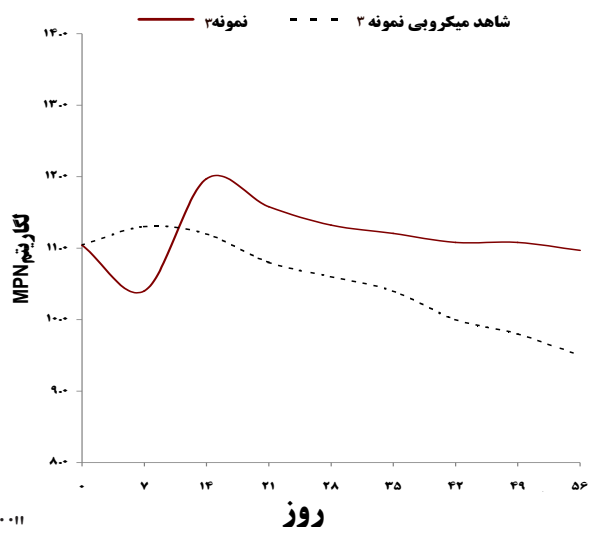
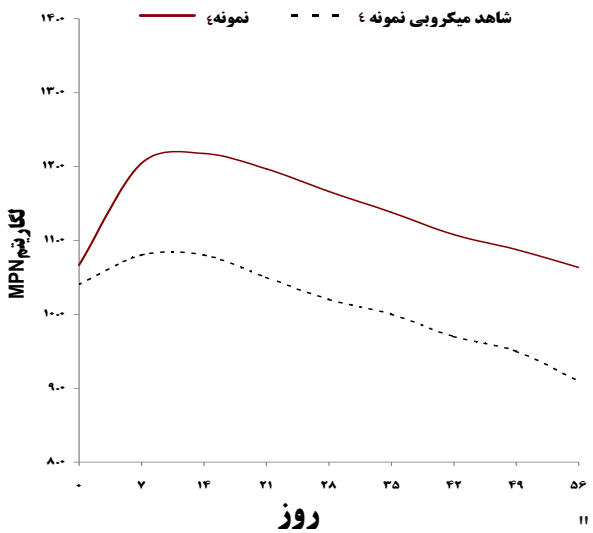
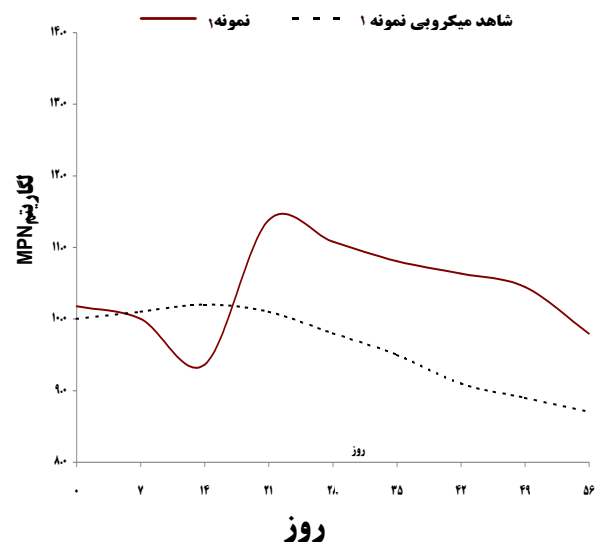
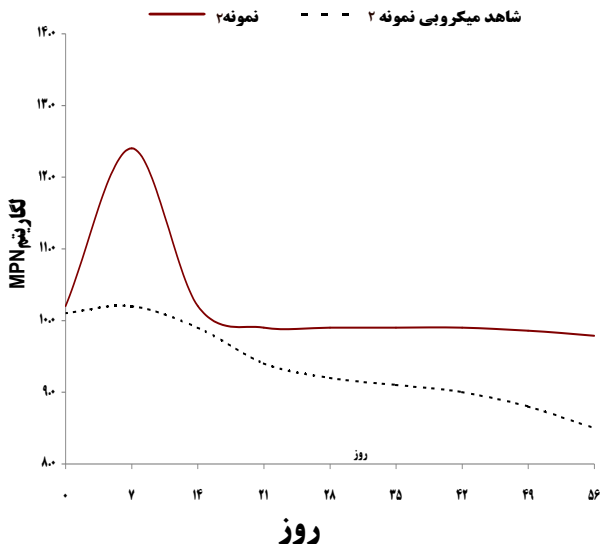
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آزمایش	مواد مغذی (Nu.)	شوری (Sal.)	مخلوط میکروبی	فناثرین
نمونه ۱	+۱	+۱	+	+
نمونه ۲	+۱	-۱	+	+
نمونه ۳	-۱	+۱	+	+
نمونه ۴	-۱	-۱	+	+
شاهد شیمیایی نمونه ۱	+۱	+۱	-	+
شاهد شیمیایی نمونه ۲	+۱	-۱	-	+
شاهد شیمیایی نمونه ۳	-۱	+۱	-	+
شاهد شیمیایی نمونه ۴	-۱	-۱	-	+
شاهد میکروبی نمونه ۱	+۱	+۱	+	-
شاهد میکروبی نمونه ۲	+۱	-۱	+	-
شاهد میکروبی نمونه ۳	-۱	+۱	+	-
شاهد میکروبی نمونه ۴	-۱	-۱	+	-

" fL ..... fZL ..... fl eL ..... fZel ..... \*

GC  
 $\dot{y}^{\circ}C$  /min  
 $\dot{y}^{\circ}C$   
 $\dot{y}^{\circ}C$

B 3550 BANDELIN SONOPLUS  
 fl ) (EPA  
 rpm Hettich Universal  
 GC min  
 HP5 CHROMPACK CP9001



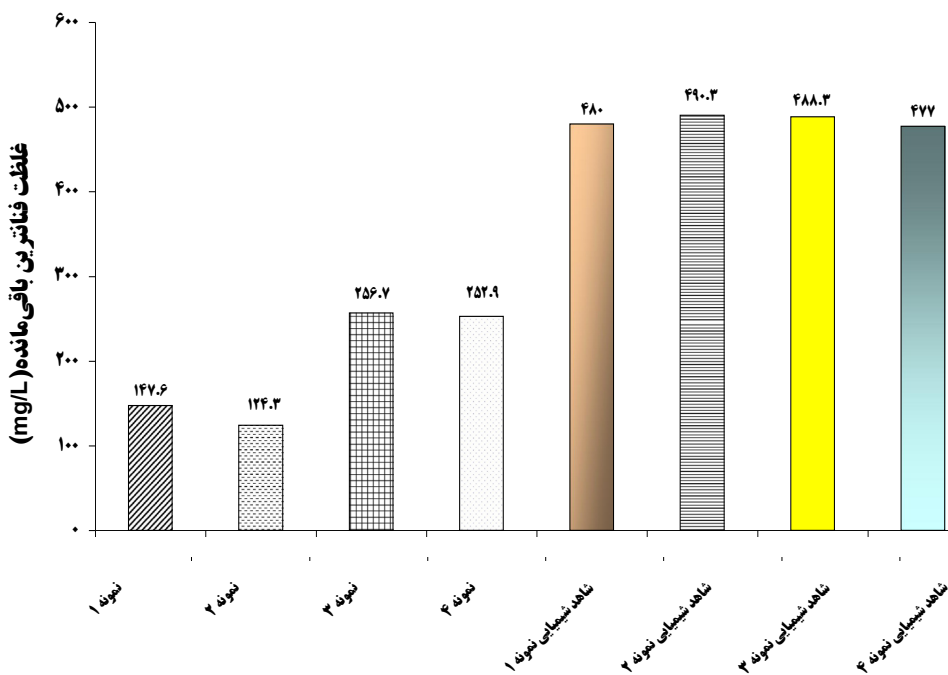
ANOVA

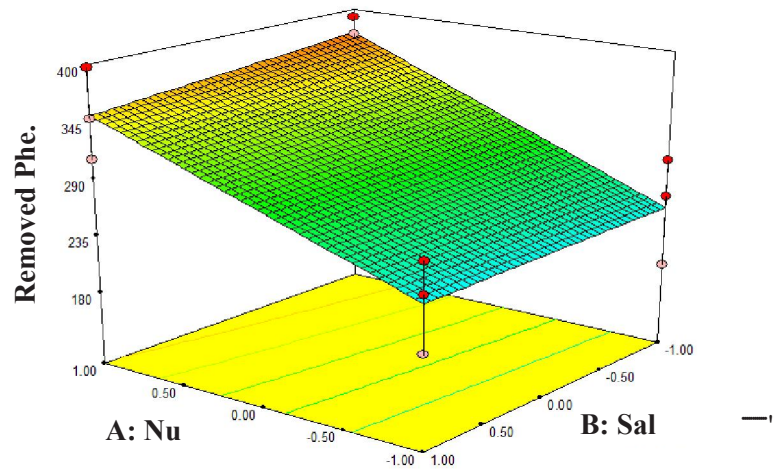
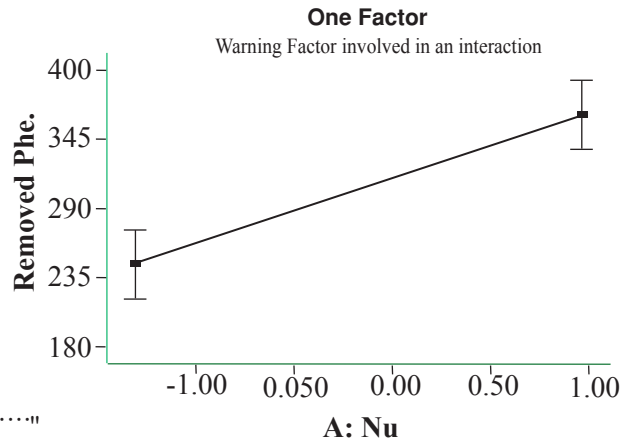
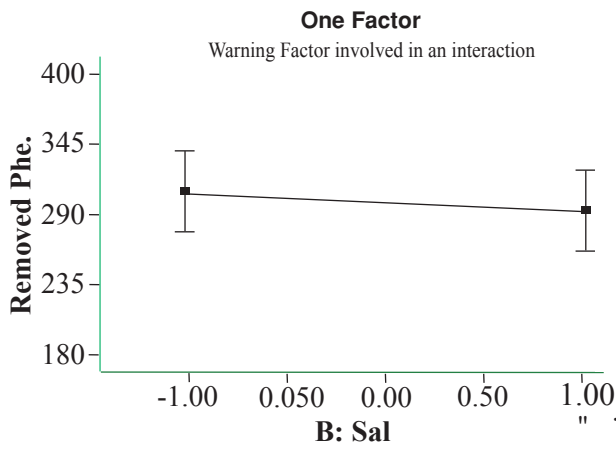
Source	Effects	Sum of Square	df	Mean Square	F-Value	P Value Prob > F	
Model		43228/1	3	14409/4	8/464	0/0073	significant
A-Nu	118/87	42387/9	1	42387/9	24/900	0/0011	
B-Sal	-13/57	552/2	1	552/2	0/324	0/5846	
AB	-9/80	288/1	1	288/1	0/169	0/6916	
Pure Error		13618/8	8	1702/3			
Cor Total		56846/9	11				

FID

mg/L

mg/L





..... y ..... fl E. fl E. x .....  
..... fl E. ....

PAHs

Linear ANOVA

(Significant  $P < 0.05$ )

fl E.

/ F-Value

Chaudhry )





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## **Comparison of Nutrients and Salinity on Phenanthrene Removal from Polluted Soil**

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### **ABSTRACT**

**Background and Objectives:** The poor accessibility of microorganisms to PAHs in soil has limited success in the process of bioremediation as an effective method for removing pollutants from soils. Different physicochemical factors are effective on the rate of biodegradation. The main objective of this study is to assess effects of nutrient and salinity on phenanthrene removal from polluted soils.

**Materials and Methods:** The soil having no organic and microbial pollution was first artificially polluted with phenanthrene then nutrients and salinity solution in two concentrations were added to it in order to have the proportion of 10% w:v (soil: water). After that a microbial mixture enable to degrade phenanthrene was added to the slurry and was aerated. Finally, the residual concentration of Phenanthrene in the soil was extracted by ultrasonic and was analyzed using GC. We measured the microbial population using MPN test. This study was conducted based on the two level full factorial design of experiment.

**Results:** MPN test showed that the trend of microbial growth has experienced a lag growth. The full factorial design indicated that nutrient had the maximum effect on bioremediation; the rate of phenanthrene removal in the maximum nutrients – minimum salinity solution was 75.14%.

**Conclusion:** This study revealed that the more nutrient concentration increases, the more degradation will be happened by microorganisms in the soils. However, salinity in the concentration used had no effect on inhabitation or promoting on the Phenanthrene removal.

**Keywords:** PAHs, Experimental Design, Soil Bioremediation, Nutrient, Salinity

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