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[illegible] r-rezaei@tums.ac.ir

[illegible]

[illegible]

[illegible] PAH [illegible]

[illegible] MPN [illegible]

[illegible] MPN [illegible]

[illegible]

[illegible]

[illegible]

[illegible] Polycyclic Aromatic Hydrocarbons (PAH) [illegible] PAHs [illegible] PAHs [illegible] PAHs [illegible] PAHs [illegible] PAH [illegible]

[illegible] (Bioremediation) [illegible]

[illegible] PAHs [illegible] PAHs [illegible] (P) [illegible] (N) [illegible] Alvarez [illegible] C:N:P= 120:10:1 [illegible] NH_4^+ [illegible] (NO_3^-) [illegible] (NO_3^-) [illegible] P [illegible] N [illegible] PAHs [illegible]

(Ħĥ)ÆəƸdžǭ ǻƶǖǭ ǳYƘǭ ğǸǪƮǭ ÆǽƷΣ ƸDžƘǕ ѲƘǾDžǸdžϬ :č ğƿyΣ

Trace Elements	mg/L
EDTA-Sodium Salt	۵۰۰
$ZnSO_4.7H_2O$	۱۰
$FeSO_3.7H_2O$	۲۰۰
$MnCl_2.4H_2O$	۳
H_3BO_3	۳۰
$CoCl_2.6H_2O$	۲۰
$CuSO_4.2H_2O$	۱۰
$NiCl_2.6H_2O$	۶
$Na_2MoO_4.2H_2O$	۳

ƿ ƿƸŧƘǭ 2 Ƙƨł Ƹ\ ÆəƸdžǭ ǻƶǖǭ YłǸǭ ğǸǪƮǭ ѲƘǾDžǸdžϬ :Č ğƿyΣ (Ħĥ)ǯd ÆǽƷΣ ƸDžƘǕ ƿ ƠǽƸǸ ƿƸǕǾǭ

	مواد مغذی (mg/L)	محلول ماده مغذی (max)	محلول ماده مغذی (min)
Macro & Micro	K_2HPO_4	۸۰۰	۰/۱۳۲
	KH_2PO_4	۲۰۰	۰/۱۰۳
	KNO_3	۱۰۰۰	۱/۷
	$MgSo_4.7H_2O$	۲۰۰	۲۰۰
	$CaCl_2.2H_2O$	۱۰۰	۱۰۰
	NaCl	۱۰۰	۱۰۰
	$FeCl_3.6H_2O$	۱۰	۱۰
Trace	Trace elements	۱mL	۱mL

ƿ ǻƶǖǭ YłǸǭ ƿ ǰƸǖƘə ǯƿy\ ťƘϬ ƿ ƙƿƸǕǾǭ ǻƿƘƒ Ǵŧ ƘHƘƠ Ǵŧ ÆǽƘǾǯǾǁ yğƘǁ ǯłǸƘǕ Ǵ\ ÆǽƘǵǴǸǯ ƶǾ ƿ Ơƨł ǻǯǸǁ ǯY ǕYǸ\ ǻǯǸǁ ƿ ǻƶǖǭ YłǸǭ ƿ ǰƸǖƘə Ǵ\ ǴƘǂǕd ťƘϬ ǻƿƘƒ ƨǽƘ ǰǾǕƘǾǭ Ƹł ǯǸǭƸd ƨǽƘ ǴǾǭŧ .(ĦğƿyΣ)yǁy Ǵƙǖ ƸǒƘ (P<ǵ/ǵĨ) ěĚĨ ǯƘǾǯǍł Ƙ\ YłyǕł ƿ yǽYƸǖ ǴƨƘƮǭ ǯłƸǕơ ǯƘ\ Ď Design-Expert V.7 ǯłǯəǭƸƙ Ƹł ĀǾĚƮơ ǰǽł ǯY .yǁy ƿ ǯłǯǖ

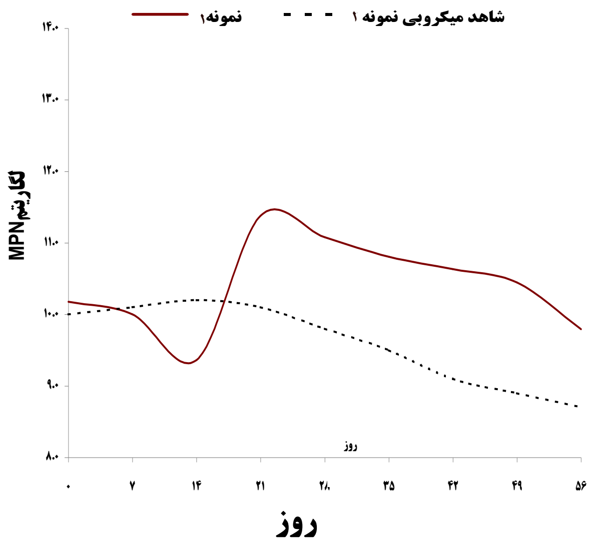
ƘǵǳYłY ƿ yǁ ǳYƘĀǭƨł ƘǵǴǸǯƙ ǯǾƘǕd ƿ Æƒłƨĭ ǻłƸ\ Excel ƿ YǯǸǭ (ANOVA) 5 ƘǽǯłƿƸǾƘd ǻǯƘǭ ǯǸǭƸd Ƹł ǳYƘĀǭƨł Ƙ\ .yǁƘƸǖ ǯłƸǻ ƘǾǪƮơ ƿ Ǵǽƶƪơ ǳy\ Ǖƶƒ ǰǽƸǕƘə | ƪƨ ǳYƘĀǭƨł Ƙ\ ťƘϬ ǯY ǳyǕǭƘƘ\ ǳyǽƸèd ƠǒǕ ǰǾǕǸ ǯǸǒǭ Ǵ\ ğyǭ ŦǾǸƨłƸǾƿł ǳǕƨY ǴǾƨƿ Ǵ\ ƿ ǯǸƨł ğÊƒ Ƹł

*ƘHƘd ÆǽƘǾǯǁ ƿ ÆƙƿƸǕǾǭ ǻƘǵyğƘ ƿ ÆǪDžł ǻƘǵǴǸǯ ƠǾǖljƿ :ĎğƿyΣ

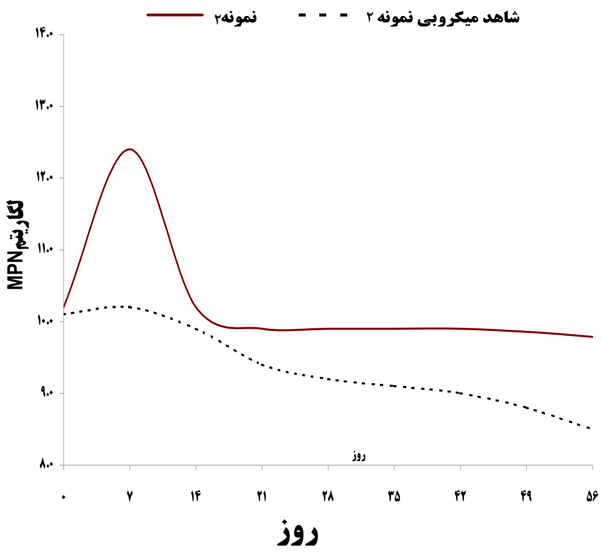
آزمایش	مواد مغذی (Nu.)	شوری (Sal.)	مخلوط میکروبی	فنانترین
نمونه ۱	+۱	+۱	+	+
نمونه ۲	+۱	−۱	+	+
نمونه ۳	−۱	+۱	+	+
نمونه۴	−۱	−۱	+	+
شاهد شیمیایی نمونه ۱	+۱	+۱	−	+
شاهد شیمیایی نمونه ۲	+۱	−۱	−	+
شاهد شیمیایی نمونه ۳	−۱	+۱	−	+
شاهد شیمیایی نمونه ۴	−۱	−۱	−	+
شاهد میکروبی نمونه ۱	+۱	+۱	+	−
شاهد میکروبی نمونه ۲	+۱	−۱	+	−
شاهد میکروبی نمونه ۳	−۱	+۱	+	−
شاهد میکروبی نمونه ۴	−۱	−۱	+	−

.yǁƨǵ (-)ǯd ǯǸǈƒ ǫyǕ ƿ (+)ǯǸǵŧƘə Ŧǽ ǯǸǈƒ ǕǈČ) ƘǵǯǸǵŧƘə ǨǻyƒƮ ƨǽ ǕǕ(+Č) ƘǵǯǸǵŧƘə ƸƦŧyƒ Ƭƨǽ* [illegible] B 3550 [illegible] BANDELIN SONOPLUS [illegible] (EPA) [illegible] rpm [illegible] Hettich Universal [illegible] GC [illegible] min [illegible] CHROMPACK CP9001 [illegible] HP5 [illegible].

[illegible] ⁰C [illegible] min [illegible] GC [illegible] ⁰C /min [illegible] ⁰C [illegible] ⁰C [illegible] ⁰C [illegible].



[illegible]



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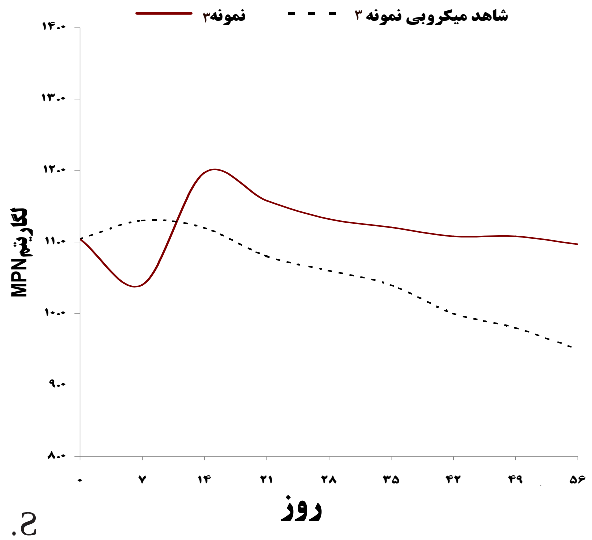

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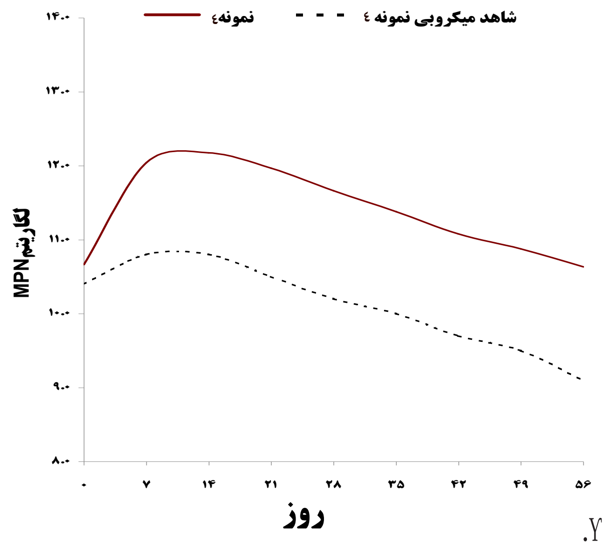


[illegible]

[illegible]

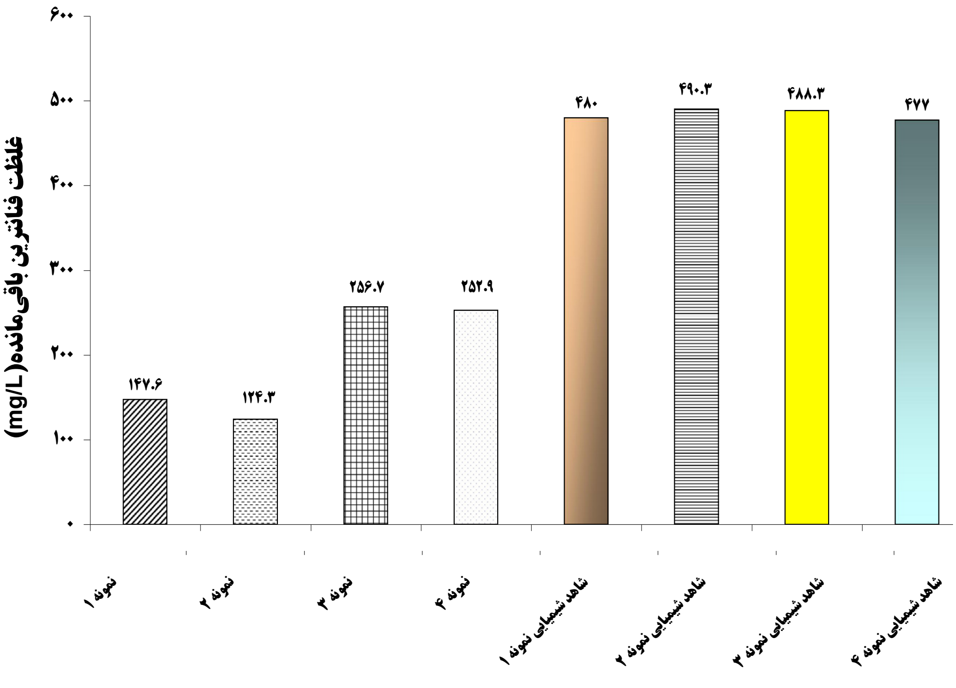
[illegible] ANOVA [illegible]

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				

[illegible]

[illegible]

[illegible] FID [illegible] mg/L [illegible]



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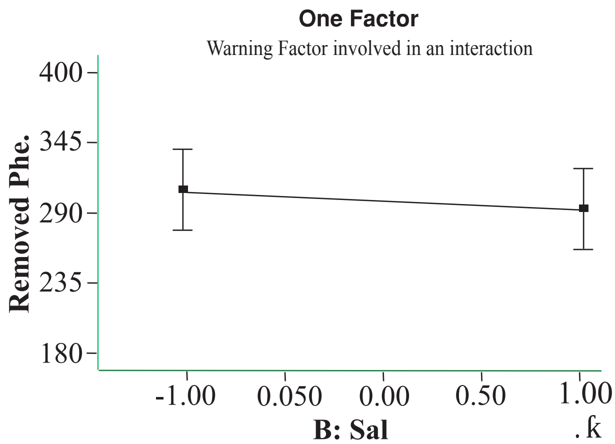

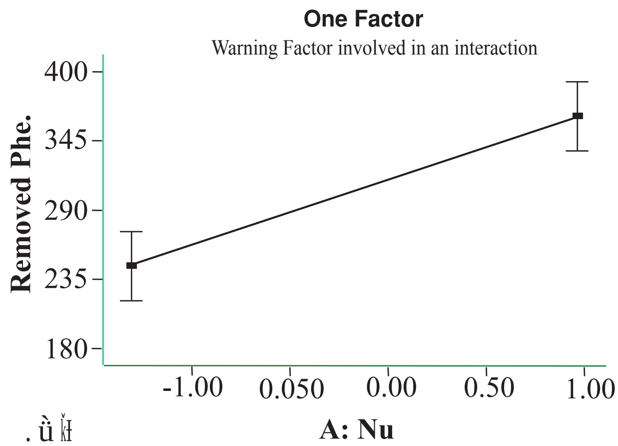

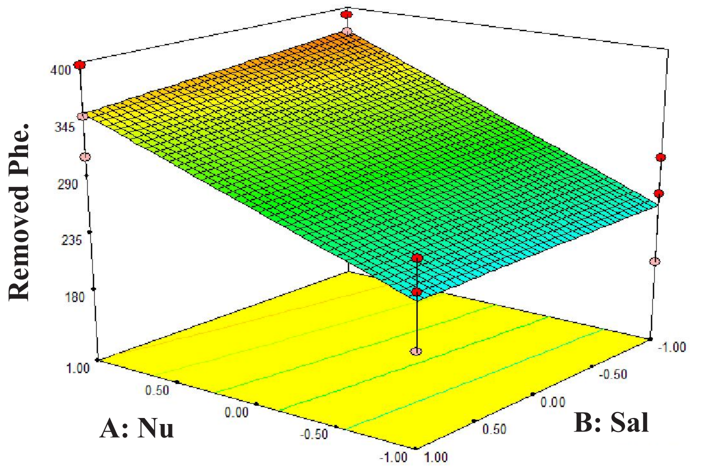

[illegible]

[illegible] (Linear) [illegible] ANOVA [illegible] (Significant) [illegible] P<[illegible] [illegible] F-Value [illegible]

[illegible] PAHs [illegible] Chaudhry [illegible]

[illegible]

[illegible]

[illegible] PP [illegible] KH_2PO_4 [illegible] KH_2PO_4 [illegible] PP [illegible] KH_2PO_4 [illegible] Franca [illegible] Olivera [illegible] pH [illegible] C:N [illegible] Silva [illegible] (N:P [illegible] P [illegible] N [illegible] biostimulation [illegible] g/ Kg [illegible]

N:P = 140: 180 [illegible] mg/Kg soil [illegible]

[illegible]

[illegible]

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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 populationusing 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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