

بهینه‌سازی فرآیند استخراج نفتالین از نفت سوخت حاصل از کراکینگ در مجتمع پتروشیمی شازند

1399/08/06:

1399/01/14:

چکیده

3-31%

°C

1/01

1/08°C (

99/4% 36/80/13°C)1/

3/1% 3/6%

(R²=0/9989) (P-value <0/0001)

) (

کلمات کلیدی:



001 g/g(

.]6[

%88
%

/ 9 / °C

3

.]1[

.] [

() ()
(-)
() ()

.] [

8 °C

]9[

]8[

8- 4 °C

%-11

]10[%80

) (

]11[%89

.]3[

4

1

0 °C

4 h

%9

1 h

%88

.]1 [

0 °C

%89

4[

%3-31

.]

0.9436 g/mL

0 °C

.]13[O/

1. Cracked Fuel Oil (CFO)
2. Unidak
3. Hydeal
4. Pyrolysis Fuel Oil (PFO)

0/ 416 %88/80

0/ 9atm

80°C

0033 0/ 4

]14[

1

%88/

(

%1/636

/31 °C

.)

%31 13

]1 [01 9

99/9

تجهیزات

300°C

: .1

()1000mL(

) 0mL()1000mL

:

1

300mL

60mm

30mm

00rpm

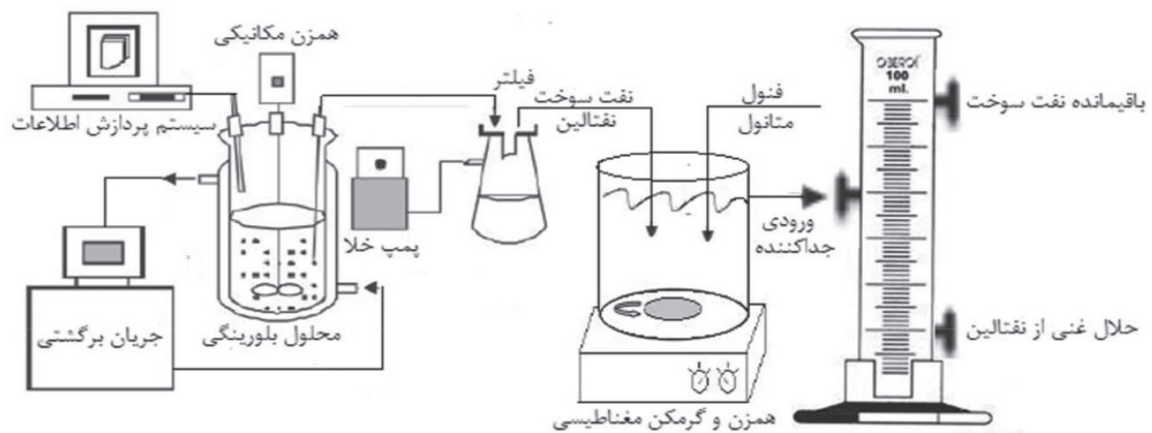
) -

(-

مواد و روش‌ها

مواد

(ppm)	(ppm)	(ppm)	(% .wt)	(kg/m ³)	(cs)	(°C)	
-0	0-0	0-10	1 -13	1 00-1000	30-1	93-6	
(°C)	(°C)	(%wt)		(°C)	(°C)	(%wt)	
-4 /8	139/1	0/ 8		80/ 6	1 /9	13/ 0	
- / 1	144/4	0/46		34/ 8	41/1	/04	-
-38/ 1	84	0/ 3		-30/48	44/	/60	-1
3	199	0/16		69/0	6/1	3/16	
40/91	181/8	0/14		-1/4	18 /6	1/	
31/04	191	0/11		/ 3	80/1	1/43	
-14/9	3 /6	008		13/ 6	138/3	1/	
34/	01/9	00		9	98	081	-6
0	49	63/ 9		- 1/41	1 8	0/69	



1

0min

1

: 3.

100mL

100rpm

:

مرحله بلورینگی

آنالیز دستگاہی

GC, HP5890, Hewlett)

(80/6°C

.]10[

(Packard, USA

(80°C

Quadrex, New Hav-) O/ mm m

(en, CT, USA

(McReynolds polarity=789) OV-1701

0°C 0 3°C/min

0min

1:6

1/8 mL/min

3 0

1 µL

300°C

100g

30g

0min

(Micro-method)

g

.]16[

$$\frac{M_P}{M_F} = \frac{C_F - C_R}{C_P - C_R}$$

)1(°C/min

$$Y = \frac{C_P(C_F - C_R)}{C_F(C_P - C_R)}$$

) (°C/min

M_F

Y

1

C_R C_F C_P

M_P

مرحله استخراج با حلال

h

.]1 [

طراحی آزمایش

1 -6 (°C

.]19 18[)

4

3

)

(

.] Q

.]1 -13[

40mL

0mL

) (() ()

(

)

- 1. Design of Experimental (DoE)
- 2. General Factorial Design
- 3. Fractional Factorial Design
- 4. Taguchi Method
- 5. Response Surface Method (RSM)

() :] 1[

()

+1 0 -1

(N)

$$N=2k(k-1)+C_0$$

C₀ k

3

$$Y = \beta_0 + \sum_{i=1}^n \beta_i x_i + \sum_{i=1}^n \beta_{ii} x_i^2 + \sum_{i < j} \beta_{ij} x_i x_j + \varepsilon \quad (3)$$

β_{ij} x_j x_i Y

1

.)3 (

3

1

نتایج و بحث

ارزیابی فرآیند بلورینگی

4

De-] [sign-Expert software (version 12.0.3.0, Stat-Ease Inc., (USA

] 3[

(A)

(T)

(C)

(B)

) (

1. Central Composite Design (CCD)
 2. Box-Behnken Design (BBD)
 3. Doehlert Design

) (

-

2

+1	0	-1			
	0	1	°C		A
1/0	1/00	0/0	-		B
00	1/0	1/00	-		C

3

(°C)			(°C)	
39	1/	0/	1	1
463	1/	0/		
6	1/	1/	1	3
61/4	1/	1/		4
0/	1/0	1/0	1	
1/	1/0	1/0		6
9/	0	1/0	1	
8/	0	1/0		8
49/3	1/0	0/	0	9
1	1/0	1/	0	10
9	0	0/	0	11
648	0	1/	0	1
6 6	1/	1/0	0	13
6 6	1/	1/0	0	14
6 6	1/	1/0	0	1

4

		(g)	(°C)
1/6	8 / 1	1/34	
1/91	84	/	6
3/36	41/6	1 /10	
30	90	189	4
66/90	800	/ 4	3
96/ 3	3/ 1	39/3	

$$T = +65.60 - 10.13A + 3.94B + 4.06C + 3.35AB - 0.45AC - 0.23BC + 3.16A^2 - 4.46B^2 - 3.86C^2$$

T A B C

4

°C
% 3/ 1

%

% 6/ 3
] 1 [

°C

- (

°C

% 8/ 8 % 38/ 8

1 atm

y=x

14/ 4

P F

) 14 °C

(

< 0.0001

°C

F

] 4[

00

P

)

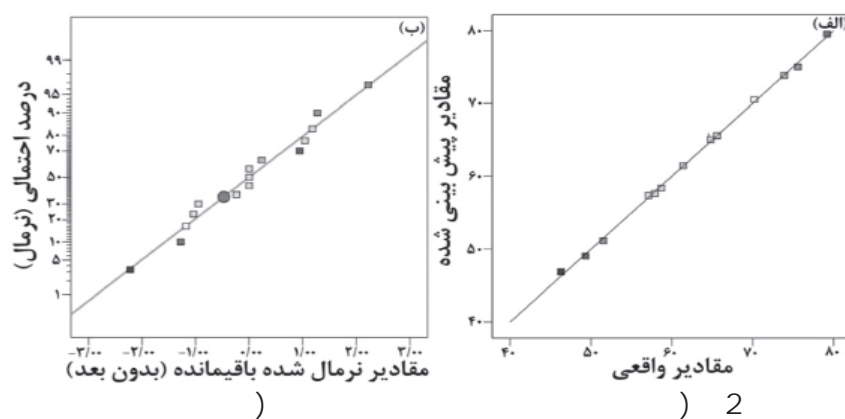
(

P < 0.0001

برازش مدل براساس آنالیز واریانس^۱

] [
 R²_{adj} R²

(] 1[
)



5

P	F			
<0.0001	14/ 4	9	1 94/3	
<0.0001	934/ 6	1	8 0/13	A
<0.0001	433/ 6	1	1 4/03	B
<0.0001	4 /38	1	13 /03	C
<0.0001	160/61	1	44/89	AB
0/1494	/90	1	0/81	AC
0/433	0/	1	0/ 0	BC
<0.0001	13 /1	1	36/93	A ²
0.0001	63/0	1	3/ 3	B ²
0.0001	19 /08	1	/09	C ²
-	-		1/40	1
-	-	3	1/40	
-	-		0.0000	3
$R^2=0.9989$, Adjusted $R^2=0.990$, Predicted $R^2=0.98$				

0.990 0.9989

 R^2_{adj} R^2

) 3) 3

] 1[

تأثیر پارامترهای متغیر بر خلوص نفتالین

°C

8/88 °C

8/63 °C

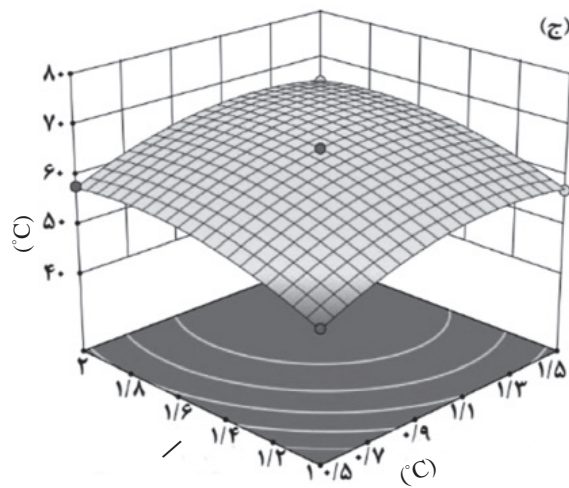
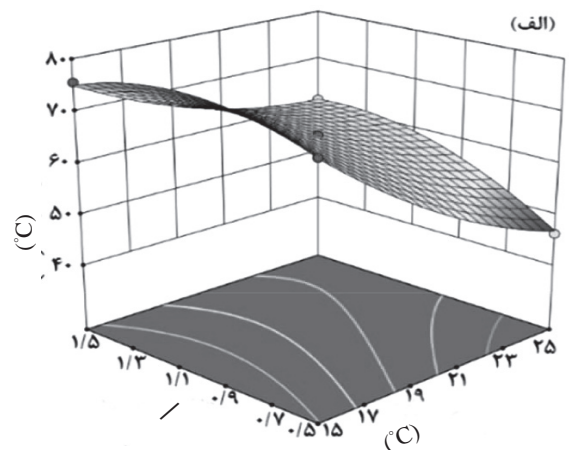
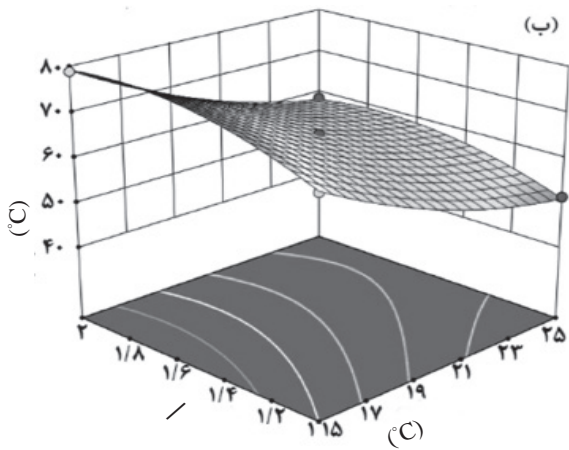
1 °C

4

1. Residual
2. Lack of Fit
3. Pure Error

3

3



))) 3

6 / 80 °C (

-3 -3

1 0/
6 / 60 °C 61 / 49 °C

) P < 0.00001 (

) 6.0 °C (1/

بهینه سازی و صحت سنجی

-3 -3

6 / 60 °C 61 / 31 °C 1/ 1

0.81 0.618 0/ 1 atm

1.08 °C

1) 9.86 °C(

1.01

4

.4 (

1/

16/

8/4

)

14/

14/ (

80/13 °C

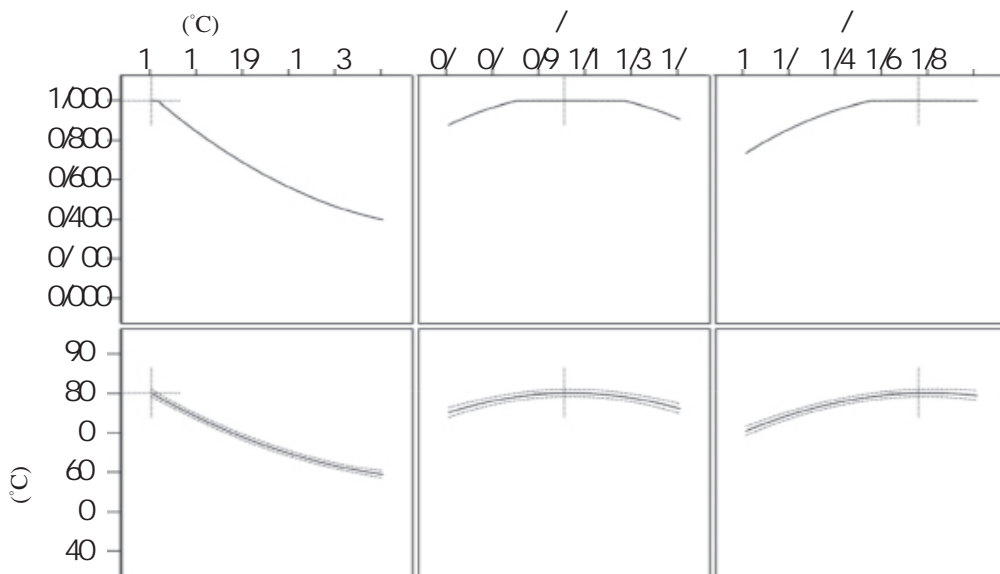
0.34

0.36

0.9/4

.1 -13[

00 °C



نتیجه گیری

1
 986 °C 8013 °C
) (3/1 96/3
)8013 °C(99/4 9 /36
)1 atm °C (%8/ %38/8
 00 °C ()0/ 1 atm
) 906 °C(%88/1 %96/18(

تشکر و قدردانی

(R&T)

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phenol/methanol of 1.01 and solvent/feed of 1.72. The extraction was performed and the melting temperature obtained was 15.08 °C.

Conclusion

The results show that the extraction yield of naphthalene is 96.18% and 98.15% at 15.08 °C and 15.08 °C, respectively. Thus, it can be concluded that the extraction yield of naphthalene is independent parameters such as the temperature of extraction, the phenol to methanol volume ratio and the volume ratio of the solvent mixture to the phase fuel on the temperature of melting. The recycling yield of naphthalene is 96.18% and 98.15% (79.06 °C), respectively. Thus, it can be concluded that the extraction yield of naphthalene is independent parameters such as the temperature of extraction, the phenol to methanol volume ratio and the volume ratio of the solvent mixture to the phase fuel on the temperature of melting.

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Fig. 2 Three-dimensional surface of melting temperature as a function of phenol/methanol ratio and solvent/feed ratio.

increasing the amount of phenol in extractant and volume of solvent up to optimum point caused higher performance of extraction. The three-dimensional surface plot shows the optimum parameters for the maximum value of the melting temperature. The optimum parameters for the maximum value of the melting temperature are phenol/methanol ratio of 1.01 and solvent/feed ratio of 1.72. The extraction was performed and the melting temperature obtained was 15.08 °C.