Use Of Bentonite Clay As A Coagulant Or A Coagulant Aid With Ferrous Sulfate For Synthetic Turbidity Removal

Mohammad S. Hassan Musa'b A. Al- Tamir
Civil Engg. Dept./University of Mosul

Abstract

In this study the bentonite clay has been used as a coagulant and coagulant aid with ferrous sulfate in turbidity removal for different initial synthetic turbidity of Tigris River samples of (10- 500) ntu, The study revealed the efficiency of using bentonite clay as a coagulant alone in removing turbidity with a dose not more than 30 mg/l, Also the study reveled the improvement of ferrous sulfate efficiency for removing water turbidity when bentonite clay used with it in a dose of 7.5 mg/l of bentonite and 5 mg/l of ferrous sulfate. The regression analysis showed that the most important variables affecting on turbidity removal were initial turbidity followed by settling time and bentonite clay dose then finally ferrous sulfate dose.

Key Words: Ferrous Sulfate, Iron Salts, Bentonite Clay, Coagulation, flocculation, Coagulant aids, Turbidity removal, Water Supply.

أستلم في 2004/12/21 قبل في 2006/1/3

[illegible]

[illegible] (Coagulant) [illegible] (Ferrous sulfate) [illegible] (Alum) [illegible] (Ferric chloride) [illegible] [1](Mahmmod and Ahmmad, 1985) [illegible] (2 -0.2) [illegible] %(30 -10) [illegible] (2-[illegible] 1-[illegible]) [illegible] Qureshi, and 1985) [2](Costello, 1984) [illegible] .[3](Malmberg, [illegible] [4](Yasin, 1991) [illegible]

[illegible] [5](2002 [illegible]) [illegible]

[illegible] .[6](Matheson and Ford, 1957) [illegible] [8](York and Morgan, 1974) [7](Lund and Nissen, 1986)

[illegible]

[illegible]

1. [illegible]

[illegible] .[9](McCook and West, 1978) [illegible] (1) [illegible]

Ƚùʅƒƨƥ!ƒ ʅƥùǅ ýǚùƤ ƜƦǴùǆǈ!ƒ ƦƤƒ ȽǀƱǈǅ Ŏ5 ȽǄŋƥ ƨǌǈ ǢǅǄ ʅƨǍǂż! ĭƨǌƮ!ƒ ýƥżǅ!ƒ :(1) !ƺƥ üǊǫƜ .(1998)

ǅǇƥĭƦƟ	ƥƑǈ	ǅǋƒƨĭǅ	ƥƐƤƆ	ƕǃƮƑǫǆƐ
3.2	3.6	9.6	9	(NTU) ʅƨǍǂƵ ʅƥơǍ ʅƨǍǂż!ƒ

2. ʅĭƑǋǊǂǅǴǆƐ ǅǉƯ :

ýǅǴǂǂ Ŏǂ!ƒ ƨƑƒǍƥ!ƒǍ ýƥƒǍǅ!ƒ ǈǅǅ ƥƥƵ Ŏ5 ǅƥƤǂʅǅ!ƒ ƘǋǴǈǍǂǈ!ƒ ǈǉƱ ǈǅ ƸǴǈƮƆ ǈƵ ĭƨơǂ!ƒ ǅǂ ǅǅùǂ ƥƥǍ Ü(2) ǅƥƨ ýǍƥŋ!ƒ Ŏ5 ʅƥƥơǅ!ƒ ƒ ǍơƼ!ƒ ǈǌǉǈƵ ƘǋƨŋƆǍ ƜƦǴǅǈ!ƒ ǈǅ ƥƥƵ ƦƤƆ ǅǂǍ ʅƥǴǅ!ƒ ǈƦǌ ýǅ ƨǴǋƤƒ ƘǋǴǈǍǂǈ!ƒ ǈǉƱ! Ƚǋǅǅż!ƒ Ƙƒƥƥơǅǅ! ǆƮƑƮƤ Ƚǂǈ ƱǅǄ! (1) ǅƥƨ ƜƦǍǅǈ!ƒ ƨǴǋƤƒ [10]

.ƘǋǴǈǍǂǈ!ƒ ǈǉƱ ƜƦǴǅǈ Ư żǈ ƒ ƑǴƮƤ :(2)!ƺƥ üǊǫƜ

ƕǃƮƑǫǆƐ	Ƚ ƤǊǅǆǆǆ !ƺƥ				
	1	2	3	4	5
% Ƚ!ǍǂʅƒƥǍ	440	84	61	64	128
% ȽǈǍƥǆ!ƒ ƥơ	97	46	46	45	87
% ȽǈǍƥǆ!ƒ ýǂƥ	343	38	15	19	41
ŎƵǍǈǅ!ƒ ǈǋǍ!ƒ	2.84	2.70	2.57	2.74	2.60

3. ƦǊǫĭǫƟǆƐ ʅƑƗĭƥǴǆ :

ý ǂƮ ĬǆƵ (%99.9) ʅǍǴǆǈǅ ȽǂƨǌƘƤǅ!ƒ $(FeSO_4 .\ 7H_2O)$ ȽǂƑǴǅ!ƒ ǋǍƥǂƥơ!ƒ ƘǴǂƨǌǂ ƘǅƥƤʅƒ .(%1) ǋǂǂƨǌ ýǍǆơǅ

4. ƔƦǆƜǛǆƐ :

(Hatch Laboratory Turbidimeter 2100A) ƔǍùǈ ǈùǅ ʅƨǍǂż!ƒ ƒ ơƼ ǋǴǈǌŋ ǅƥƤʅƒ ǋǴǈǌŋ ǅƥƤʅƒ ǴǅǂǍ .(ʅƨǍǂƵ ʅƥơǍ) (ntu) ʅƥơǍǈ ƩǴǆǈ! ǅǂǍ ȽŋǴǈż!ƒ ƥżǈǍ ýǈƥ ƜƦǴǅǈ!ƒ ʅƨǍǂƵ ƒ ơƼ! ƥùżǈǍ ýùǈƥ ƜƦǴùǅǈ! ŎǈǌŋǍƨƥùǌǈ!ƒ ǅƥƨ!ƒ ƩǴǆ! (WTW, pH 322) ƔǍǈ ŎǈǌŋǍƨƥǌǈ!ƒ ǅƥƨ!ƒ ƩǴƥ .ȽǆǅǴżǅ!ƒ

ƩǴù5ƨ ƘƒƦ ǴùǈǈǅƮ ýǂ ƘǴŋǋǴǅ ƩǅƤ ĬǆƵ ĭǍƘơǍ (Jar test) ʅƨŋ!ƒ ƒ ơƼ ǋǴǈǌŋ ǅƥƤʅƒǍ ĭƨùƑƒƥ ýùƱǈǅ ƘƒƦ Ƚǂŋǈǋ ƘǴǋǍǴơ ǋǴǈǌŋ!ƒ ýǅ ƘǅƥƤʅƒ Ü(ǅʅ2) ƯƨƵǍ (ǅʅ6) ýǍƱǈ (Blade) :ȽǂǛƒ ƘǈƒǍǂ!ƒǍ ƘƒƨǂǅǅǅƒƼ ǈǌ!ǚƤ ƘǅƥƤʅƒ ʅƨŋ!ƒ ƒ ǍƼ ǈǅǅ ȽǆʅǆʅƘǂƨŋƆ Ü(ƨǂǆǆǅǅ1000) Ƚżʅ

1. ƘƒƨǂǅǅƼ ƒ ơƼ ʅƨŋ!ƒ ǅǂǍ ǈǌǂǍǈǍǂ ǴǂǛǴǂ: [11]Ü[12]Ü[13]

Ɔ. ƜǋƥƘ (100 ƥǍƨʅ\ Ƚǂǋƥƥ) ʅƥǅ! Ƚǂǋƥƥ ǍƥơƒǍ ǛʅƥǈǈƒǍ ƜƨƥǈǍ ƨƵƵƨʅ ǅǂƒƥǂǅ ǈƨƒƥǈǅ (62 Ƚǂǈǈ $^{-1}$).

Ɣ. ƜǋƥƘ (40 ƥǍƨʅ\ Ƚǂǋƥƥ) ʅƥǅ! (Ƚǂǋƥƥ30)Ü ƜƨƥǈǍ ƨƵƵƨʅ ǅǂƒƥǂǅ ǈƨƒƥǈǅ (15.8 Ƚǂǈǈ $^{-1}$).

Ɯ. ƨǅǂ ǈǂƨʅ Ɣǂʅǈ ĬƮƥƆ ǈƨƒƥǈǅ (30 Ƚǂǋƥƥ).

2. ƩǅƤ ƘǴǋǍǈʅǅ ǈǅǅ ʅƨǍǂż!ƒ ȽǂƑƒƥǈǛƒ ǈƥǂƮƮƤǅ! (10, 15, 25, 100, 500) ʅƥơǍ ʅƨǍǂƵ.

3. ƩǅƤ ƘǴǋǍǈʅǅ ǈǅǅ ƔƨŋǍ ǋǂǂƨǌƘ ǋƥǍƥơ!ƒ ǈǂǈǍƆƨ ǈǂǈ (2.5- 30) ǈǋǆǈǅǅ ƨǂ!\ǅǅƨǴǂǂ ƨǂǴǂǂǂ ơʅƔ ǋǈǍǂʅǅǍ ȽǂƑƒƥǈǛƒ ʅƨǍǂż!ƒ.

4. ƩǅƤ ƘǴǋǍǈʅǅ ǈǅǅ ƔƨŋǍ ƘǋǴǈǍǂǈ!ƒ ǈǉƱ ǈǋǆǈǅǅ ƨǂ!\ǅǅƨǴǂǂ (1- 25) ƨǂǴǂǂǂǂ ơʅƔ ȽǂƵƨŋ ǈǂǍǂǴǂǈǂƘǂǅ ǋƥǍƥơ!ƒ ƘǴǋǍǈʅǅ ȽǂƑƒƥǈǛƒ ʅƨǍǂż!ƒ.

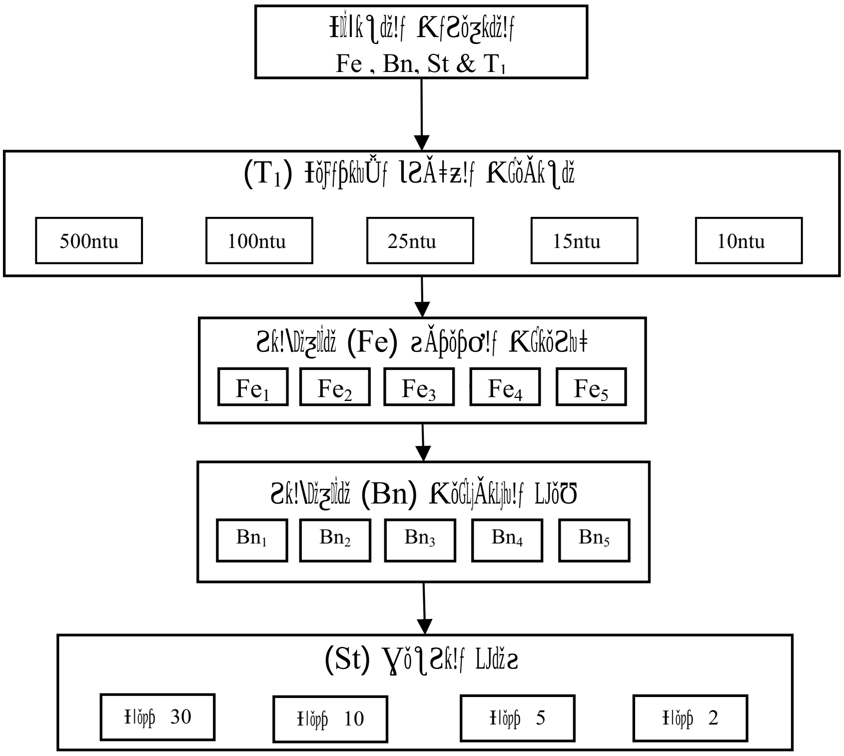
5. ýǋƨƆ ƘǴǋǍǈʅǅ ǈǅǅ ȽǈǅǋƆ ǈǂǈƨǂǂ!ƒ.

6. ǅǂǍ ƯǆǴǴ!ƒ ƘǋǴǈǍǂǈ!ƒ ýǅ ƘǴǋǍǈʅǅ ǋǂǈƥƥơ!ƒ ƩǴƨ ƘƥǍ!ƒ ǈǅǆƯ Ƚǂǈƨǂ!ƒ ƜǋǅǂƬ!ƒ ǈǅƨǂ!ƒ.

ƀǠþɯǂǁ !ĭĎǮƬǂ

ƨùǒʓķďž!ƒ ŎŊ ǂďžǤǯďž ýǂ! (T_2) ǂǒǀƀķďž!ƒ ǀƨǍǂƶ!ƒ ǈǍǂķ ǂǒơƀ ǂƀƨɳķǁ! ŎƑǤƮơȣ ĎǒďžƮķ ƇƒƨɳȣĎķ Ü(Fe) ƨǍþùǒþơ!ƒ ƘǤùķǒƨƀǂ ǂùƵƨɳ Ǒŋ5 ǂǁķƪďž!ƒ ƘƒƨǒʓķďžƒǤďžĐ Ü(Dependent variable) þďžķƶďž!ƒ Ǒù5 ǂùǉǒƀďž ǤďžǂǍ (St) ƔǒƪƨķƒǈďžƨǍ(T_1) ǂǒƑƒþķƀǕƒ ǀƨǍǂƶ!ƒ ǎǍķƪďž Ü(Bn) ƘǒǤǉǍķǉƀ!ƒ ǈǒƱ ǂƵƨɳ .(1)ĎǒþƨýǂƬ!ƒ

Stepwise) ƘƒǍƱƤ!ƒ þþƶķďž ƨƒþơǉǕƒ ýǒǁơķ ƔǍǁƪĐ ǏǁƵ þǤďžķƵǕǤƀ ǾǒƑǤƮơȣ ƝƑǤķǉ!ƒ ýǒǁơķ ĎķǍ ǏǁƵ þǤďžķƵǕǤƀ ǂǒǀƀķďž!ƒ ǀƨǍǂƶ!ƒ ǂďžǒǀƀ ƋƀǉķǁǃŎưǤǒƨ ɯƦǍďžǉ þǤɳǒǕ(Multiple Regression Analysis [14].ǂǁķƪďž!ƒ ƘƒƨǒʓķďžĎǒþ

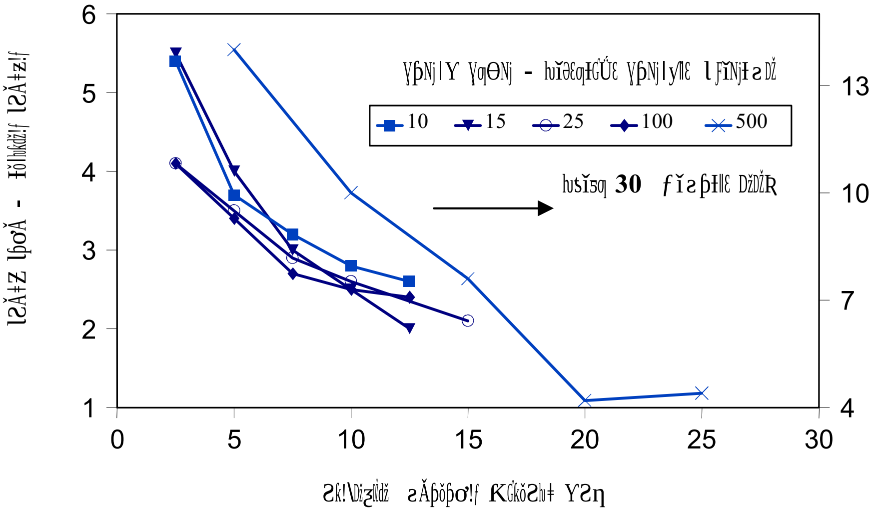


.ƔƨǤɳķǁ! ŎƑǤƮơǕƒ ĎǒďžƮķ!ƒ :(**1**) !5þ ülƪ

[illegible]

[illegible]:

[illegible] (2) [illegible] [16] [15] [illegible] (20 ،10 ،10 ،12.5 ،10) [illegible] (500 ،100 ،25 ،15 ،10) [illegible] (4.2 ،2.5 ،2.6 ،2.3 ،2.8) [illegible].



[illegible] :(2) [illegible].

[illegible]:

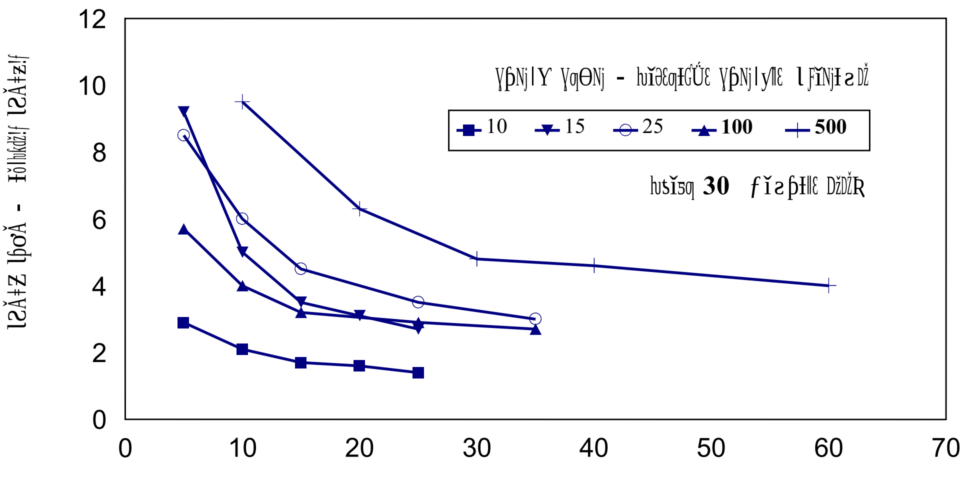
[illegible] (3) [illegible]:

1. [illegible].
2. [illegible] [9].

3\. [illegible] [17] [18]

4\. [illegible] [15] [19] [20]

[illegible] 15) [illegible] (30 15 25 15 [illegible] (500 100 25 15 10) [illegible]

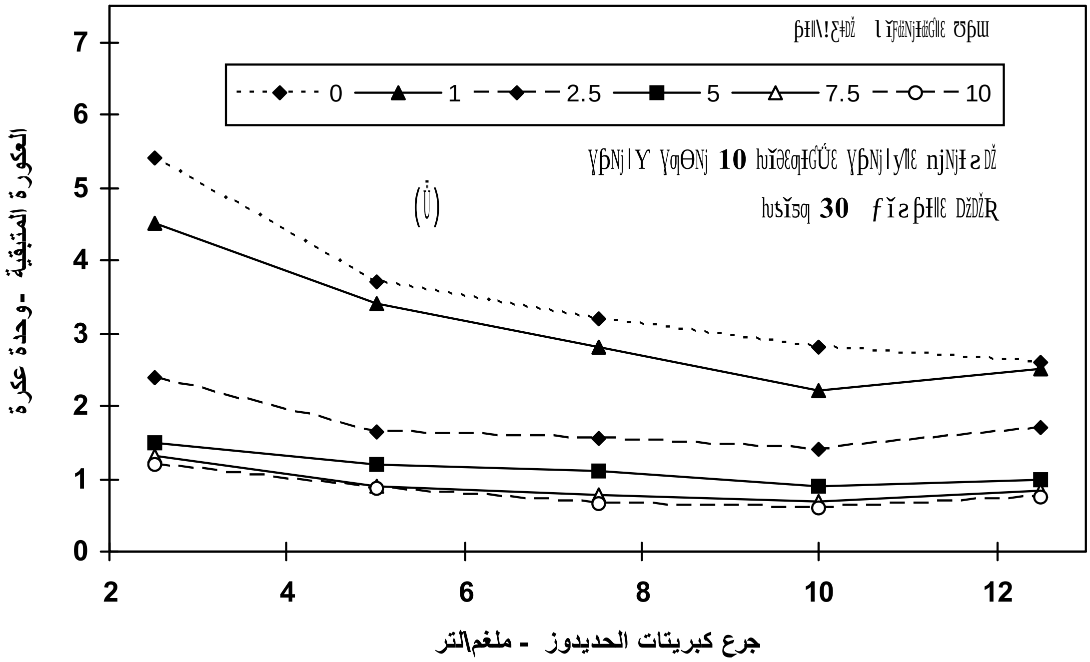


[illegible] :(3) [illegible]

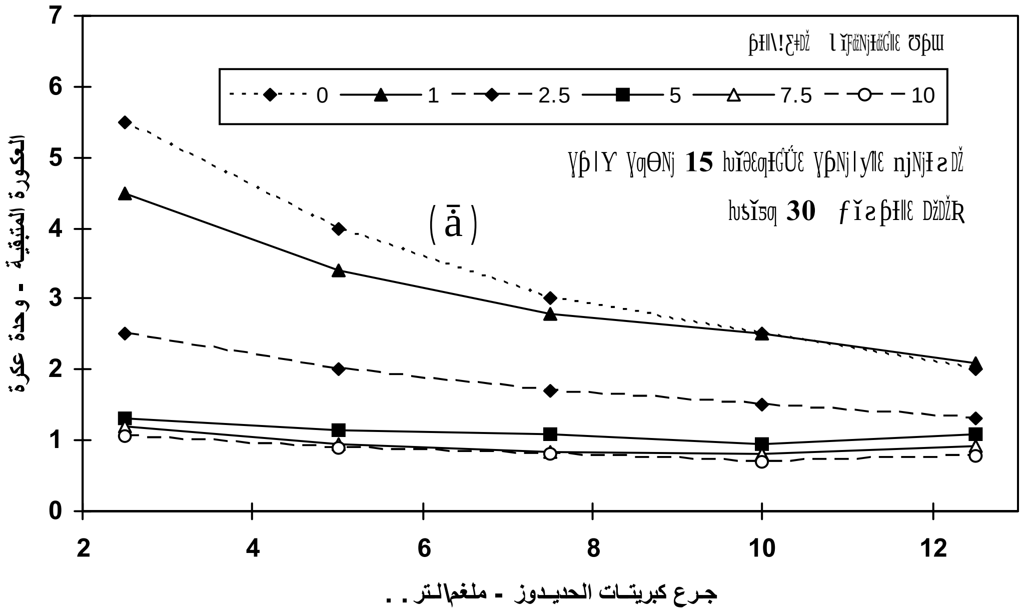
[illegible]

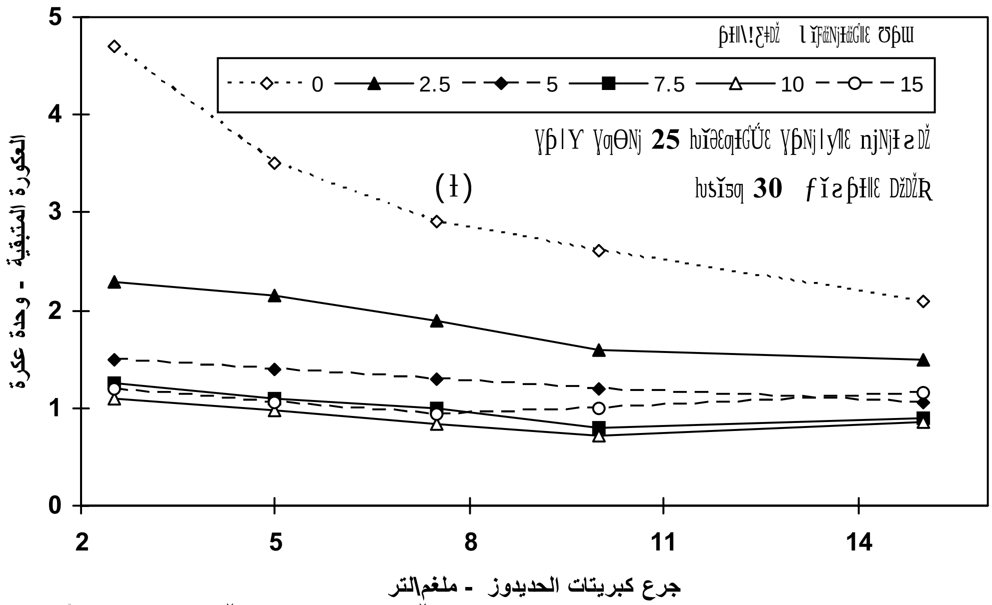
1\. [illegible]

[illegible] (4) [illegible] (25 15 10) [illegible] (2.5) [illegible] (1) [illegible] (10) [illegible] (Restabilization) [illegible] [15] [21] [illegible] (0.61) [illegible] (10) [illegible] (10) [illegible] (5) [illegible]


0
1
2.5
5
7.5
10
العكورة المتبقية - وحدة عكرة
جرع كبريتات الحديدوز - ملغم/لتر

2


0
1
2.5
5
7.5
10
العكورة المتبقية - وحدة عكرة
جرع كبريتات الحديدوز - ملغم/لتر



ƧŏǺƤǩǁ! þƵǴʅǆŧ ƘŏǴǈĂǩǈƕ!ƒ yǆ ƧǺƤǆŧ ƨĂþŏþʊ!ƒ ƘǴǩŏƧƕŧ YƧɳ ƧŏǴʓǩ ƧŏǺǇǩ :(ł - ƈ) :(4) !ƾþ ül ʅ

.ŧƑƱƒĂ!ƒ ŧŏƑƒþǩƕǕƒ lƧĂŧƶ!ƒ ƘǴŏĂǩʅǆ! ŧŏlƕǩǆ!ƒ lƧĂŧƶ!ƒ Ĭǁ Ƶ

ƕƯƨNjŧǄǁƐ ƕĭƏƐɊŧĜǗƐ ɣþNjlyǁƐ njNjŧƨǄ

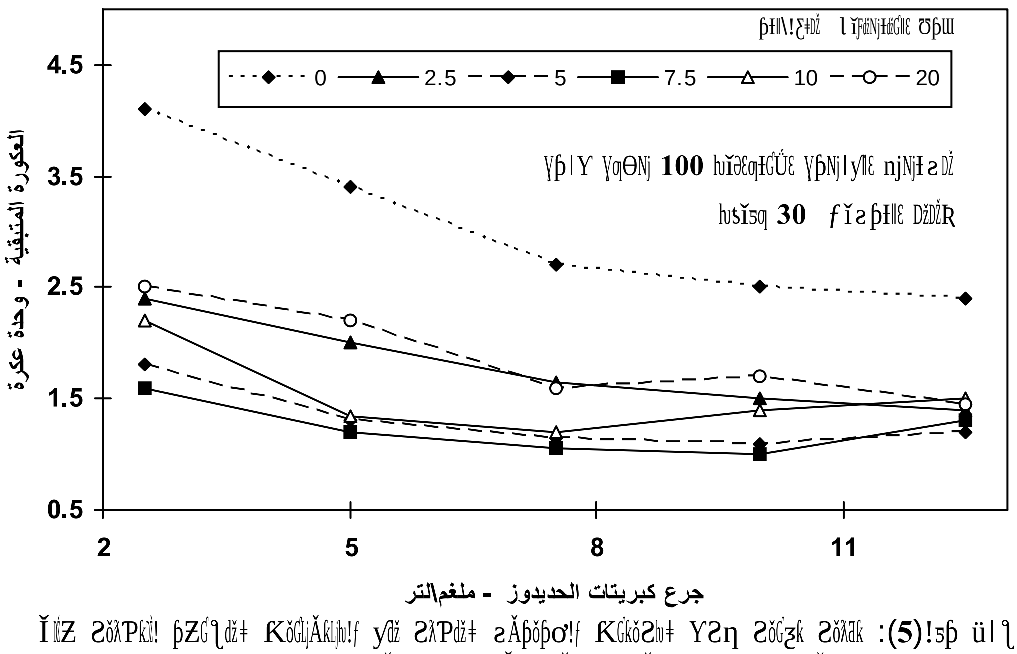
ăĂǩʅùǆ! Ƙùŏ ǴǈĂǩǈƕ!ƒ yǆ ǈǆƒþƤǩʅƒ þǈƵ ƨĂþŏþʊ!ƒ ƘǴǩŏƧƕŧ YƧɳ ƧŏǴʓǩ ƧŏǺǇǩ (5) ýŧT!ƒ ǇŏƕŏŧùƵƧɳ lþǴùŏƨƕ Ư ƾƤǈùǩ ŧùŏlƕǩǆ!ƒ lƧĂŧƶ!ƒ Ǉǈ ŧƯʊǕǆ ǇŧǆŏÝlƧĂŧƵ lþʊĂ (100) ŧŏƑƒþǩƕǕƒ lƧĂŧƶ!ƒ

ƘǴùǩŏƧƕŧ ǇǆƧǩ!\Ǆʓǁǆ (10 Ü5 Ü2.5) yǆ ƘŏǴǈĂǩǈƕ!ƒ ǇǆƧǩ!\Ǆʓǁǆ (5) ǄƒþƤǩʅƒ þǈƶ5 ƨĂþŏþʊ!ƒ ƘǴǩŏƧƕŧ

ŧŏlƕǩǆ lƧĂŧƵ yǆ ŧǈƧǴlǆ ɣŏǩƧǩ!ƒ Ĭǁ Ƶ lƧĂŧƵ lþʊĂ (1.1 Ü1.3 Ü1.8) ŧŏlƕǩǆ!ƒ lƧĂŧƶ!ƒ ǇĂŧǩ ƨĂþŏþʊ!ƒ

ƧŏǺǅùǩ Ʊùʊǖŏ Ǵǆŧ ÜǈþʊĂ! ƨĂþŏþʊ!ƒ ƘǴǩŏƧƕŧ ǄƒþƤǩʅƒ þǈƵ lƧĂŧƵ lþʊĂ (2.5 Ü 3.4 Ü4.1) ǴNjƧƒþlǆ

.ŧŏlƕǩǆ!ƒ lƧĂŧƶ!ƒ Ǉǆ ýŏǁlǩ!ƒ Ŏ5 Ƨǩ!\Ǆʓǁǆ (10-1) Ǉŏƕ ŧƑƱƒĂ YƧɳƕĂ ƘŏǴǈĂǩǈƕ!ƒ



Ĭǁ Ƶ ƧŏǺƤǩǁ! þƵǴʅǆŧ ƘŏǴǈĂǩǈƕ!ƒ yǆ ƧǺƤǆŧ ƨĂþŏþʊ!ƒ ƘǴǩŏƧƕŧ YƧɳ ƧŏǴʓǩ ƧŏǺǇǩ :(5)!ƾþ ül ʅ

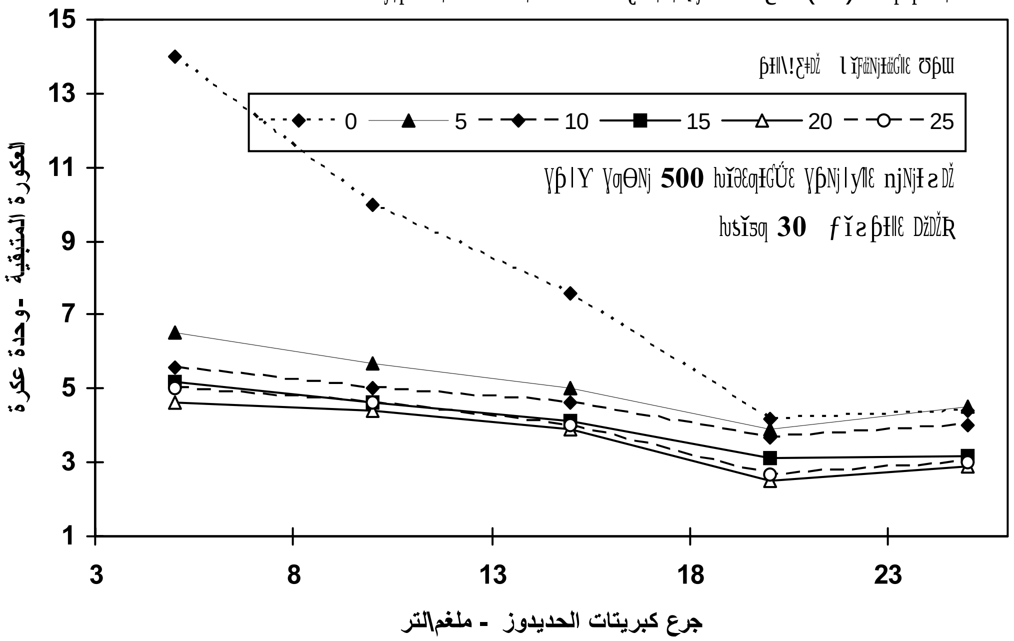
.ŧƱʅĂǩǆ!ƒ ŧŏƑƒþǩƕǕƒ lƧĂŧƶ!ƒ ăĂǩʅǆ! ŧŏlƕǩǆ!ƒ lƧĂŧƶ!ƒ

DžƒϸPƙʅĜƕ lƧĂǂƵ lϸơĂ (1.0) ƘǇĜǂ ăĂƙʅdž!ƒ ƒȐŊ LJdžư ĜnjŏǁƵ ýĂ Ꚍơ!ƒ Džƙ ǂŏlƕƙdž lƧĂǂƵ ýpƊ LJdž Ĭǁǁdž!ƒ ǂƵƧƞ!ƒ ƧĜƕƙƵƒ LJǂdžŏĂ ÜƨĂϸŏϸơ!ƒ ƘĜƙŏƧƕǂ LJdž Ƨƙ!\Džʓǁdž (7.5) ydž ƘŏĜǇĂƙǇƕ!ƒ LJdž Ƨƙ!\Džʓǁdž (10) .Ƨƙ!\Džʓǁdž (5) ŎŊ ǂŏƑƒϸƙƕŬƒ lƧĂǂƶ!ƒ LJdž ăĂƙʅdž!ƒ ƒȐŊ LJdžư ƨĂϸŏϸơ!ƒ ƘĜƙŏƧƕǂ

3. ƕĭǁƑyǁƐ ƕĭƏƐƣǂĜŬƐ ƔϸŊʅyǁƐ njŊǂƨǅ

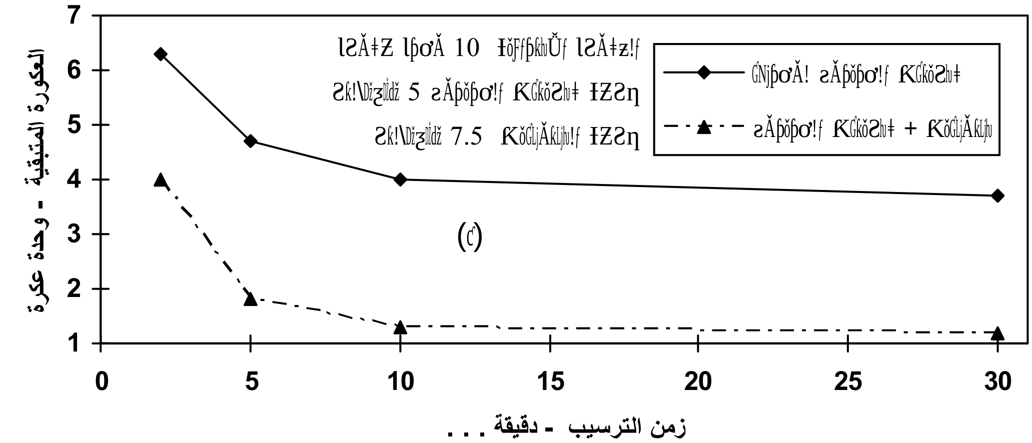
yùdž ŊdžƒϸPƙùʅƒ ϸùǇƵ ǂŏlƕƙdž!ƒ lƧĂǂƶ!ƒ ĬǁƵ ƨĂϸŏϸơ!ƒ ƘĜƙŏƧƕǂ ƳƧƞ ƧŏĜʓƙ Ƨŏƛdžƙ (6) ý‡T!ƒ ýƛdžŏ Ü5) yùdž ƘŏĜǇĂƙǇƕ!ƒ LJdž Ƨƙ!\Džʓǁdž (10) DžƒϸPƙʅĜƕ ÝlƧĂǂƵ lϸơĂ (500) ǂŏƑƒϸƙƕŬƒ lƧĂǂƶ!ƒ ăĂƙʅdž! ƘŏĜǇĂƙǇƕ!ƒ yùdž ǂǇƧĜldž lƧĂǂƵ lϸơĂ (3.7 Ü5 Ü5.6) ǂŏlƕƙdž!ƒ lƧĂǂƶ!ƒ LJĂǂƙ ƨĂϸŏϸơ!ƒ ƘĜƙŏƧƕǂ LJdž Ƨƙ!\Džʓǁdž (20 Ü10 ƧŏƛdžùƘ LJƊ Üơǖŏ .ǇϸơĂ! ƨĂϸŏϸơ!ƒ ƘĜƙŏƧƕǂ DžƒϸPƙʅƒ ϸǇƵ lƧĂǂƵ lϸơĂ (4.2 Ü10 Ü14) ĜŊǇƧƒϸldž lƧĂǂƵ Ŏù5 ŊùŏǁƵ ĂùŊ Ĝùdž! ŊƕĜTdž ǂŏƑƒϸƙƕŬƒ lƧĂǂƶ!ƒ LJdž ăĂƙʅdž!ƒ ƒȐŊ! ƘŏĜǇĂƙǇƕ!ƒ ydž ƨĂϸŏϸơ!ƒ ƘĜƙŏƧƕǂ DžƒϸPƙʅƒ ǶꞆĂꞆùPĂ ǂƕĜʅù!ƒ ƘĜŏĂƙʅdž!ƒ LJdž ýpƊ ƘŏĜǇĂƙǇƕ!ƒ ǂŏǁƵĜ5 LJƊ Ǖǫ Ýǂŏƒƒϸƙƕŭƒ lƧĂǂƶ!ƒ LJdž ǂƕĜʅ!ƒ ƘĜŏĂƙʅdž!ƒ .ƨĂϸŏϸơ!ƒ ƘĜƙŏƧƕǂ ǂƵƧƞ lϸĜŏƨƕ

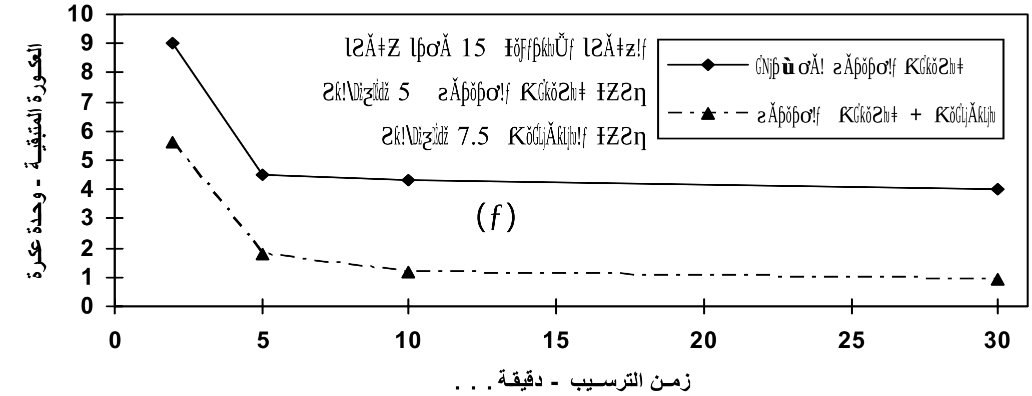
DžƒϸPƙùʅĜƕ lƧĂùǂƵ lϸơĂ (2.4) ŎŊ ăĂƙʅdž!ƒ ƒȐŊ LJdžư ĜnjŏǁƵ ýĂꞆơ!ƒ Džƙ ǂŏlƕƙdž lƧĂǂƵ ýpƊ LJùdž Ĭùǁdž!ƒ ǂƵƧƞ!ƒ ƧĜƕƙƵƒ LJǂdžŏĂ ƘŏĜǇĂƙǇƕ!ƒ LJdž Ƨƙ!\Džʓǁdž (20) ydž ƨĂϸŏϸơ!ƒ ƘĜƙŏƧƕǂ LJdž Ƨƙ!\Džʓǁdž (20) .ǂŏƑƒϸƙƕŬƒ lƧĂǂƶ!ƒ LJdž ăĂƙʅdž!ƒ ƒȐŊ! Ƨƙ!\Džʓǁdž (20) ƨĂϸŏϸơ!ƒ ƘĜƙŏƧƕǂ

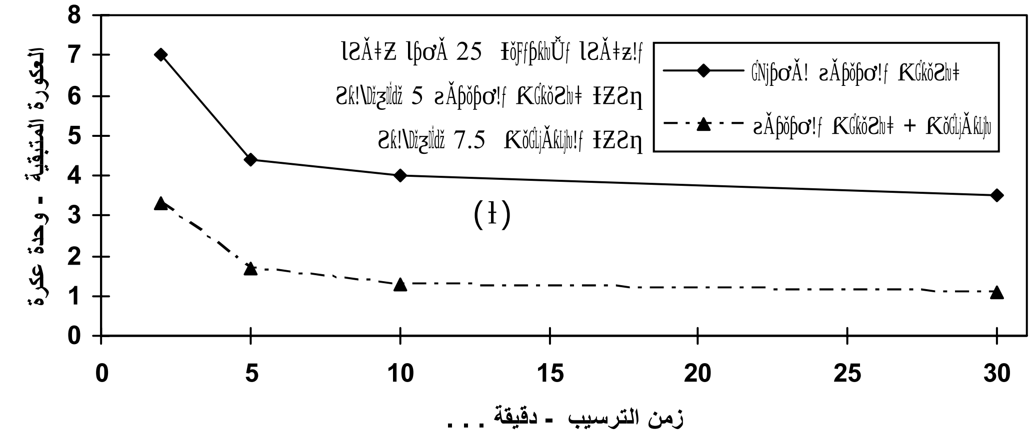


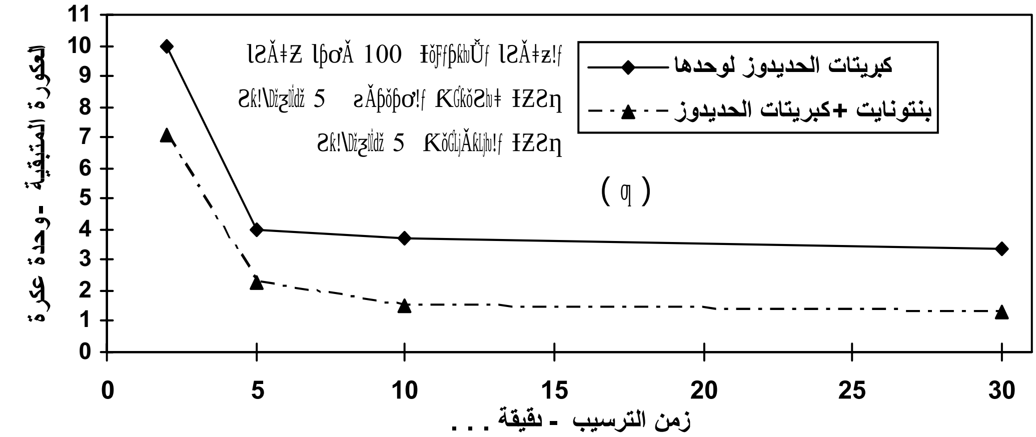
ƧŏƛPƙǁ! ϸƵĜʅdžǂ ƘŏĜǇĂƙǇƕ!ƒ ydž ƧƛPdžǂ ƨĂϸŏϸơ!ƒ ƘĜƙŏƧƕǂ ƳƧƞ ƧŏĜʓƙ Ƨŏƛdžƙ :(**6**) !ƽϸ ülʅ .ǂŏ!Ĝƶ!ƒ ǂŏƑƒϸƙƕŬƒ lƧĂǂƶ!ƒ ăĂƙʅdž! ǂŏlƕƙdž!ƒ lƧĂǂƶ!ƒ ĬǁƵ

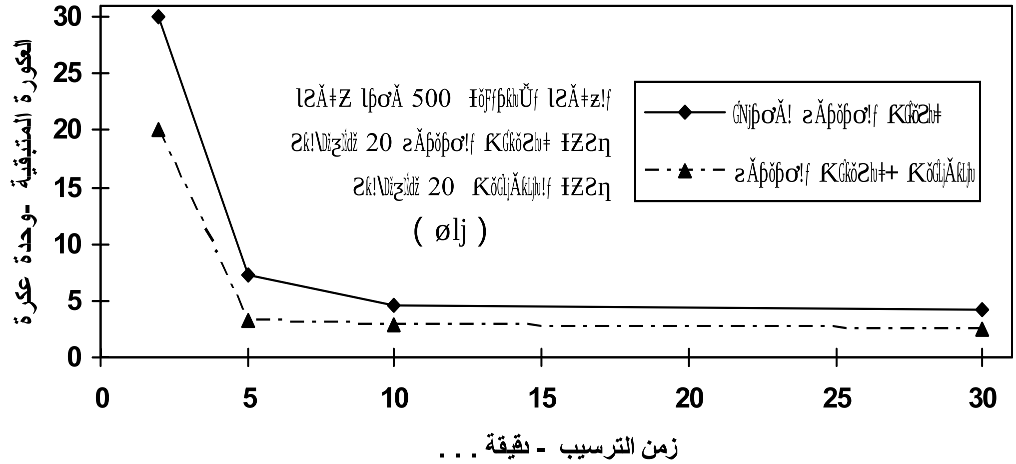
ȐŊǫĭǫƟǁƐ lǷǂĭϸĜl ƲDž lĭƑǁŊǂǁĜǁƐ !ƐǫƜǂƨƐ ǫǁdžY ƕĭƨĜǂDžǁƐ ƔϸŊʅyǁƐ ĂǂY ƒĭƨϸǂǁƐ DžDžŽȐ ϸĭƙƊǂ Ĭùǁƛdž!ƒ ƳƧƞǁ! ǂŏlƕƙdž!ƒ lƧĂǂƶ!ƒ ĬǁƵ ƔŏʅƧƙ!ƒ LJdžƨ ƧŏĜʓƙ Ƨŏƛdžƙ (ùŊ -Ɗ) (7) ƊpƧ ý‡T!ƒ ƠưĂŏ lϸùơĂ (500 Ü100 Ü25 Ü15 Ü10) ǂùŏƑƒϸƙƕŬƒ lƧĂùǂƶ!ƒ ƘĜŏĂƙʅdž! ƨĂϸŏϸơ!ƒ ƘĜƙŏƧƕǂ ydž ƘŏĜǇĂƙǇƕ!ƒ LJdž ăĂƙʅùdžǁ5 ƔŏùʅƧƙ!ƒ LJùdžƨ LJùdž ƻŏƽƱ ý‡Tƕ LJʅơŏ ƨĂϸŏϸơ!ƒ ƘĜƙŏƧƕǂ ydž ƘŏĜǇĂƙǇƕ!ƒ LJƊ Üơǖŏ ÜlƧĂǂƵ LJùdž Ƨùƙ!\Džùʓǁdž (20) ydž ƘŏĜǇĂƙǇƕ!ƒ LJdž Ƨƙ!\Džʓǁdž (20) DžƒϸPƙʅĜƕ lƧĂǂƵ lϸơĂ (500) ǂŏƑƒϸƙƕŬƒ lƧĂǂƶ!ƒ Ü2) ƔŏʅƧƙ!ƒ ƘĜpĂƊ ϸǇƵ lƧĂǂƵ lϸơĂ (2.5 Ü2.9 Ü3.3 Ü20) ǂŏlƕƙdž!ƒ lƧĂǂƶ!ƒ LJĂǂƙ ƨĂϸŏϸơ!ƒ ƘĜƙŏƧƕǂ Ü30) ǂùŏlƕƙdž!ƒ lƧĂǂƶ!ƒ LJĂǂƙ ǇϸơĂ! ƨĂϸŏϸơ!ƒ ƘĜƙŏƧƕǂ DžƒϸPƙʅƒ ϸǇƵ ĜdžǇŏƕ ƔŏƙƧƙ!ƒ ĬǁƵ ǂlŏpϸ (30 Ü10 Ü5 ƔŏùʅƧƙ!ƒ LJùdžƨ ƧĜùƕƙƵƒ LJǂdžŏĂ Üǂƕĝʅ!ƒ ǂŏƑƒϸƙƕŬƒ ƔŏʅƧƙ!ƒ ƘĜpĂƊ ƩƽǇ!Ă lƧĂǂƵ lϸơĂ (4.2 Ü4.5 Ü7.2 Ȑǫ ÝǇǖƵƊ ǂŏƑƒϸƙƕŬƒ lƧĂǂƶ!ƒ ƘĜŏĂƙʅdž ǂ5Ĝǂ!Ă ǂlŏpϸ (5) ƨĂϸŏϸơ!ƒ ƘĜƙŏƧƕǂ ydž ƘŏĜǇĂƙǇƕ!ƒ DžƒϸPƙʅƒ ϸǇƵ ýƛdžŬƒ LJùƵ ǂƞƙĜǇ!ƒ ƘƒϸĜƕǁ!ƒ LJĂǂ Ĭ!ǫ ǁ!Ȑ Ŏ5 ƔƕʅƧ!ƒ ϸĂƶŏĂ .ĭĂǇƶdž Ƨŏƺ LJdžƨ!ƒ ƒȐŊ ϸƶƕ lƧĂǂƶ!ƒ Ŏ5 ƯĜ5PǇŬƒ LJƊ .ǂŏ!ĜƵ ǂ5ĜƛǂƘƒȐ ǂdžĜƵ lƧĂꞆƕ ϸŏϸơ!ƒ ƟǖdžƊ [3]


العكورة المتبقية - وحدة عكرة
زمن الترسيب - دقيقة . . .


العكورة المتبقية - وحدة عكرة
زمن الترسيب - دقيقة . . .


العكورة المتبقية - وحدة عكرة
زمن الترسيب - دقيقة . . .


كبريتات الحديدوز لوحدها
بنتونايت +كبريتات الحديدوز
العكورة المتبقية -وحدة عكرة
زمن الترسيب - دقيقة . . .



[illegible] : (ølj Û ɋ Û Ɨ Û ƒ Û ƈ)(7) [illegible]
[illegible]

[illegible]

[illegible] (T_2) [illegible] (St) [illegible] (T_1) [illegible] (Fe) [illegible] (Bn) [illegible] (R^2) [illegible] (e) [illegible] (3) [illegible] (0.7) [illegible] (0.21) [illegible] %(70) [illegible] %(30) [illegible] (β) [illegible] (t) [illegible] (4) [illegible] (t) [illegible] (β) [illegible]

[illegible] :(3) [illegible]

[illegible] (R^2)	[illegible]	[illegible]	[illegible]
0.308	9.54	$T_2 = 8.919 - 0.312\ Fe - 0.447\ Bn - 0.252\ St + 0.041\ T_1$	1
0.506	0.91	$\sqrt{T_2} = 3.046 - 0.21\sqrt{Fe} - 0.286\sqrt{Bn} - 0.335\sqrt{St} + 0.135\sqrt{T_1}$	2
0.7	0.21	$\log T_2 = 0.466 - 0.187 \log Fe - 0.276 \log Bn - 0.499 \log St + 0.468 \log T_1$	3

Ƨŏƹ ƘƒƧŏƺƙďž!ƒ ǈďž Ƨŏƺƙďž ý‡Ɯ ƗƮǴƤ!ƒ (β) ǈƒƨĂĐĂ (t) Ďžŏp :(4) !ƽþ üǋǫǁ
. Ɨ !ǴĂ!ƒ ǁŖĂďžǉǋ! ǀþďžƙƺďž!ƒ

3. ǭƘƮǷƤďž!ƒ ǅďž ƘŏǴǉĂƙǉƜ!ƒ ǅƳ ƘǴƙŏƧƜ‡ ƨĂþŏþơ!ƒ		
(3 ĎžpƧ) ǑďžƛƧǴƹĂǁ!ƒ ǁŖĂďžǉ!ƒ :ƧǴƙƤďž!ƒ ǁŖĂďžǉ!ƒ		
t Ɨďžŏp	β Ɨďžŏp	**þďžƙƺďž!ƒ ƧŏƹƧŏƺƙďž!ƒ
*25.8	0.74	T_1
*22.2 -	0.54	St
*10.2 -	0.28 -	Bn
*5 -	0.13 -	Fe

. %95 ƗǁƛƗƞƧþ þǉƵ ƗŏĂǉƺďž ĂƦ Ƨŏƺƙďž!ƒ ǈƒ Ǒǉƺƙ *

. Ɨ!Ǵơ ý‡! ƗŏǁƜƙďž!ƒ ǀƧĂ‡ƺ!ƒ ǏǁǁƵ ǴǋƧŏƛƙ ýƮǁǁƙ ƔƮơ ǀþďžƙƺďž!ƒ Ƨŏƹ ƘƒƧŏƺƙďž!ƒ ƘƜƙƧ **

T_1 = ƗǁƛƗƞƧþ ǀƧĂ‡ƺ!ƒ (ǀþơĂ ǀƧĂ‡Ƶ)

T_2 = ƗŏǁƜƙďž!ƒ ǀƧĂ‡ƺ!ƒ (ǀþơĂ ǀƧĂ‡Ƶ)

St = ƔŏƮƧƙ!ƒ ǈďžƨ (Ɨǁŏpþ)

Fe = ƨĂþŏþơ!ƒ ƘǴƙŏƧƜ‡ ƗƵƧƞ (Ƨƙ!\Ďžƺǁďž)

Bn = ƘŏǴǉĂƙǉƜ!ƒ ƗƵƧƞ (Ƨƙ!\Ďžƺǁďž)

ǀƑƮƬǋƗǁǀǋ ǀƑǁƑƗďžƗƨǕƐ

:ƗƮƒƧþ!ƒ ƻĂƧƱ ƘơƙƗŏ!Ǵƙ!ƒ ƘǴŏƮĂƙ!ƒĂ ƘǴƞǴƙǉƮǕƒ þŏþơƙ ǈ‡ďžŏ Ďžþǁƙ Ǵďž ýǕƤ ǈďž

1. ýďžƺŏ ǈŏƷ ƘŏǴǉĂƙǉƜ!ƒ ý‡Ɯ þŏƞ ǏǁƵ ýŏǁǁƙ!ƒ ǈďž ǀƧĂ‡Ƶ ǴǴďž!ƒ þǉƵ ǋďžƒþƤƙƮƒ ƧƛƤď‡ ýǁƙƮďž !ǉþơĂ .ƗƑƷƒĂ!ƒ ƗŏƒƒþƙǕƒ ǀƧĂ‡ƺ!ƒ ƘǴŏĂƙƮďž þǉƵ ƗƮǴƤ

2. ǀǴƽ‡ ĎžƒþƤƙƮƒ ƘŏǴǉĂƙǉƜ!ƒ ƘǴŏǴƮďž‡ Ƨƛƺǁ ǅďž ƨĂþŏþơ!ƒ ƘǴƙŏƧƜ‡ Ǒƽ ýŏǁǁƙ!ƒ ǈďž ǀƧĂ‡Ƶ ǴǴďž!ƒ ǀþơĂ (25-10) ƗŏƒƒþƙǕƒ ǀƧĂ‡ƺ!ƒ ǈďž ƗƑƷƒĂ!ƒ ƘǴŏĂƙďž!ƒ þǉƵ ƗƮǴƤ Ƨƙ!\Ďžƺǁďž (7.5) þĂþơƜ ƔƧƞƜĂ ǀƧĂ‡Ƶ ǈďž ƔƧƞƜĂ ƨĂþŏþơ!ƒ ƘǴƙŏƧƜ‡ (5)þĂþơƜ Ƨƙ!\Ďžƺǁďž.

3. (20 Ü5 Ü5 Ü5 Ü5) Ƙǉǵ‡ ǋƺďž ƘŏǴǉĂƙǉƜ!ƒ ǈŏƱ ĎžƒþƤƙƮƒ þǉƵ ƨĂþŏþơ!ƒ ƘǴƙŏƧƜ‡ ǈďž ǏǁƛƧďž!ƒ ƔƧƞ!ƒ ƗŏƒƒþƙǕƒ ǀƧĂ‡ƺ!ƒ ƘǴŏĂƙďž! Ƨƙ!\Ďžƺǁďž (20 Ü5 Ü7.5 Ü7.5) ǴǋƧƒþǁďž ƘŏǴǉĂƙǉƜ!ƒ ǈďž ƔƧƞ ǅďž Ƨƙ!\Ďžƺǁďž .ƔŏƙƧƙ!ƒ ǏǁǁƵ ǀƧĂ‡Ƶ ǀþơĂ (500 Ü100 Ü25 Ü15 Ü10)

4. Ŭ ĂŏƞþƗ ǈƮơƙ ƧŏƜ‡ ƨŏŏƧ Ŏ5 ƔŏƮƧƙ!ƒ ǈďžƨ ƔƮǁƙ þǉƵ ƨĂþŏþơ!ƒ ƘǴƙŏƧƜ‡ ǅďž ƘŏǴǉĂƙǉƜ!ƒ ǈŏƱ ĎžƒþƤƙƮƒ þǉƵ ƗƮǴƤ ƘŏĂƙƮďž ƗƑƷƒĂ!ƒ ƗŏƒƒþƙǕƒ ǀƧĂ‡ƺ!ƒ ƗŏĂƺ!ƒĂ ƘǴƜƙƧƒ ǈ‡ďžŏĂ ýǖďžƙ (5) þŏþƽ.

5. ǏƮĂŏ ĎžƒþƤƙƮƒ ƘŏǴǉĂƙǉƜ!ƒ ǅďž ƨĂþŏþơ!ƒ ƘǴƙŏƧƜ‡ Ŏ5 ƨƒ!Ɨ ǀƧĂ‡ƺ!ƒ ƗƮǴƤ ǈďžư ƘŏĂƙďž ǈďž ƔƧƞ ǅďž ƘŏǴǉĂƙǉƜ!ƒ ǈŏƱ ǈďž Ƨƙ!\Ďžƺǁďž (7.5) þĂþơƜ ƔƧƞƜĂ ƗƱƮĂƙďž!ƒĂ ƗƑƷƒĂ!ƒ ƗŏƒƒþƙǕƒ ǀƧĂ‡ƺ!ƒ ƘǴƙŏƧƜ‡ ƨĂþŏþơ!ƒ (5) þĂþơƜ Ƨƙ!\Ďžƺǁďž.

6. ǈďž ýŏǁơƙ!ƒ ǑƑǴƮơǕƒ ǋƒǉƮǉǋ! ǈǁ þƞĂ ýďžƒĂƺ!ƒ ǕƛƧ‡ ƾƧŏƛƙ ǏǁǁƵ ǀƧĂ‡ƺ!ƒ ƗŏǁƜƙďž!ƒ(T_2) þǉƵ ƨĂþŏþơ!ƒ ƘǴƙŏƧƜ‡ Ƙǉǵ‡ ǏǁǁƵ ǀƧĂ‡ƺ!ƒ :Ǒ!ƒĂƙ!ƒ ƗŏƒƒþƙǕƒ ǀƧĂ‡ƺ!ƒ (T_1)Ü ƘŏǴǉĂƙǉƜ!ƒ ǈŏƱ ǅďž ƧŏƛƤǁƙ! þƵǴƮďž‡ ƘŏǴǉĂƙǉƜ!ƒ ǈŏƱ ƗƵƧƞ ĎžƛÜ(Bn) ƨĂþŏþơ!ƒ ƘǴƙŏƧƜ‡ ƗƵƧƞ Ü(Fe) ĂƒƮƙǉƮƒ Ü(St) ƔŏƮƧƙ!ƒ ǈďžƨ ƗƵƧƞ ǈŏƱ Ɨďžŏp ǅþĂ! Ǒ!ǴƙƮ ǑưǴŏƧ!ƒ ǁŖĂďžǉ!ƒ (T_2) ƗŏǁƜƙďž!ƒ ǀƧĂ‡ƺ!ƒ

$$\log T_2 = 0.466 - 0.187 \log Fe - 0.276 \log Bn - 0.499 \log St + 0.468 \log T_1$$

.(0.7) ƱƮƙƧǕƒ ǅďžǴƺďž Ü(0.21) ǑƮŏǁ!ƒ ƋƱƤ!ƒ Ɨďžŏp)

7. ǈďž ƗƽǁǁƙƤďž!ƒ ƔƑĂƮ!ƒ Ɨ!ƒƨǫ Ŏ5 ƨĂþŏþơ!ƒ ƘǴƙŏƧƜ‡ ǅďž ĂĐ ǉþơĂ! ƘŏǴǉĂƙǉƜ!ƒ ǈŏƱ ĎžƒþƤƙƮƒ ƗŏǁƜǴp ƗƮƒƧþ .ƗŏĂư ƺ!ƒ þƒďž!ƒĂ ƗǁƮǁƛ!ƒ ǈþǴƺďž!ƒ ýƛďž ǴǴďž!ƒ

8. .ƨĂþŏþơ!ƒ ƘǴƙŏƧƜ‡ ǅďž ƘŏǴǉĂƙǉƜ!ƒ ǈŏƱ Ɨƽǵ ư ǫ ýǋǴƙƙ ƗƮƒƧþ

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