ƀFDŽĺĹE DžDŽ ϒfNj/yĹĹE hυĺĹERd ĂǂY f ǀ ĺĹE 5fθ fĭkĐŁ

Ŏkdž ϒĂlzŏ LJĞŏĺŏ!
ŀĂơh ƨ‡ƧdžfŻĆǀdž Σ Ƨfdž
ŀĂĺĺk!f ĬĺŻ lƧƱŏǀ!fĂ ŁFĞh!f
ý ŢĂdž!f ŀzdžĆη

ĭĂĞhŻ fhŻ fĆzǀ
ŀŏljfdž!f ŀǀfljnj!f Džǀp /fŻĆǀdž RĞkǀD
ŀǀfljnj!f ŀŏĺ‡
ý ŢĂdž!f ŀzdžĆη

f ĺPkǀdž!f

LJùdž ýùpf ŎùNj Ŏk!fĂ CĆdž!f LJdž ŀư₅PljdŽ!f lƧĂ‡z!f Ł!fƨǫ Ŏ5 NpƧơ fzh ϒT!f ýdžŻ Dĭŏŏlk ŀơh!f ýĂĞljkŏ YƧùη Ł5Ćù ư Ćh ǁ!ŖĂ (75NTU) fĂfơh ŎNj Ŏk!fĂ CĆdž!f Ŏ5 ŁƱǀĂkdž!f lƧĂ‡z!f Ư₅PĂ (10NTU) NùpƧơ fzh ϒT!f fŖNj LJdž YƧη!f Σ₅lj ydž ĞnjkljƧĞldžĂ $Al_2(SO_4)_3.16H_2O$ ĭ fĆz!f ϒT!f LJdž Ł₅ĺkPdž Ŏù5 Ƨùŏŏʒk!f ŀzhĆkdžĂ ŀŏĂFdž ŀηƧf (600Ü 500Ü 400Ü 300Ü 200) ĸĺdžT Ł₅ĺkPdž ŀŏƧfƧơ ĸĞηƧfh (Jar Test) lƧùη!f f ùơ5 CfƧηD ýŭP LJdž ŎFĞhƧnj‡!f ýŏǀĂk!fĂ pH Ü lƧf‡!f ĞnjljdžĂ CĆdž!f f FĆǀP .ŀŏĺŏʒTk!f ƧĂƧU!f Σ₅lj ĸơk ĸĞljözf ĬĺŻ
ŎƱzk ƧλǂĞ5 ŀŏĂFdž 200 ŀηƧfh ƨĂƧơdž!f ϒT!f LJdž Ƨk!/Dižĺdž (10) ŀŻƧη LJf ŀơh!f JNFĆkl ĸƧnjUD fpĂ ŀùŏFĞnjlj lƧfù‡ ĭ fĆùz!f ϒTù!f LJùdž ŀùŻƧη!f Σ₅lj ŎƱzk Ğdžljŏhu (2NTU)fĂfơh ĞNjƧfƥldž ŀŏFĞnjlj lƧf‡ lƧfù‡!f Ư ù₅P ŀù!Ćơ Ŏù5 Ğdžć . (10NTU)Ł ư₅Pljdž!f lƧf‡!f Ł!fƨǫ Ł!Ćơ Ŏ5 (7-8)NTUfĂfơh ŀùŏĂFdž ŀηƧf 200 ŀηƧfh ƨĂƧơdž!f ϒT!f LJdž Ƨk!/ Dižĺdž 10 ŁŻƧη LJf fηĂ f15 (75NTU) ŁƱǀĂkdž!f .(3 NTU)fĂfơ Ĭ!f lƧf‡!f Ư₅Pk
DižfPkùǀf Ł!Ćơ LJdž (14%) ýfĞzk Ł‡ĺnjkǀdž!f ϒT!f ĸĞŏdž‡ Ŏ5 ŀŏfĆŢkpf ăĂfη ǁ ĞljNj LJf ŀơh!f ĸhλf Ğdž‡ .(5NTU) ýpf ŀŏfĞnjlj lƧf‡ Ĭ!f ŁƱǀĂkdž!f lƧĂ‡z!f Ư₅P Ŏ5 ĭ fĆz!f ϒT!f LJdž ŰfBh ƨĂƧơdž!f ϒT!f (lƧη!f f ơ5ÜŁfƱfĂ!f lƧĂ‡z!f Ł!fƨǫ Üƨ ĂƧơdž!f ϒT!f) :Ł!fƥ!f ĸĞdžĺ‡!f

The Effect Burnt Alum To Removing Turbidity From Water

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Abstract

The research focuses on the use of ordinary and burnt alum to remove the light turbidity (10 NTU) and reduces the medium ones (75NTU) by adding of different doses of ordinary alum $Al_2(SO_4)_3.16H_2O$ and compare the results with these obtained from the burned alum at varying temperatures (200, 300, 400, 500, 600) C^0.

Jar test is used to find the change in the water characteristics of turbidity, pH, EC at the conditions. The study revealed that 10mg/l of burnt alum at 200C^o and more give, final turbidity of about (2NTU), while it gives NTU between (7-8) in the case of using ordinal alum in removing of the light turbidity of (10NTU). In the case of reduction of the medium turbidity it find that 10mg/l of burned alum at 200C^o reduces the final turbidity to about (3NTU).

It appears also that the alum consumption is about 14% in case of using burnt alum as compared with the ordinary alum especially in reducing of the medium turbidity to 5NTU.

key word (burnt alum, remove the light turbidity, Jar test)

أستلم في 2004/1/25 **قبل في 2005/11/10**

huDŽqsDŽllε

YƒÅùLjD Gnjhwlùk lƧÅ‡z!ƒ ljRNjÅ Ü‡!GlÚƒ KGƵơdž DiUzdž! Ššlžƒ2! 2ƒþNjŨƒ LJdž CGdž!ƒ lƧÅ‡Z ‡!ƒεq þzk Ƨùh‡ƒ ‡ùl!GZ Hhll Tˆ KGdžôlη LJôhÅ ĺþη ‡lšppþ ‡šÅƧε YƒƒÅT LJôh Gnjdžηơ ƧšGzkš ‡!Gz!ƒ þƒÅdž!ƒ LJdž ‡sllkPdž Yùηš ‡ùη!Gzdž!ƒ KGùƵơdž Õ5 GnjkldžGzdž YzTk Ǒk!ƒÅ ĺþη ‡lšppþ!ƒ YƒƒÅTll! ‡!Gz5 ‡!ƒεq sšlơk!Å Ü ldžηơ .Ƨôh‡ ý‡Th ‡šlldžz!ƒ ljRNj ΘGηLjŨ Hhlgljdž 2ÅƧU ‡šƒnjk ydž Gnjk!ƒεŨ ‡džFŭdž KƒƧlPdž DifþPklƒ KGkšƧh‡ (Alum) YT!ƒ lþGdž Di!Gz!ƒ Õ5 ylƒÅ sGƵLj ĬllZÅ DifþPklk LJŨƒ þơ!Å ‡Ljl ‡FGdž LJdž Ƨλ‡ƒ RljdžÅ Ĭù!ƒ lþGZ ldžÅGldž XHdžôp LJÅ‡kÅ CGdž!ƒ sšÅƧk KGdlldžZ Õ5 ƧlPdž‡ $Al_2(SO_4)_3.XH_2O$ ‡šFGdž!ƒ DiÅšljdž!Ũƒ YTù!ƒ DifþPklƒ LJ‡džD KGnjdžŨƒ KfþGTεq LJdžÅ KfÅLjl! ‡TGP!ƒ GljhƧGηk LJdžÅ. [8] CGdž ‡šFεη(18,16,14) NpƧơ ŏNjÅ ‡oh!ƒ fRNj CfƧηD lƧ‡5 KCGη GljNj LJdžÅ Di]η!ƒ OFfÅƧ! ‡llšεdžÅ lƧnjƵdž lþGdž‡ Gš!εljdž sÅƧơdž!ƒ KGšFεη LJfþ15 Ĭ!ƒ ĭþƋk NLjơƵÅ YT!ƒ sƧơ ‡šlldžZ LJŨ ‡ư5PljdžƒÅ ‡Ƶlǎkdž!ƒ lƧþ‡!ƒ ‡!ƒεŨ NdžfþPklƒÅ LJdž þšεš fRNjÅ LJþzdž!ƒ KGljÅšD LJdž Ƨh‡ƒ þþZ ĬllZ GnjFfÅkơf lþGšεÅ ‡šơƵl!ƒ NkơGldž lþGšε Ĭ!ƒÅ NLjdž CGdž!ƒ fRùNj ýùllơkh Dphk lþlzdž!ƒ KŭZG5k!ƒ LJdž ‡llll Õnj DiÅšljdž!Ũƒ Θŭdžŭ ‡šFGdž!ƒ KŭZG5k!ƒ . εƒεkdžŨƒ lƧNjGU lƧùdžlhkdž Ƨùšε ‡šÅGšdžš‡ KGh‡Ƨdž ‡ljÅ‡dž YƒƒÅT!ƒ ydž ýlơk!ƒ LJZ ‡ηkGl!ƒ LJþzdž!ƒ KGljÅšD ýZG5k DiλOldž!ƒ KGùšÅlj!ƒ lþþùzkdž!ƒ KGùh‡Ƨdž!ƒ LJdž ‡ZÅdžηdž LJÅ‡k! Gnjư5h ydž KGh‡Ƨdž!ƒ ljRNj RPkk Diλ (Monomeric) Ĭùll ƨùkdžkÅ LJþùzdž!ƒ KGljÅšD LJdž Ƨλ‡ƒ ÅD LJölljÅšf ĬllZ ĭÅkơk Ǒk!ƒÅ(polynuclear compound) ĭRù!ƒ YƒfR!ƒ Ƨšε LJþzdž!ƒ þšl‡ÅƧþšNj LJÅ‡kš Gdž‡ .GnjkljơT ‡ljεfÅdž Ĭ!ƒ NšþDdž ‡šÅƧξ!ƒ KGdžšlη!ƒ GnjơƵl .[8]CGdž!ƒ LJdž GnjhšlƧk ýnjlš ‡šljókŭη lþGdž ý‡T ĬllZ LJÅ‡š

KΘGllε ε£qljc

YTù!ƒ LJšùhÅ (10NTU)LJùdž ýpf ‡uƨPljdž!ƒ lƧþ‡!ƒ ‡!ƒεq Õ5 ĭþGz!ƒ YT!ƒ ýdžZ LJôh ‡ljƧGldž CfƧηD-1 .‡sllkPdž ‡šƧfƧơ KGηƧþh sÅƧơdž!ƒ

ÕùNj Õùk!ƒÅ ‡ƵùlÅkdž!ƒ lƧÅ‡z!ƒ Uƨ5P Õ5 ĭþGz!ƒ YT!ƒÅ sÅƧơdž!ƒ YT!ƒ ýdžZ LJôh ‡ljƧGldž CfƧηD-2 .(75NTU) þÅþơh

Ĭù!ƒ ‡ƵlÅkdž!ƒ lƧÅ‡z!ƒ Uƨ5P Õ5 ĭþGz!ƒ YT!Gh ‡ljƧGldž sÅƧơdž!ƒ YTll! ‡šþGTkpŨƒ ăÅþη!ƒ YGlơ-3 .(5NTU) LJdž ýpf

huƧGFƨll ε lFƨ£þqll£

þšþz!ƒÅ þšþz!ƒ ll GljNj LJ‡!Å lƧþ‡!ƒ ‡!ƒεq Õ5 sÅƧơdž!ƒ YT!ƒ DifþPklƒ Ĭ!ƒ ƧšTš ÕdžlZ ƧþTdž þηÅš Ŭ KGùh‡Ƨdž Ƨùhkzk .CGùdž!ƒ lƧþ‡ ‡!ƒεƒ Õ5 ĭþGz!ƒ YT!ƒ DifþPklƒ ýÅGljkk ‡llšÅƵ KfƧk5 LJdžÅ ƧþGTdž!ƒ LJdž Y!GơƵ!ƒÅ Gš2k‡h!ƒ ÜHơFf2!ƒ ÜDzƵ!ƒ ÜLJÅll!ƒ Ül‚þ‡!ƒ ‡!ƒεŨ ýGdžzklŨƒ Õ5 ldžÅšT Ƨλ‡Ũƒ DiÅšljdž!ŨfÅ þšþơ!ƒ d5Gù‡k KfR Fh!Gùl KGljÅšDÅ FhηÅdž KGljÅšD FljÅ‡dž LJödkk GnjLjd5 CGdž!ƒ Ĭ!ƒ 2Gư5k Gdžþljz KGh‡Ƨdž!ƒ ljRNj LJŨ .[1]Õ!GZ

ljRùNjÅ ‡ùšFGdž KfþšlùlÅƧþšNj CGùƵZŨ ýšlùlÅƧþšnj!ƒ LJÅšD ydž DiÅšljdž!Ũƒ KGh‡Ƨdž KGljÅšD ýZG5kk Ü‚ùšÅPk!ƒ ‡šlldžZ ĬllZ þZGlk Gdždž CGdž!ƒ Õ5 lþÅηÅdž!ƒ KGšÅƧz!ƒ ydž HljơT!ƒ GNjƧÅþh ýpGzk KfþšlƧlÅƧþšnj!ƒ .[1,6]‡š!Gk!ƒ KŬþGzdž!ƒ Õ5 Gdž‡ Ylƨkk Gnjư5h ydž ydžηkk5 þÅzk ‡šÅƧz!ƒ -‡šε5!ƒ KfþšlƧlÅƧþšnj!ƒ LJfÅ

$Al^{+3}+H_2O= AlOH^{+2}+H^+$ ---------- (1)
$AlOH^{+2}+ H_2O= Al(OH)_2^{+}+ H^+$ --------(2)
$Al(OH)_2^{+}+H_2O= Al(OH)_3+H^+$ --------(3)
$Al(OH)_2+H_2O=Al_2(OH)_4^{-}+ H^+$ --------(4)

þùǒǁǉƙƒ ǂùƱǀǇ ǇƒǍ ƘƓùǒǍƧƺƒ ƔǒùƖƧƙ ǂþùƞ ǆùƞǆ (pH)ǑǇǒƞǍƧþǒƞƒ ǆƤƧƒ Ǐ Ƶ ƖƧƱǒƖƒ ǇƒƇƓùdžƒ Ǒù5 ƖþùƞƒǍƙdžƒǍ ƖƧǍǂƺƒ ǂƘƖdžƒ þƒǍdžƒ ƳǍǀ Ǐ ƵǍ ƇƓdžƒ ǂƺǒƱ Ǐ Ƶ þdžƙƺƙ (optimum)ƴƙdžǕƒ .[7](pH) ǑǇǒƞǍƧþǒƞƒ ǆƤƧƒ ǂdžǒƤ Ǐƒ ǂ5ƓƢǗ

ǇùdžƘùƛǂùǒơ ƓǆƙƧǍǂƵ Ƣ5ƤǍ ǆƓƤƒ ǇƓǒdžƒ Ǐƒ ǂ5ƓƢdžƒ ǏƓdžƒ ǂƵƨƞƒ þǒþơƙ ǏƧǍƧƢƒ ǇdžƘƒþþùơdžƓƖ ǂùǇƧƓǀdž ǂǒ5ƮùƙƒǂùƱơdž ƖƇùƼǂ Ǒù5 ƧùƖǂƒ ƧƛǕƒ Ƙ! ƴdžƓƺƒ ƒƘǋ ǇƒƖþǒþƺƒ ƘƓƖƒƧþƒ ǇǒƧþƮdž ǆƒþƤƙƖƒ ƴƓơ Ǒ5 ƓǆƖ5ǇƔƬƒ ƘƓdžǂ ƾƓƢƙ ǇƒƴþǍƙdžƒ ǇdžƙƑǒ5 ăƧƤƉ ǂǋƞ ǇdžƙƑ.[10]ăƧƤǕƒ Ǒù5 ƖþùƞƒǍƙdžƒǍ ƖƧǍǂƺƒ ǂƘƖdžƒ þƒǍdžƒ ƳǍǀ ƧǒƓƼƙ Ǐƒ ƒƘǋ ăƨƺǒǍ ƓǒǒƧǀƙ ƓǆƖ5ǇƔ ƖƧǍǂƺƒ ƓǆǒƧǇƒ ǇƓǒdžƒ .[13]ǆƓƤƒ ǇƓǒdžƒ

þùƺƛ ǂƓùƖǕƒ ƘƓùƱơdž ǆƓƤƒ ƇƓdžƒ þǒƞ ƧþƮdž ƴƮǍdžƒ ǂǇǒþdž Ǒ5 ǂǏƞþ ƧǇǇƴ þƺǒ[8,9]þǒþƺƒ ƒƓǇǋ Ǒù5 ƧùǇǇƒ ǇƓǒdž ǂƖƓǇƓƖ ƖƧþǂƒ ǂdžǒƤ ǕǇƓǒdžƒ ƾǒǇƮ Ǒ5 Ɩþdžƙƺdžƒ ǂǒǍþƒ ǂǒƖƓǒƒ ƘƓ5ƮƒǍdžƓƖ ǇƘǇƧƓǀdž Ƣƺƛ Ǒ5 ƲơǕǇǍ Ɩþǒƞ ǂdžǒƒǇ ǇƑǋǍ (370-1) NTU ǇƕƛƘƒƧƙ ƘƒǍǇƖ ƴƙƧƒ ƖþdžƒǍ ƴƮǍdžƒ ǂǇǒþdž ǇƓùǒƧƞ ǂƵƧƖ Ǉdž ƧǒƺǒƓdžǒ ǂǁǍǆƒ ǇƓƛǍƑǍ ƖƧǒƨƺƒ ƧƓƱdžǕƒ ƔƖƖǂƒ ǂǇǕǍ ƖƧþǂƒ ǂdžǒƤ Ǒ5 ƖþƓƨ ǇƓǒơǕƒ .ƖƧþǂƒ ƖþƓƨ Ǐ Ƶ þƵƓƖǒ ǑƓƛƓƛǍ ǇƧƒƧǀƖƒǍ ƧǇǇƒ

ǇƤþƟ ƛǏǂǅƳǋ ƒƖǂƐ

ǂùǒƓƺƒ ǀƓǀǇƒ ǏƦ $Al_2(SO_4)_3.16H_2O$ ǂǒƑdžƒ ǅƓǒǇǅǕƒ ƘƓǒǒƧǂ ǏþƓƺƒ ƔƬƒ ǂơƛƒ Ǒ5 ǅþƤƙƖƒ Ǉǒƺdž ǇƨǍ ƦƤƛ ǇǕƵǅ ƔƬƒ ƼƧơ ǅƙ .ǂǒþǍƖƒ KENIRAKEMI.AB ǂǂƧƬ Ǒ5 ƴǇƮdžǍ (99.7%) ƼƧùơƒ ǇƧù5 Ǒ5 ǂǇ5ƞƒ ƴdž ƔƬƒ ƴƜǍǍ ƓǒǇƨǍ þƺƛ ǂ5ǒƱǇ ǂǒƨƤ ǂǇ5ƞ Ǒ5 ǋƺƜǍǍ ƧƓƞƒ ƔƬƒ ǇdžƘ þƺƛ ƼǍƧơdžƒ ƔƬƒǍ ǂǇ5ƞƒ ǇƨǍ ǇþƵǅ ǅƙ ǂƛǍƱdžƒ ǇƧƒƧơƒ ǂƞƧþ ƘǍƛƙ þƺƛ ǇǒǂƵƓƖ ǇþdžƒǍ (Furnace) ǂƞƧþƛ ƼƧơƒ ǂǒǇdžƵ ǅþƛƘǍ.ǂ5Ƨƺƒ ǇƧƒƧơ ǂƞƧþ þơ (Dissicator) ǑƞƓƨ ƩǍƤǇǇ ƴƤƒþ ƓǋþǒƧƛƘ ǅƘǒ Ǉƒ ǇƒþùǇ5 ǍùǋǇ 600 ǂƞƧþ þơ ǂþơǒ ǏƦƒ ƧǒƺƙƒƒǇƒ ǓơǕǇ ǂǒơ ăƧƤǕƒ ǂǒƒƧơƒ ƘƓƞƧþƒ ǅƙ ǅ200ǅ Ǒ5 ƧǒƺƙǂþơǒǂǒƓƵǂǒƒƧơƘƓƞƧþ þǇƵ Ǉǂƒ .5ǂƓƛǅƺdžƒ Ǒ5 ƠƓǍdž ǅdžǂ ƇƓdžƒ ƘƓǍƑƨƞ ǇdžƘ ƇƨƞƔƬƒ ǂùơƑƒƧƒ ǂùǕơǕdž ǇƘùǂdžǒǍ ƘǒƧƛǂƒ þǒƓǂƒǍ ǅƙǍƓǒdžǕƒ þǒƓǂƒ Ǐƒ ƔƬƒ ƴǍơǒ ǂǒƑƓdžǒǂƒ ǂƺƛƱƒ .6ǂƓƛǅƺdžƒ Ǒ5 ƠƓǍdž ǅdžǂ ƼƧơƒ ǂǒƓƵ ƇƓǇƉƘǒƧƛǂƒ ǂǒƒƒ -:ƼƧơƒ ǂƓƛǅƺdž ǇƵ ƧǒƛƙƒǂƒdžǒǇdž

$$Al_2(SO_4)_3.16H_2O \xrightarrow[\text{ǂ5ǒǇƤdž ǂǒƧƒƧơ ǅ600 þơ Ǐƒ}]{\text{ƘƓƞƧþƛ ƼƧơ}} Al_2(SO_4)_3+XH_2O\uparrow \text{ --------(5)}$$

$$2Al_2(SO_4)_3.16H_2O \xrightarrow[\text{ǅ1000ǅ< ǂǒƓƵ ǂǒƧƒƧơ}]{\text{ƘƓƞƧþƛ ƼƧơ}} 2Al_2O_3+6SO_3+16H_2O\uparrow \text{ -------(6)}$$

.[2]ǂǒƓƙƒ ǂƓƛǅƺdžƒ Ǉdž ƼƧơ ǂƓƵ ƴǂƒ ƇƓdžƒ ƘƓƑƨƞ Ǉƒþƒ5 ƧþǇdž ƳƓƖơ ǅƙ þƤǍ

$$\frac{\text{(ƜƑƘǍdžƓ) ǑƑƓdžƒ ƠǋdžƒǇǍǇƒ}}{\text{(ƇƓdžƒ Ǉƒþƒ5 þƺƛ) ǑƑƓdžǕƒ ƠǋdžƒǇǍǇƒ}} = \frac{\Sigma\ 18 + \text{ǑƑƓdžǕƒ ƠǋdžƒǇƒ ǑƑƨƞƒ ǇǍǇƒ}}{\text{ǑƑƓdžǕƒ ƠǋdžƒǇƒ ǑƑƨƞƒ ǇǍǇƒ}}$$

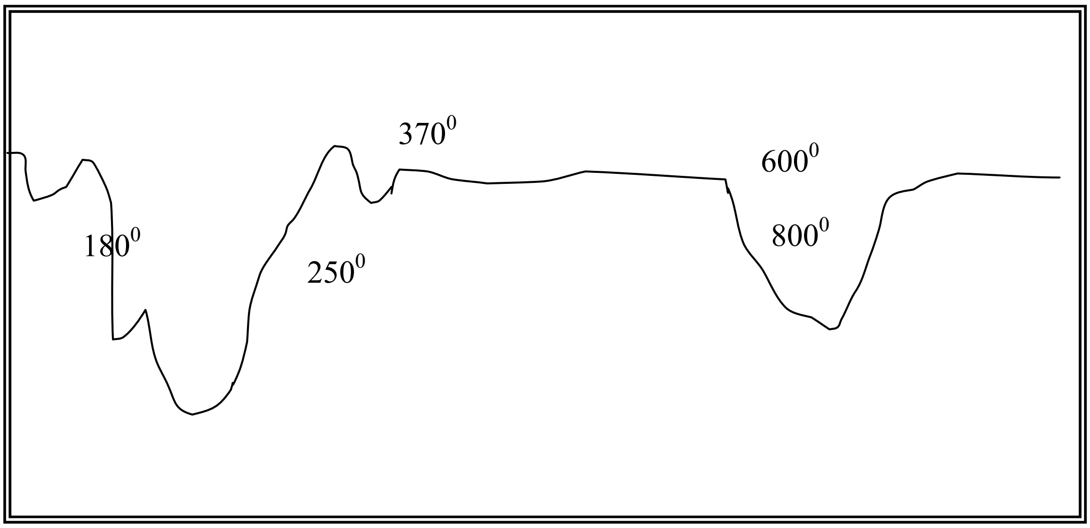
þĂǀƨdž!ƒ ƇƠdž!ƒ ƘƠǒƑƨƞ þþƵ ýǸdžǩ Ʃ ǈƒ Ɨ ǒơ

.ƔT!ƒ Ɨǩǂ ǑƼĂ ƇƠdž!ƒ ƘƠǒƑƨƞ þþƵ Ǒƻ ǈƒþǀ!ƒĂ ƗƼǩƤdž ƗǒƧƒƧơ ƘƓƞƧþǜ ǊǜƧơ þǆǜ ĭþƠǆ!ƒ ƔT!! ƗǒĂƠdžǒǂ!ƒ ƗƷǒƮ!ƒ ǈǑǜǒ (1) ǅǜƧ ýĂþƞ!ƒ

ƾĂƧơdž!ƒ + ĭþƠǆ!ƒ ƔT!ƒ ƗƷǒƮ ǈǑǜǒ (1) ǅǜƧ ýĂþƞ

ƗǒǩǂƠƞ!ƒ ǈƓƮ ǀǖ!ƒ	ƇƠdž!ƒ ƘƠǒƑƨƞ þþƵ þĂǀƨdž!ƒ	ƗǒƑǒƨƞ!ƒ ƗƷǒƮ!ƒ ƔT!!	⁰ǅ ƾƧơ!ƒ ƗƞƧþ
-	0.0	$Al_2(SO_4)_3.16H_2O$	ĭþƠǆ!ƒ ƔT!ƒ
%33.3	9.0	$Al_2(SO_4)_3.7\ H_2O$	200
%42	14.0	$Al_2(SO_4)_3.2\ H_2O$	300
%44	15.0	$Al_2(SO_4)_3.\ H_2O$	400
%44	15.0	$Al_2(SO_4)_3.\ H_2O$	500
%45	16.0	$Al_2(SO_4)_3$	600

.[4] ƗƼǩƤdž ƗǒƧƒƧơ ƘƓƞƧþǜĂ ƾƧơ!ƒ ƗǒǂdžƵ þǆǜ ƔT!ƒ ƧƧƮǩ (Ivan) ƠưĂ þǀ!Ă



þǀƵ ƔT!ƒ ƇƠdž ƘƠǒƑƨƞ ǈƒþǀƼ ƗǒǂdžƵ ƠưĂǒ (1) ýǂT

ýdžƵ!ƒ ƗƼǩƤdž!ƒ ǀƧƒƧơ!ƒ ƘƓƞƧþ!ƒ ƔĂǩǆĂ ǀƨǋƞǕƒ

ǀƧĂǂƵ!ƒ

- ƘǑǜǜǒǍ

ƨƠǜǋƞ!ƒ ƒƦǜǋǜ ƘƠǑƠǀ!ƒ ǈƵ ƧǜƵǒ Hach Turbidimeter 2100A ǅĂǑĂdž!ƒ ƨƠǋƞ!ƒ ƗƱǑƒĂǜ .NTU ƘƒþơĂǜ

- WTW pH522ƨƠǋƞ ǅƒþƤǩǑƠǜ ǑǈǒƞĂƧþǋ!ƒ ǅǜƧ!ƒ Ʃ ǒǍ
- .ǅƹ 0.001 ǊǩǍþ Fx-300,A & D Company ƔĂǀ ƩƠǑơ ǈƒƨǒdž ǅþƤǩǑƒ
- EC KARKOLP Scientific Technical ƔĂǀ ƨƠǋƞǜ ƗǒƑǜƧǋǂ!ƒ ƗǒǑƮĂǩ!ƒ ƘǑǒǍ

Supplies Buchschlag. Frank Furt. West Germany.

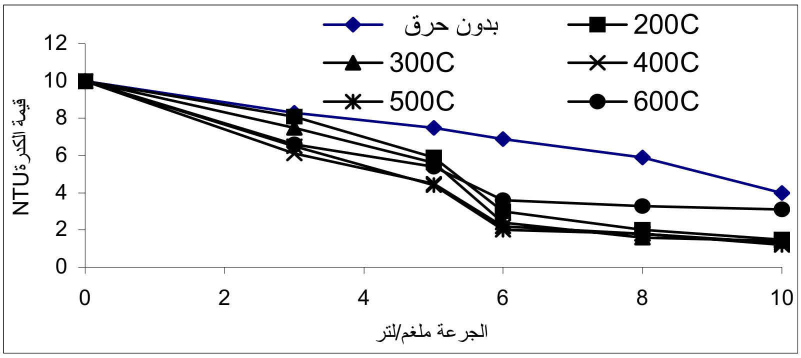
- OEAWA.SEIK CO.,LTD ƳĂǉ ƖƧƞ!ƒ ƒ Ơ5 ƨǅǌƞ ǅƥƤǨƪƒ
ǅùƪ 2 ƯƧƵĂ ǅƪ 6 ýĂƱ ǨƒƦ Blade ƒ ǆƥƧ ǨƒƦ ǅǌǈǅ ýǂ ǨǅƞƨǅǄ 6 ǏƜƵ ƨǅǌƞ!ƒ ƒƦǋ ǐĂǨơŏ
ƬƵƧƪùƜ! ǅƱǈǅ ƨǅǌƞƜ!Ă Ü FlocƬǉĂǂǨďž!ƒ ǨƒƥǅƜ!ƒ ƬŏǅƧ ǏƜƵ ƖƥƵǆƪǅ! ǑǉǅǆƞŎƒĂƯ ƧƥƮǅ ƨǌǉƞǅ
.ƧǨǅǅ1000 Ƭƶƪ ƬǉƒĂƱƪƉ Ƭŏƞǅƨ ǨǅǅĂǅơ ǨďžƥƤǨƪƒ ÜƬƖǉƥ/ƖƧĂƥ(180-0) ǈǉ ƟĂƒƧǨŏ

ƖƧĂǂƶ!ƒ Ƭ!ƒƨƹ ƖĊǅǂ ƥǉƥǨ

1. ǨǅǨ ǅƦǅǅ ƬǌƒǅƑ ǅǉ ǅƥǂ ǅǈ ĊĞďž ǅ5 ǅƪǨƧ Ăƒ ǈƱ!ƒ ƬƦƹ ǈďž 75NTUĂ10NTU ǅƨƞƥǅ ĊĞďž ǅǅĂǅǉ ƬŏƑǌǨ ǨďžǨ Ƭùǅƞƥ ƧùǌǉƵ . ýƮĂƜ!ƒ ƬǉƥďžýƥĂďž ǈďž Ư
2. ƔƮ!ƒ Ƭ5ǅƯƹ ýǅǅ ƬǅƤǨǉďž ĊĞďž ƬǉƵ ýǂ! ǑƑǅƧǌǂ!ƒ ýŏƮĂǨ!ƒĂ ƖƧƥǂ!ƒĂ ǑǉǅƞĂƧƥǌ!ƒ ǅƥƧ!ƒ Ƭďžƥ ǨƪƥǅƧƞ.ǅǌǅ!ƒ
3. ƔƯ ƒ!Ƨ ǈďž ƹƵƧƪ!ƒ ǈďž Ő5 ǂý ĂƵǅĊ ǅǅ ƯĂǨƮ ƞƧƵƬ ƔƮ!ƒ ƖƧƧǅďž!ƒ ǅǅǉ.
4. ƬǉƵ!ƒ ǨǂƧǨĂ ǅƨďž!ƒ ƻƥĂƒ ǅǅ Ƭǉƥƥ 20 ƖƥďžĂ Ƭǉƥƥ!ƒ Ő5 ƖƧĂƥ 30 ƬƵƧƪǉ ƔƮ!ƒ ƴďž ƬǉƵ!ƒ Ǩƞƨďž .ƔŏƪƧǨ!ƒ ƬǉǅďžƵ ƬĂƥơ! Ƭǉƥƥ 20 ƖƥďžǅǅƧǨ ǈĂƥǉ
5. ƬǉƑǌǉǉ!ƒ ǅŏ!ƒ ƩǅǅƥŐ5 ǅƥƤǨƪǨ! ƬǉƪƧǨďž!ƒ ƥĂďž!ƒ Ő5 ƔƒƧƱƯƒ ƬƥơǈƒǈĂƥǉ ǨǅǉƵ!ƒ ǈďž ĊƨƞƔơƪ ƬùƵƧƞ ýƯù5 ƥùǉƥơǨ ƯƧƺ! Ƭ!ǅơ ýǂ! ǑƑǅƧǌǂ!ƒ ýŏƮĂǨ!ƒĂ ǑǉǅƞĂƧƥǌ!ƒ ǅƥƧ!ƒĂ ƖƧƥǂ!ƒ ǈďž ýǂ! .Ƭ!ƒƨƹ ƖĊǅǂ ǏƮƥŰ

ǉƪ5ƑǅǅƉǅǅǅ ǅƏƑƬǅǅǅ

ƔƮù!ƒ ǈďž ƧǨ!/ ǅƶǅǅ 10 ƬƵƧƞ ǅƒƥƤǨƪƒ ǈǅǉ ƬơǉƜ!ƒ Ő5 ǅǌŏ!ƒ ýƮĂǨ!ƒ ǅǨ Ǒǉ!ƒ ǋƑǅǨǉ!ƒ ǈďž ƱơǗǉ ƖƧƥùǂ!ƒ Ư ù5Ƥ! Ƭŏ5ǅǂ ǈĂǂǨ (ƬŏĂƑďž ƬƞƧƥ 600 ƒƥƵ)ƧƛǂǅƑ5 ƬŏĂƑďž 200 ƬơǉƜ!ƒ ǨǅƞƧƥǉ ƽĂƧơďž!ƒ .(2) ǅƥƧ ýǂƮ (2NTU) ǈďž ýƥƒ Ǐ!ƒ (10NTU) Ƭŏ!ĂŰƒ

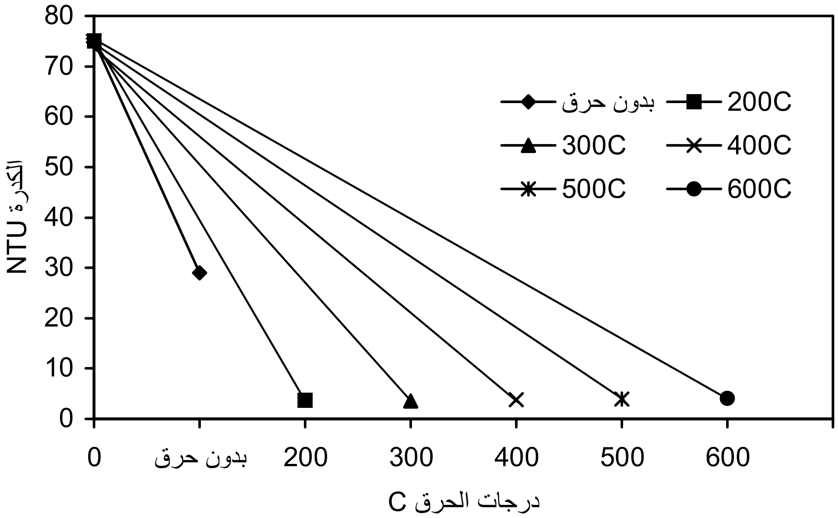


10NTU ƬƯ5ƤǉďžƜ!ƒ ƖƧƥǂ!ƒ Ƭ!ǅơ Ő5 ƬŏƑǌǉǉ!ƒ ƖƧƥǂ!ƒ ǋƑǅǨǉ ǈǉǅŏ (2) ǅƥƧ ýǂƮ

ƖƧƥùǂ!ƒ Ư 5ƤǨ ǈƒ ǈǂďžŏ ƧƛǂǅƑ5 ƬŏĂƑďž 200 ƬƞƧƥǉ ƽĂƧơďž!ƒ ƔƮ!ƒ ǈďž ƧǨ!/ǅƶǅǅ 10 ƬƵƧƞ ǈƒĂ Ǒ!ƒĂơ Ǐ!ƒ ǐƥƶ!ƒ ƔƮ!ƒ ǈďž ƬƵƧƞ!ƒ Ʃ5ǉ ǅǌƯ5ƤǨ ǅďžǅŏǉ 4NTU ǈďž ýƥƒ Ǐ!ƒ 75NTU ƬƱƪĂǨďž!ƒ ǐƥŏùǨ ǈƒ ǈǂďžŏ ǅǉơƱĂ ƔƮ!ƒ ƽƧơ ƬǉǅďžƵ ǈƒ ǏƜƵ ýŏ!ƥ ƒƦǋĂ .(2) ýĂƥƞ (3) ýǂƮ Ʊ!5 30NTU ƥƥùƵ ǏùƜƵ ǅǌƒƒĂǨơƒĂ ǅ! ƬŏơƱƪ!ƒ ƬơǅƪƜ!ƒ ƖƥǅŏƨǏ!ƒĂ ƔƮ!ƒ ƬŏƑƨƞ ǈďž ĊĞďž!ƒ ǨǅŏƑƨƞ ƳƒƨǨǉƒ Ǐ!ƒ ǨǅŏĂǉ!ƒ ƖƥƶǨďž!ƒ ǨǅǉǂƧďž!ƒ ǈŏĂǂǨ ƖƥǅŏƨĂ ƨƒƨǨŰƒ ƖƧǋǅƯ ǈďž ƜƜ!Ʀ ƥŏƨŏ ǅďžďž ǈƥƶďž!ƒ ǨǅǉĂŏƉ ǈďž ƧǉǂƒĂ .ĊĞďž!ƒ ǈďž ǅǌǉŏƪƧǨ ýǌǉƪŏ ǑǨ!ƒĂ

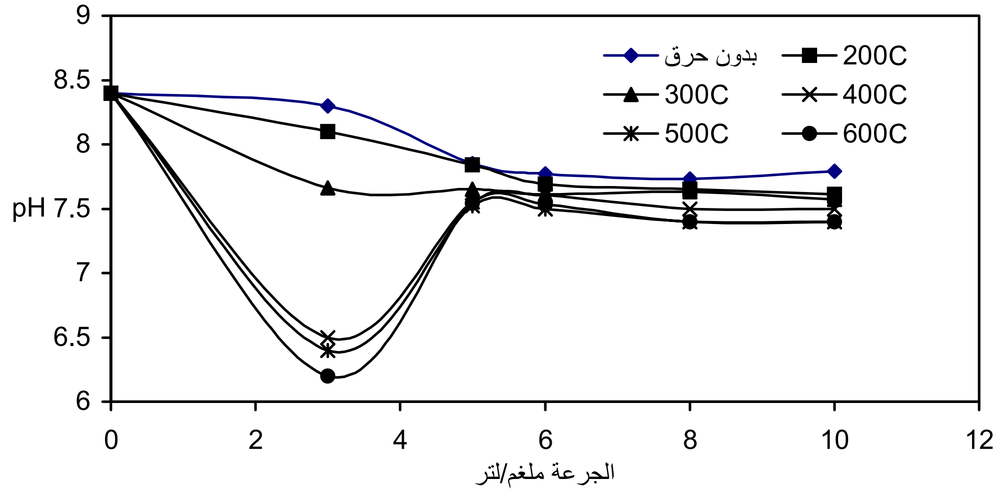
ƯƼƤ Ƙ!ƓƠ Ŏ5 ƧƙƸ/ǅǅǅ 10 ƗƵƧƞĂ ƔT!ƒ ƽƧƠ ƘƓƞƧƥ ƧǒƓƺƙ ƴǅ ƖƧƥǂ!ƒ ƯƓƼƤǈƒ ǇǑƚǑ (2) ƴĂƥƞ
75NTUƗƱƪĂǅǅ!ƒ ƖƧƥǂ!ƒ

ǅǅ ƽƧƠ!ƒ ƘƓƞƧƥ	Ƙǒ!ĂǕƒ ƖƧƥǂ!ƒ	10ƗƵƧƞ ƗƼƓƯƒ ƥƶƚ ƖƧƥǂ!ƒ ƧƙƸ/ǅǅǅ
ƽƧƠ ǇĂƥƚ	75	29
200	75	3.7
300	75	3.6
400	75	3.8
500	75	4
600	75	4.1



ƖƧƥǂ!ƒ ƯƼƤ Ƙ!ƓƠ Ŏ5 ƧƙƸ/ǅǅǅ 10 ƗƵƧƞĂ ƔT!ƒ ƽƧƠ ƘƓƞƧƥ ƧǒƓƺƙ ƴǅ ƖƧƥǂ!ƒ ƯƓƼƤǈƒ ǇǑƚǑ (3) ƴǂT
75NTUƗƱƪĂǅǅ!ƒ

ƖƥƓùǒƨ ƴǅ ƳƧƞ!ƒ Σƽǈ! pH ǅǒƥ ƯƓƼƤǈƒ (4) ƴǂT ƝƑƓǈ!ƒ ǇǅǅƯƠǕǒ5 pH ù!ƒ ǅǒ!! ƗƚƪǈƓƚ ƓǅƓ ƓǅǅǅƓ (H^+) ǇǑƞĂƧƥǒǈ!ƒ ǇĂǒƒ ƧǒƧƠƙĂ ƇƓǅ!ƒ ƴǅ ƽĂƧƠǅ!ƒ ƔT!ƒ ƴƵƓƙ Ǐ!ƒ ƒƦǆ ăƨƶǒĂ ƽƧƠ!ƒ ƗƞƧƥ ƘƒƥǒƪùǂĂƧƥǒǈ!ƒ ǇǑĂǂƙ ǇƵ (1،2،3،4) ƗǒĂƓǅǅǒǂ!ƒ ƘǕƥƓƶǅ!ƒ ƧǒƬƙ Ɠǅǂ ƗǒƯǅƓƠ!ƒ ƖƥƓǒƨ Ǐ!ƒ ǐƥĂǒ Ƙ!ĂƚǅǅǅŻ!ƒ ƥĂƥƠ!ƒ ǇǅǅƯ ƘǇƓǂ ƘǕƓƠ!ƒ ƴǂ Ŏ5 pH ƴƒ ǅǒƥ ǇƒƱƠĂ! ǇǂǈĂ ƖƧĂǂƦǅ!ƒ ƗǒĂƧƺ!ƒ-ƗǒƨǅƼ!ƒ Ɠǅǅǅ
.[3](8.6– 6.5) ƔƧT!ƒ ƇƓǅ!



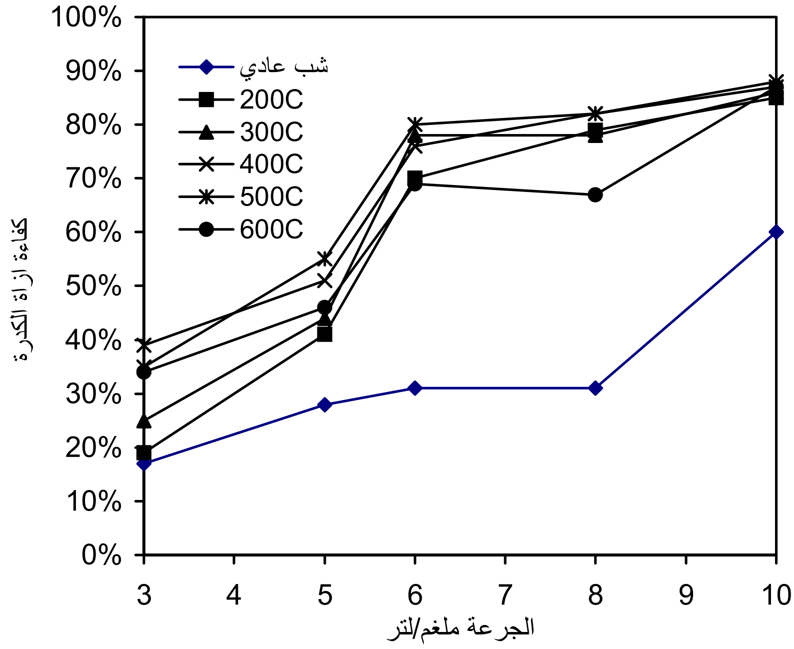
10NTU ǂƜƽƤǉdž!ƒ lƧƥǂ!ƒ ǂ!Ǵơ Ŏ5 pH ƧǒǨk LJǒǜ (4) ýǂT

ƔƧƞ!ǴùǜĂ ƔTù!ƒ ƔƒĂǇ ýǂ!Ă Ɲ!Ǵzdž!ƒ CǴdž!ƒ ǑǠǜƧǌǂ!ƒ ýǒƮĂk!ƒ Ǆǒp Ŏ5 ǯƥƞ ƻǒƽƱ ƧǒǨk ƲơĂ! Ǵdžǂ
.(3)ýĂƥƞ ǂƞ!Ǵzdž!ƒ CǴǉǨ ǂǐƮǴơ!ƒ ƨƒƨkdžŬƒ ƘŬǴơ Ǐ!ƒ ǁ!Ʀ ăƨzǒĂ ǂƽǐkPdž!ƒ

ǂƜƽƤǉdž!ƒ lƧƥǂ!ƒ ǂ!Ǵơ Ŏ5[2]10* Ǆƪ/ƨĂdžĂƧǂǒǴdž ǑǠǜƧǌǂ!ƒ ýǒƮĂk!ƒ Ǆǒp Ŏ5 ƧǒǨk!ƒ(3) ýĂƥƞ
(10 NTU)

ǄǕ ƨƧơ!ƒ ƘǴƞƧƥ	ƧƘ!/ǄǨǐdž ƔT!ƒ ǂƵƧƞ				
	3	5	6	8	10
ƨƧơ LJĂƥǜ	2.95	2.68	2.66	2.65	2.64
200	2.98	2.89	2.87	2.7	2.65
300	2.95	2.92	2.9	2.7	2.65
400	2.95	2.9	2. 81	2.72	2.65
500	2.99	2.9	2.8	2.7	2.63
600	3.95	3.5	3.69	3.8	3.98

ǉǁǋ LJŬ ăƧPŬƒ ƘǴƞƧƥ!ƒ ǂǒǜ LJZ ǂǒĂFdž 600 ǂƞƧƥǜ ƨĂƧơdž!ƒ ƔT!ƒ ǁĂǁT ƘŬǴơ!ƒ ýǂ LJdž ƲơĂ!
ƨƧùơ!ƒ ǂùƞǒǨǉ Ǵùƞǌǐǂ CǴdž!ƒ ƘǴǑFƨƞ Ƙƥǀ5 ǴƞǉǉŬ ƒ ǴP ýǂTǜ ƻƧƮkk ƔT!ƒ ǂǒFƨƞ ƘǐƵƞ ǂƞƧƥ!ƒ
.(1) ýĂƥƞ
.ƔT!ƒ ƨƧơ ƘǴƞƧƥĂ ǂƵƧƞ!ƒ ƻǖkPƒ ǇǕ lƧƥǂǐ! ǂ!ƒƨŬƒ lǴǀ5ǂ LJǒǜ (5) Ǆpƨ ýǂT



ƔT!ƒ ŧƧơ ƘǴŋƧƥĂ ŦƵƧŋ!ƒ ƻǚƤƒ ƴďž ƖƧƥŧ!ƒ Ŧ!ƒƨǫ ƖĈǴƽŧ ǇǒǴǔƙ ǇǒǔǑ(5) ýŧT

ƕŏơƑƬŦƽŰƸ njǊǫǙƸ

ƖƧƥùŧ!ƒ Ư ƽƤƙ ŧƧơ ǇĂƥǔ ïƥǴž!ƒ ƔT!ƒ ǇǒǏ Ƨƙ!/ ǏǅǏǏ (50) ŦƵƧŋ Ǉƒ (4) ǏƿƧ ýĂƥŋ ǇǒǏ ǇǒǔƙǑ ƱùƖƼ Ƨƙ!/ǏǅǏǏ (10) ŦƵƧŋ ŦǏǑƖ!ƒ ǉƦǊ ǇǒǏ ýƿƒ Ǐ!ƒ ǴǊưƽƤƙ ǴǏǏǉǑǔ (4NTU) Ǐ!ƒ (75NTU) ŦƱƪĂǏǏ!ƒ ǇǴǉǅǅ ƥƖƽŏ ïĂǏǏ 200 ŦŋƧƥǔ ŧĂƧơǏǏ!ƒ ƔT!ƒ Ǉƒ ǴǏǔĂ (2) ýŧT ŦǑĂǏǏ 200 ŦŋƧƥǔ ŧĂƧơǏǏ!ƒ ƔT!ƒ ǇǒǏ ƥùǉƵ ŧĂƧùơǏǏ!ƒ ƔT!ƒ ŦǏǏŧ Ǒƽ ŦǑƥǴƬƙƿƒ ăĂƥŋ ƥǴŋǑƒ ǇŧǏǑ ǁ!ƦǏ (1)ýĂƥŋ ǊǉƨĂ 3/1 Ǒ!ƒĂơ ŧƧơ!ƒ ǏƒƧùƸ 16.6 ǊǉƨĂ ƠǔƬǑ ïĂǏǏ 200 ŦŋƧƥǔ ïƥǴž!ƒ ƔT!ƒ ǇǒǏ ǏƒƧƸ 50 ŧƧơ ƥžǔ Ǉƒ ŧǑơ ǕǊǏǏƒƥƤƙƪƒ ƒƦǊǔĂ ǉǚƵƒ ƖƧƥŧ!ƒ Ǐǁ Ƶ ýĂƬơǁ! Ǒƽŧǒ ŦŋƧƥ!ƒ ǉƦǊǔ ŧĂƧơǏǏ!ƒ ƔT!ƒ ǇǒǏ ǏƒƧƸ 10 ŦǑǏǏŧ ǇƒĂ ŧƧơ!ƒ ƥžǔ ƪǇĂŧƙ ƥĂƥơǔ ŦǑƥǴƬƙƤǓƒ ăĂƥŋ!ƒ ǇǐĂŧƙƪ 50 ýŧ! ǏƒƧƸ6.6 .%14 Ǒ!ƒĂơ ýƥǴžƙ ïǅ ǏƒƧƸ

ŦƱùƪĂǏǏ!ƒ ƖƧƥùŧ!ƒ Ư ùƽƤ! ŧƧùơ ǇĂƥǔ ƔT!ƒ ǏƒƥƤƙƪƒ Ŧ!Ǵơ Ǒƽ ŦǑƑǴǊǉ!ƒ ƖƧƥŧ!ƒ Ǐǒƿ ǇǒǔǑ(4) ýĂƥŋ .75NTU

Doze	10	20	30	40	50
Turbidity	34	14	6	4.5	4
pH	6.72	6.57	6.46	6.37	6.3

[illegible]

1. [illegible] 6 [illegible] 200 [illegible] 10NTU [illegible]
2. [illegible] 75NTU [illegible]
3. [illegible]
4. [illegible] pH [illegible]
5. [illegible] Floc [illegible]

[illegible]

1. [illegible] 200 [illegible] 10NTU [illegible]
2. [illegible] (75NTU [illegible]) [illegible] 200 [illegible]
3. [illegible]

[illegible]

[illegible]

1. [illegible] 1988.
2. [illegible] 1984.
3. [illegible] 1990.

[illegible]

4. Ivan Kostov, "Mineralogy" Oliver and Boyd .Edinburgh and London .first English Edition 1968.587p.
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