Æ ł ǵpŤř ÆŽǫŰ ǻ ĠǫĸŁǫdžə Ůnjǿ Ţǫ p Ơǫ Ê ƽ Ǵǫ ǰǫ
ŽłƩł njǿ Ţǫ Ơ ǁ łyƦƛ ÆŽǫŰ ǰŽǰǫ
Ħǵĩ ĸơ ĥĬĬ ΘĸŢǻDž ,ĤĦĬĤ ƹǿǩŕ ,ǫŃƽ ŧƵĸŽǁ ,Ǫ ǰǫŕ ŧƵƤƳ

ǻŃ ǁ pƠ ƽ ǁ ƹł Æ ǁ ĸ k Êljĸə **COD** ł ǵĸŧ ƵƳ ŽŃǫəŃǫə yƛłƩə ƳƩƛƵĸŧ Ơ ǁ ĸǫŰəƵŃƽ ƹł ŧžŘǻǫƽł ĸƛ **(TPH)** ÆǫǺ ǁ ΘĸǁǿŧƩơ Ǵƛ ŧžŃǻd ǻĸǵ t' ĸƟ

ᴰ ǻ yŽŢǫ yǫĸ f ᵘʰ ǻ yƽł ÆǫŰ ᵘᴰ ǻ ŃŢǫ ǰ ǿƽ f Ʃǿǫł ᵘᶜĸǺDž ƵpƩƽ ¡ᶜÆ ǁ ƽłƩĦǫ ĸljƵyŽŢǫ

*Sorur.Safa@gmail.com*njǿŢǫ Ơ ǁ łyƦƛ ŧpƩū ᵘƠ ǁ łyƦƛ ŧyĞ ł ǁ Ƴ ᵘƵĸ ǁ ŧ ÆĞ ǁ ƶř ǫŃǫŰ ŧĸŭ ł ǁ Ƴ ᵘÆǫĸdžǫᵘĤ ǰ ŧpƩř ŽĸĸǿƟ ᵘƵĸ ǁ ŧ :ğŃlƽǫ ŧyƛƽŧŃ

ĬĤ/ǵĬ/ǵĤ : p Ʃŧƶř ĬĤ/ǵĥ/ǵĬ :ƠaĸŧƵY

ŧyǿŰš

p ÆəYĸdžơ ǻĸǵƠ ł ǁ ᵘ ł ƽ ĸƛǫĸū ŭəY ᵘƛƳƩƽū YƩƵĸŧ . Ơƽł ǰƩŧ p ƵŧpƵyǿǵ ᵘ(TPH) ÆǫǺ ǁ ǻĸǵ ǰƩŧpƵyǿǵ ÆǫĸŽơ ƵĸǫƟĸƽ 2 ĸƽł :Ùyğ p Ǵƛǫƽ yƛłĸŽl ÆəĸƛǿƩƽŧƩŧ ǻĸǵ k ơ p t' ĸƟ ƵY ÆƛèŃĂ Θyǫ Ǵl (PAH) Ŧ ǿĸǫpƵƵơÆǫř ǻĸǵ ǰƩŧpƵyǿǵ p Æłơ ǻĸǵğÊ f YŃ ǁ Æǫ ŸŰĸl ΘĸƛǿŧƩơ ǰŧł Ơ ł ǁ YƩƵĸŧ p y ǁ Ǵǫƽ ǁ īǵ ǰƛŃơ ƠƛǫŰəƵŃƽ njƽŃơ ÆǫǺ ΘĸƛǿŧƩơ Ǵl ƛYŃơ t' ĸƟ / ǵpŤř ǰŧł ƵY . YYƩūÆǫ ÆŽǫ ÆəǿŢǫ Ơƽŧ ǻĸǵyǫĸŕ Ǵl Ʃ ł ǫ Ǵŧ . ƠəƩū ƵŧƩǻ ÆƽƵƩl YƵŃǫ ŘDžĸf k Êljĸə Ǵǿǻdžơ ƵY ƵŃǫəŃǫ yƛłƩə

ůǰǵơ Ơǫǫŭ ǻĸǵƩǿůǫ ƵŃǫəŃǫ yƛłƩə ÆŧƵĸŧ ÆƽƵƩl ǻŧƩ . Ơƽł k ơ ƵY Ř f Ř ĸŭǻ p èĸl Ǵǫŧ ŧŃŭƽŧp ĸl Ūǫƶ YƵƩ Æüŧĸǫ īǵ ǰƛŃơ :ÆƽƵƩl p pƵ p ǻ YŃƵŰ ŘŰ ǁ Ǵl Ǵŧ YŃl (wħċċ) ǻƛŃǿΣ ƵĸUl njƽŃǫ ƵĸƬə Řǫè UV / ĸơ ŭǫ . yŧyŧYƩū Ǵüǿĸǎǫ / ĸơ ƶĸǫƩ Θyǫ p pH ¡ H_2O_2 Ơǫǫŭ . YŃl ƛyƦl ƛYŧY Ƶŧŧǻ č L Ǫ ǫ f Ǵl Ǵ ł ǿ ǁ 5 ƛΣ ƩŧƵŃǫŧŧƵ ŘƟŧY ǵŃǫŢǫ ƵY ãƩüŧƽǫ

p / ƛŧŧp njǿŢǫ pH ¡ H_2O_2 ůǰǵơ ǴǿǻPł Ƶyŧãǫ Ʃł Æüĸơ ǻyǿŃơ k ÊljĸəCOD Ùƶ f Ơ ŧΣ ƶŃǫəŃǫə yƛłƩə ƶĸǫyƛƵ Ǵŧ YŧY ƶĸ ł ǁ ƨ ĸƛǫĸ :ĸǵǴǫəĸƨ / ĸơ ƶĸǫƩ p pH=Ď p ǵ/ħĦ M ƵŧpƵyǿǵyǿƽŧŧƩŤř ůǵ/Ĥ mM ǰǵơ Ơǫǫŭ ƵY COD Ʃł ěĩĪ/Ħ ,ǴǿǻĦl njƛłƩ ǁ ƵY . Ơƽł UV ƵŃ / ĸơ ƶĸǫƩ Θyǫ .YpƵÆǫ ènl Ùƶ f ƶŧƩǫǫ ,pH / ǵĸŧ ĸl Ǵŧ ǻ ƵŃĂ Ǵl YƵĦY yƛłƩə ǰŧł ÆƛƵĸŧ ƵY ÆŽĦǫ Ƶĸǿƽƛ / Ă pH . yǁ Ùƶ f Ơ ŰĸƽŋĦ Θyǫ Ǵl UV Řǫè k Êljĸə Ʃł ŘDžĸf COD Ùƶ f ƵY ƩĥŃǫ p pƵ Ŧ ŧ (pH=Ħ) ǻ yǿƽł njƛłƩ ǁ ƵY ƶŃǫəŃǫə yƛłƩə ,Ǵüǻĸǎǫ ǰŧł Ʃł ŘDžĸf ƨ ĸƛǫĸ Ă ĸĸǎǫ :ǻ Ʃ ūǴ ł ǿ . Ơƽł ƵŃŧƶǫ

UV/Fe²⁺/H_2O_2 *yƛłƩə ÙǴǫəƩ ł ŧř ƶŃǿƽłyǿƽ ŧł Ůīǵ ǰƛŃơ ů **(TPH)** ÆǫǺ ǁ ǻĸǵ ǰƩŧpƵyǿǵ Řŧ :ǻ yǿǫŧ ƶĸūţŧp*

ƶĸ ł ƩƵ ÆŰ ǁ ƶř ǫŃǫŰ ŧĸŭ ł ǁ Ƴ ᵘƠ ǁ łyƦƛ ŧyŰ ł ǁ Ƴ ƶĸǿ ł ǁ Ƴ ᵘnjǿŢǫ Ơ ǁ łyƦƛ ǻ łƩǫŧY -Č
ƶĸ ł ƩƵ ÆŰ ǁ ƶř ǫŃǫŰ ŧĸŭ ł ǁ Ƴ ᵘƠ ǁ łyƦƛ ŧyŰ ł ǁ Ƴ ᵘnjǿŢǫ Ơ ǁ łyƦƛ y ǁ ƷŁ 2 ĸƨ ǁ ƷĸŰŧ -č
ƶŧƩĦơ ÆŰ ǁ ƶř ǫŃǫŰ ŧĸŭ ł ǁ Ƴ ᵘƠ ǁ łyƦƛ ŧyŰ ł ǁ Ƴ ƶĸƶYĸǫƽł ᵘnjǿŢǫ Ơ ǁ łyƦƛ ǻ łƩǫŧY -Ď
ƶĸ ł ƩƵ ÆŰ ǁ ƶř ǫŃǫŰ ŧĸŭ ł ǁ Ƴ ᵘƠ ǁ łyƦƛ ŧyŰ ł ǁ Ƴ ƶĸƶYĸǫƽł ᵘnjǿŢǫ Ơ ǁ łyƦƛ ǻ łƩǫŧY -ħ
ƶĸ ł ƩƵ ÆŰ ǁ ƶř ǫŃǫŰ ŧĸŭ ł ǁ Ƴ ᵘƠ ǁ łyƦƛ ŧyŰ ł ǁ Ƴ ÆƩǫ ᵘnjǿŢǫ Ơ ǁ łyƦƛ y ǁ ƷŁ 2 ĸƨ ǁ ƷĸŧĨ -

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ÆĽđ ΘKШ0ŧƐơ ĠǂƹƖơ ƷY ÆǂèKʎ OƠǪʞKǎ ƷÑǪƀə yЏǂƑƐə Ġŧ ǰǂł ŘǾĽY ƐǂKs Ġʎ OƖƖsǁ ƷłyǺǂřŕ p Æǁyǔǫ ǫƐə Ġʎ ΘKШ0ŧƐơ ǰǂł ŘǂyШơ p ƷÑNJf ƷY yЏǂƑƐə ǰǂł ÆəƇĂ ɛł p ÛOƧłƵłY łƵ AOP ǻĸgyЏǂƑƐə H_2O_2 ƶ0ǾÑǪə p Fe(II) Ġʎ Fe(III) ǻƵÑШ K0fŧ ŘǾĽY Ġʎ UV ƷÑǁ Ŧǂ ƷĿÑШĎ Ġʎ yЏǂƑƐə ǰǂł ɛł ÛyʞKǂÆǫ ǻƐ0ūQ+š ǴǂƹƖơ ƷĸǫyǁƵ .(Ĥħ) YYƐūÆǫ ƀYĶǻǪ§ł ƐǪÑǫ p pƵ p Stepnowski njƧÑơ ĉċċċĉ ğĸƧ ƷY Ġŧ ǻĺĠūǾĸãǫ ƷY ĸÊljĸə ƷY ĸǵƀyЏǂèđ ĠǪəƐ+0ř ǻƵÑǁ ĠǂƹƖơ ǻpƵ Ɛʎ ƷłƵĸŪŽǵg Ќŧ ƷÑ0ƧłyǾŧŧł ÛOəƐū ǫĸƖǁĿ ÆǪĶǁ YĿÑǫ ƀĸŪ+ǂèʞř ɛł ŘDžĸf Uƺ H_2O_2 ǰ0ǂʞř ĸǪǁsǁ ǻĸgOŏǫŮ ƷY (TPH) ÆǪĶǁ ΘKШ0ŧƐơ ǻĸggĸŪžYłƵ yЏÑơ ǀ ǂłƹəł Ř0ĽY Ġʎ UV ǀ ʞƠ ǀ ǂłƹəł p YłY .yǂƳƐū ƷÑ0ƧłyǾŧŧł ǀ Ŀŧłp ƷY ŭǂƐƨơ ŧ Ŀƨ ÛŘ0ƨŧpƵyǾǵg ƷY TPH ǴǂƹƖơ Ġŧ YłY ƷĸǂǀĽ Ā0ÆŤơ ǰǂł ɛł ƀyǫđ OƧY Ġʎ Ġƹ0ǪĿ ¡ēdÆĂ ƷY p ĠǪəƐū ǫĸƖǁĿ ÆŬǪƨǵđ Ġʎ ÛƀyǁĿ ÆƨƵƐʎ ĸÊljĸə ĸÊljĸə ƷY ĠǾǫł TPH ƷłyÆǫ) OƧł ƀyǂƳƐū Ùƺf ƶđ ēĩĚ Richardo .(ČĨ) (YÑʎ ĤĨŦĦħ ± ĤǵĪ µg/L ƀĸŬ+ǂèʞř ǰǂł ʞ t' ĸƠ ŧ ÊDžł ǻpƵ Ɛʎ ǻĺĠūǾĸãǫ čċČċ ğĸƧ ƷY ƶłƵĸĞŽǵg p OЏĸǪŪəƵÑƨ ʞ t' ĸƠ ǻÑǁpOƨǁ ÛƶĸǪǫɛǪǵg yЏǂƑƐə pY ɛł ƀYĶǻǪ§ł ĀǾÆŤơ ǰǂł ƷY Ġŧ ÛyЏYłY ǫĸƖǁĿ ƷÑǫƀÑǫə ʞ ƷÑ0ƨŧpƵyǾǵg ŧ Śƨ p OЏĿ Triton X-100 (TX-100) ÆĽđ ğÑǪŤǫ ɛł ƀYĶǻǪ§ł ĶI ¡DDT ǻłƐʎ t' ĸƠ ɛł Ùƺf ǻĸgƶĸǫyǁƵ Ûŧ' ĸƠ ǻÑǁpOƨǁ .yǫđ OƧY Ġʎ ĕČċċ p ēċ ¡ĩĩ ŧ ǾơƐơ Ġʎ ŘǂǂpƐĸū p DDE ƷY ŘǂǂpƐĸū p DDE ¡DDT ĠǂƹƖơ ǻĸgƶĸǫyǁƵ OʻǂĸHШ ƷY p ǰgđ OŏǫŮ ʞI ƷÑǪəÑǪə yЏǂƑƐə Ŧƶŧ Ġʎ ÛŘDžĸf ĸÊljĸə Ġʎ Û ǀ ʞƠ ĩ h ɛł ƧřpĤǵ M p ĤĥmM ŧ ǾơƐơ Ġʎ H_2O_2 ,ŘǂǂpƐĸū ǴǾǂpł OŏǫŮ) yǫđ OƧY Ġʎ ĕČċċ p ĔĨ ¡ĖĔ ŧ ǾơƐơ ĤĪ p ĦĪ ,ĦĨǵ mg/L ŧ ǾơƐơ Ġʎ ĸÊljĸə ƷY DDE p DDT mg/L Ġʎ ŧ ǾơƐơ Ġʎ ĸĦШđ ÆʻĸĦШ OŏǫŮ yЏǂƑƐə ǫĸƖǁĿ ɛł Ƨřp -ĠūǾĸãǫ ƷłƵĸĞŽǵg p Tsai.(ČĎ) (OəĸǂǀĽ ǵ/ǵĥĤ p ǵ/ĨĤ ,ħĤ YpƐǫŪĨĦ ÆʻĸǾŽǾǁ ÆūYƷÑƠƵ YƐǪƵĸŧ ǻpƵ Ɛʎ ĉċČċ ğĸƧ ƷY ǻł ǻƐĸƨŧĸŕ ǻłƐʎ ƷÑǫƀə Ŧ0ǫǿƨpƐǫŪĨĦ ƷÑ0ƨŧyǾŧŧł ĸI ƀƐŽǵg ǰgđ yǁYłY ƷĸǂǀĽ ΘĸǂʻĸǫƐđ yǁYłY ǫĸƖǁĿ ĸĎĸpƐĸū Ġʎ ƀYĶǻđ ĸǵgt' ĸƠ ĀǾÆŤơ ǰǂł ƷY .YÑʎ ċ/ČM NaCl OʻĸpƐǫŪĨĦ ǰʻƐơ ł ƨKǫ Ġŧ p OəĸǂǀĽ ǵ/ŧĸ Ďċċ mg/kg Ġʎ Čċċċċ ɛł TPH-D Ơǒǫŭ p H_2O_2 Ùě ē ƷYpƶəł ƀƐŽǵg Ġʎ (Fe_o/Fe_t) OƖƖsǁ Ġŧ ÆǫĸŪƀǵ ǀ ǂłƹəł ċ/ĎĎ Ġʎ ċ/Č ɛł ÛΘĸǾǪŽŪ ĩċd ɛł 5ř ċ/ČM NaCl ǻĸgt' ĸƠ ĠǾǻdžơ .(Ĥĩ) yǾƨƷ ě ĖĒ Ġʎ Ùƶf ƷĸǫyǁƵ ÛOəĸǂ ĸʎ ƷÑǾƨłyǾŧŧł ʎЏǂƑƐə ɛł ƀYĶǻǪ§ł ĸʎ ÆǪĶǁ ǻĸgt' ĸƠ ǻÑǁpOƨǁ ɛł ÆǪĶǁ ǻĸgǰʎƐŧpƵyǾǵg Ġʎ ƀYÑʎđ ŽŤǾŧŧł ĸʎ ƀyǁ ƀyǁĿƐÑƨ ƐǪŧŧĸƠ YƐǪƵĸŧ ƀƐŽǵg Ġʎ H_2O_2 Ġüĺĸãǫ Kao njƧÑơ ĉċċĔ ğĸƧ ƷY OʻŧǾĸoĸŧ ƷĿÑШĎ Ġʎ (BOF) ƐǪŧŧĸƠ Ċċċ g/kg p H_2O_2 ÙěČĨ ǀ ǂłƹəł ĸʎ .OƧł ƀyǂƳƐū ł ǾơƐơ Ġʎ ŘǾǂpƐĸū p ƵƷÑŧ OʻÃǁ Ù ǀ ŀŧłp ħċh ɛł 5ř (BOF) ǻĸgǰʎƐŧpƵyǾǵg Ќŧ ĠǾǩpł OƠǫŮ) yǪyǁ ÙƶfĕĚĩ p Ēĩ Nogueira .(ČĒ) (YÑʎ Čċċċċ mg/kg ƐĿƐʎ (TPH) ÆǪÃǁ OƧŧƐ ǪǾǵĸÃǫ ĠŀǾǫƐ ƷY ǻŧĠüĺĸãǫ čċċē ğĸƧ ƷY ƷłƵĸŪŽǵg p .yǪYłY ǫĸƖǁĿ ƷÑǪəƐ njƧÑơ ŧ' ĸƠ ŧ ÊDžł Ġʎ NjÑʎƐǫ ÆăǾŢǫ Ġʎ ŧ' ĸƠ ČĨċg ƷY ŘǾǂpƐĸū p DDT ĠǾǩpł OƠǫŮ Ġüĺĸãǫ ǰǂł ƷY ƷÑǪəƐ ĩh hɛł 5ř .OƧł ƀYÑʎ Ĩ m p Č/ĩ mg/g Ûŧ ǾơƐơ ǀ ǵĸŧ Ĩċ µg/L Ġʎ DDT ƷłyÆǫ ÛkĶŮpY Ĩċċ mL ǻpƵ Ɛʎ .OƧł ĠǾǩpł OƠǫŮ ƷY ěĒĨ ǀ ǵĸŧ ƀyǪǵYƷĸ+ǁ Ġŧ OƧł ĠǫəǾǂ ÛOƧł ƀYÑʎ ěēċ ÛƀyǁĿ ƐŧƵ ƷĸǫƐ Θyǫ ƷY ŘǾǂpƐĸū ƷłyÆǫ ǀ ǵĸŧ ɛł ƀyǁĿ ÙĸKDž kĶŮpY ƷY (DOC) ğÑǪŢǫ ÆĽđ ǰʎƐŧ ĠŧÆĽĸf ƷY .(Čē) YÑʎ ĠǫəǾǂ ǀ ǂłƹəł ēēċ mg/L Ġʎ ēċ OʻHΣ ĠǫəƐ+0ř ƷÑǾƨłyǾŧŧł p pƵ ɛł ƀYĶǻǪ§ł Ġŧ ǰǂł ŘǾĽY Ġʎ ƐǪƵĸŧ īǵ ǰǾǂNơ ĸʎ ŧ' ĸƠ ǻÑǁpOƨǁ ɛł ŘDžĸf kĤljĸə ĠǾǻdžơ ǪǪƨǾƨ ÆǂłƵĸŧ ǀ ǵpŤř ǰǂł ƷY ÛOƧł ĠǫəƐū ƷłƐǎ Ġüĺĸãǫ YƷÑǫ ǻĸgyЏǂƑƐə ğĸŪǁł ɛł ÆŪź ƷĿÑШĎ Ġʎ UV/Fe^{2+}/H_2O_2 ƷÑǪəÑǪə Æǁĸǁ ÆūYÑʎđ ƷYƐʎ ǰ0ʎ ɛł ǻłƐʎ (AOP) ĠǫəƐ+0ř ƷÑ0ƨŧyǾŧŧł ŘǾЏǻ ǰǂł ǻÑǁpOƨǁ ɛł ŘDžĸf kĤljĸə ƷY ÆǪÃǁ ΘKШ0ŧƐơ ɛł .OƧł ĠǫəƐū ƷłƐǎ ÆƨƵƐʎ YƷÑǫ ÛĸǵtʻĸƠ

ĸǵ p pƵ p YłÑǫ

Ùƶf OʻHΣ ƷÑǪəÑǪə yЏǂƑƐə ΘĸdžU+ǫ ÃǾÆŤơ ǰǂł ƷY Ġʎ ƀYÑʎđ ǻĸgt' ĸƠ ǻÑǁpOƨǁ ɛł Æǁĸǁ kĤljĸə COD UV Řǫè ɛł .YÑʎ ŘǂƵ ŧƐǁ Ġʎ OʻĸǪŪəƵÑƨ njƧÑơ ŘǾǂpƐĸū ǀ ʞƠ Θyǁ ɛpY ,ħċċ w ƷłÑơ :ΘĸdžU+ǫ ĸI) njƧÑǪǫ Ʒĸǂəğyǫ ,Ĥǵminɛł yЏǁ ČĨ cm ǪǫDžĸə ƷY Đēċċ µw/cm² :Řǫè ƀyǪƐĸƨ ÆǁĸŚŽŧ p UVC :Řǫè ŮÑǁ ,UVOX :Řǫè YƵÑǫ ƵÑǪŧŧłƵ .yǁ ƀYĶǻǪ§ł ǀ ʞƠ ŭǁǪǫ ƷłÑǁĿ Ġʎ (Arda France

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ŀ ŀĬĬ

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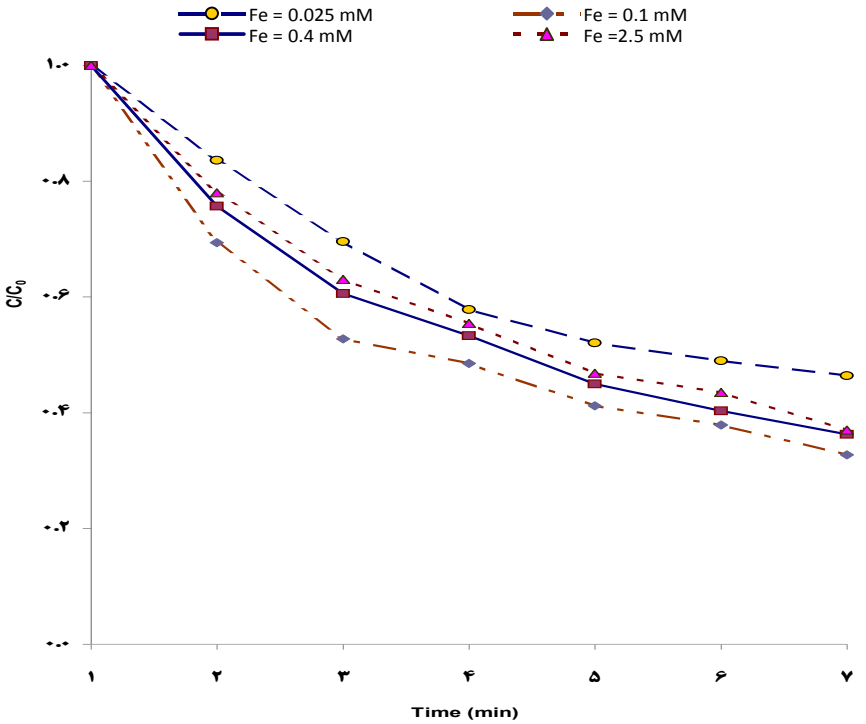
ǰǵđ ù ǪǪUǫ ǻǩǵOŏǪŮ ƐǾþǩơ yǘǂƐə Ɛʎ ǰǵđ ù ǪǪUǫ ǻǩǵOŏǪŮ ƐǾþǩơ ÆƐʒƐʎ ǻŧƐʎ OƵʂǻ ʒY Ǵŧ ÆȺǩʂř ǻpʒ Ɛʎ ǩǵ ǀ ǽǩǫƐđ ÛUV/Fe/H_2O_2 ʒHYǩđ ǰǵđ ğŊǪŢǫ .yǂYƐū ǫǩ٦Ⱡ Ûy٦ ƱYHY TǾljŊơ ǨǄǻ Ĥ/Ĩ þ ǵ/ħ ¡ǵ/Ĥ ¡ǵ/ǵĥĨ mMǻǩǵOŏǪŮ ʒY ($FeSO_4.7H_2O$) Ǵʎ OȞΣ njǾŢǫ ǻǩǫY þ pH=Ħ ʒY ǵ/ħĦM ʒŧʒǾǫ Ǵʎ H_2O_2 þ yǘǂƐə .yǂYƐū Ǵəǩljŧ ǩʎʂř Ǵʎ ǰǵđ ǴȠǾȞʎ ʒŧyǂǫ ʒƳʒÞđ OƵʏ ƐǨŮđ UV Řǫĕ ʒǩǫƐǪǵ ʒyƳ ǰ ǁþʒ þ H_2O_2 ʒyƳ Ǵəǩljŧ ǩʎ ǫǩ٦Ⱡ Θyǫ ğŊĂ ʒY ǨǄǻ ʒY ƱyƳ Ɛŧƶ Ǩfŧƨǫ ÆǫǨʒơ .yǂYƐū ƐǾþǩơ ɾŧ ǨDžǨf ɾǽǩǪǁ ĥ ǨŨǁ ʒY .Oƶŧ ƱyǂYƐū ĬʞŢǩ yǘǂƐə ƱyƳ ƱYHY ʒǩǂǁ ʒŊǾƶŧłyǾʂŧł yǘǂƐə Ɛʎ ǰǵđ ù ǪǪUǫ ǻǩǵOŏǪŮ ǵ/Ĥ m M ǰǵđ OŏǪŮ ʒY COD ÙƶƒÆǂŧʒǩŧ ǰǽƐǪĦȠ .Oƶŧ ǨŨǁ .YʒHY ƱŧƐŽǵ Ǵʎŧʒƶ ɤĩĪ/Ħ ÙƶƒʒǩǫyĦʒ Ǵŧ yǪəŧÆǫ āǩĂơł ʒǩŧ Ǵʎ ÆüǾǪĂ ǩʎʂř ǻŧƐʎ Ǵŧ Oƶŧ OǾüǻǂþ ǰǂŧ ǻǩǂŊū (Ĥ) ǀ ǽŧʒəł ƐǂŧƐʎ ƿY Ǵʎ ǰǵđ OŏǪŮ ʒŧʒǾǫ ƐüŧÛĀǾŧƬơ ǰǂŧ ʒY ǴǪəʒ ěĩĦ/ī Ǵʎ þ yǩǂÆǫ ǀ ǵǩŧ ÛʒŊdžơ 5 ŨŰƐʎ ÙƶƒʒŧʒǾǫ yǩǂ ¡ǵ/Ĥ m M OŏǪŮ ǩǓUǪĦ OŢDž ɾŧ ʒǩǾǪŽĂŧ ǻŧƐʎ þ yƽʒÆǫ

ǀ ǂŧŧÞ OŰƐƽ ŧǂƐlj èŊŽūǫ ǀ ǂŧŧÞ ǴΣʒY ǰǾǾūơ ʒŊŏǂǫ Ǵʎ ÚǴǪƽŊŏŕǩǓ ΘǩŧǂǩǫƐđ ɾŧ Ʊyǫđ OƵY Ǵʎ ƨǂǩǪǁ ɾŧ ƱYǩÅǪƽŧ ǩʎ Ǵʎ ÆǁyǾǫ þ ΘŊǪǂǩř 2 ǩǾÆǫ ʒY þ ǫÞŧyǫ ŽǩǂƐΣ ǻǩǵ ǀ ǽǩǫƐđ ÚǴǪƽŊŏŕǩǓ ΘǩŧǂǩǫƐđ ɾŧ ǨDžǨf ǻǩǵǂYHY ₮Žŧ ǩʎ .yǄđÆǫ OƵY þ þʒ þ ǻƐǾūğŧƐŬǓǁǂ ǨǫǨǁ ǩǵ þ þʒ ŬǂŊǂǁ YƐʎʒǩŧ ǩʎ ŧ ǂŧƐlj ƱYǨÅǪƽŧ ǩʎ ŭΣŧƐǫ ʒY ʒŊŏǂǫ ǰǂŧ ǻŧƐʎ .YŊǁÆǫ ǰǾǾūơ ǨǾʂǂŧƐÅǂY Ûnjʊ ŧ ǿǁ ǰǾǾūơ þ ǀ ǂŧŧÞ ǴΣʒY ǰǾǾūơ Ǵʎ NjŊŽƐǫ ΘèYǨūǫ ɾŧ .(ĤĬ) OƵŧ ǴǁƽǨŢǫ Ǩǩǻǀ ǂŧŧÞ OŰƐƽ OȞǩǪ

ǨǵǴǪəǨǂ

ÆǂǨHǁơ Ǵʎ **UV** yǘǂƐə ƐǾþǩơ

ǨǫǨŰ ǰǂŧ ǻŧʒ٦ǫ ƐǾþǩơ ǰǾǾūơ OȞΣ ÆǂǨHǁơ Ǵʎ UV ǀ ǽǩǫƐđ OƵʂǻ ʒY Ǵŧ ÆȺǩʂř ǻpʒ Ɛʎ ǀ ǽǩǫƐđ .yǂYƐū ǫǩ٦Ⱡ ÆǂǨHǁơ Ǵʎ Ǵŧ ǀ ǽǩǫƐđ ǰǂŧ .yǂYƐū ǫǩ٦Ⱡ Ûy٦ ƱYHY ŧƐǁ ǨǾdžÅơ Ǵʎ ǨǄǻ **كارايي حذف فرايند** Ǵŧ YHY ʒǩǂǁ ÛyǾƽʒ ǫǩ٦Ⱡ Ǵʎ čh Θyǫ Ǵʎ **مجزاي** UV، Ē/Čħ ٪ **بودهاست.**



UV/Fe/H_2O_2 yǘǂƐə ʒY COD ǀ ǵǩŧ Ɛʎ ǰǵđ OŏǪŮ ΘŧƐǾūơ ƐǾþ :ĥǨŨǁ

(UV=ħǵǵ w ¡H_2O_2= ǵ/ħĦ mol¡pH=Ħ ,COD_0 =Ħīīǵ -ħĬǵǵ mg/L)

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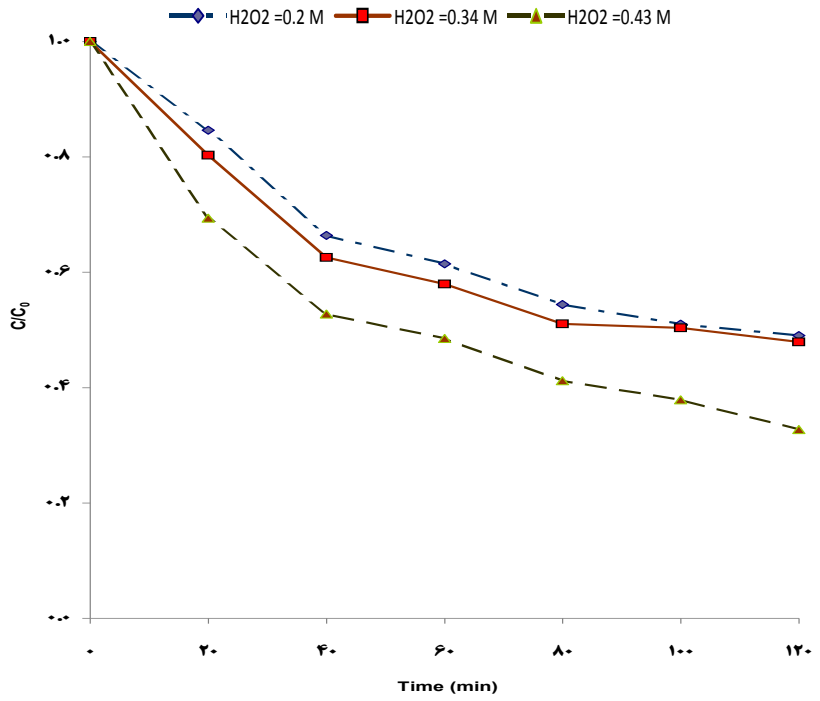


UV/Fe/H_2O_2 ÿĩãĐə ƷŸ **COD** ĺģĸt ƐĬ **H_2O_2** ǑŏǫǓ ΘłƐǾǾŭơ ƐǾł :ĦĶÕǁ

(UV=ħģģ w ,$(FeSO_4.7H_2O)_{opt}$= ģ/Ĥ mM ,$(pH)_{opt}$=Ħ)

ΘÓūäÞ ĵÁł ÅĸÀÙū ĥ ǨŨ‖ .(ĥĤ) Ơѕł ȣYÙŽ₪ ɛPĸ]ơ yf ƐūŁ ÛĀÓÁĒƮơ ĵÁł ŽY ĠŋəŽ ŽĸŁ Ġλ ÆüÓ₪Å kĸѕř ÅŁƐλ ĠŁ Ơѕł 5 ÙŰĴƐλ ĠÁƶ]ơ ŽŁƶÓǫ yĸĸÁ ‖ ÁŁƶəł ƐHƐλ pY Ġλ ĵ ģd ƠŏǫŮ ŽŁƶÓǫ ŽĸĠ₪ŽĂŁ ÅŁƐλ p yѕŽÆǫ ěĩĦ/ī Ġλ p yĸĸÆǫ ‖ ģĸŁ ÛŽÙdžơ ȣYĸÅ]ѕł ƶ₪ Ơŏǫŭ ƐHƐλ Ĩ ɛł Ûģ/Ĥ Ơŏǫŭ kĸUŋH ƠƮDž ɛł ĠŋəĸÁ ‖ ģĸŁ ěĩĦ Ġλ Ùzf yDžŽY Ġŧ yŸ ȣyğĸŧǫ p yÁYƐū ΘŽpyŧ ÛĵģdƐŋŧÓλ ‖ ÁŁƶəł Kλ Ġŧ Ơѕł ĵÁł ƐǫŁ ĵÁł ƠǫŰ .Ơѕł ŽĸÁĸŽ₪ ȣƐÓơ åƐΣd ŪŋŽ Ġλ Ġŧ kĸѕř ŽY ĵģd ŪŋŽ ɛł ǨDžĸf ƶÓŁÑǫə åŁƐλ ɛĸÓ₪ YŽÑǫ UV Ñơƒř kzΣ ŭ₪ǩǫ ÛƠѕł ȣyÁYƐū åĸģğĸÛźYĮŽ Yy]ǫ Ł ŧŧƐơ ƤŰĸλ YŧƐĸǫ ĵģd ĵÓπšǪģ .YÑ‖Æǫ (HO⁰) ğĸÛźYĮŽ Kλ Fe(II) ŸŽÑǫ ĵÁł ŽY .YÑ‖Æǫ ǨÓŁѕŧpŽyÓģ ĠÓŁpŁ H_2O_2 ƠŏǫŮ .(ĥģ) yğYÆǫ ‖ ŧŧłp ȣyŋƐÓū ŽŁÑ₪Ű Ġλ COD Ùzf p ÆŁd ΘĸŋŧƐơ ŽÑÓѕŧyÓѕŧł ‖ ŧŧłp ǫĸ]Ł ƠĦΣ ÆəƐdžǫ H_2O_2 ƠŏǫŮ .Ġš£ģ .Ơѕł ƠÓŽģŁ Kλ ŽĸÓѕλ kĸѕř ‖ ÁŁƶəł .ƠəĸÁ yğŁÑƵ ‖ ģĸŁ ƶÓ₪ Ùzf ŽĸÓyŋĮŽ Ûy‖Kλ ƐơĵÓÁĸř ÆŁd YŁÑǫ åŽÑ₪ ĠÁƶ]ơ Û ‖ ŧŧłp njØƮǫ Ġλ ÛH_2O_2 ĠÓŁpŁ ƠŏǫŮ yǫəĸÓǫ ãĸÅƉł Æ₪Óūǫ ĠãÆ₪ Kơ ‖ ÁŁƶəł ĵÁł Ġq₪Ł .yğYÆǫ ‖ ÁŁƶəł ŁŽ YŁÑǫ ÆÛÓ₪ŋĸÑǫə ĠÁƶ]ơ åŁƐλ Æüŋĸǫ YÑƵ H_2O_2 yűλ Ġλ ŽdɛŁ p ŽÑ₪ŮĠλ YÑƵ Û£oèĸλ ƐźYĸÅǫ ŽY H_2O_2 ŁƐÁɛ .YYƐūÆǫ ğyŋǫ Æ₪d .(ĥģpĤĥ) yŋŧÆǫ ǨŽŰ YŧƐd ğĸÛźYĮŽ (ȣyŋŧŧůŽΣ) ȣyŋŧÙƐdžǫ ΘèYĸūǫ .yĸĸÆǫ ‖ ģĸŧ åyÓĸÑơ YŧƐd ğĸÛźYĮŽ ƠŏǫŮ ĵÁł Ƹλ₪

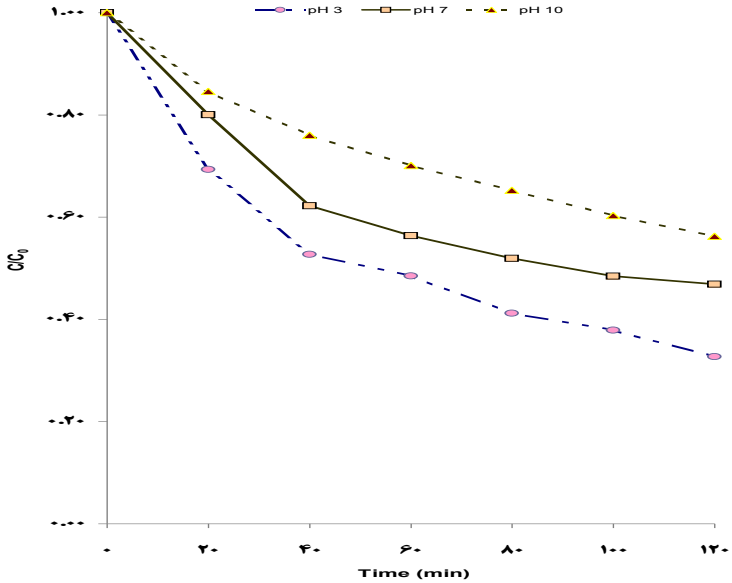
ĠΣŽY ‖ ŧŧłp ŦÓŋ₪ȣyŋģYŽĸŁ‖ Ġŧ ĩ ǨŨ‖ ŽY Ġŧ ÆĖĸf ŽY ɛł ŽĸǫƐ ǨλĸÅǫ ŽY ln (C/C_0) ΘŁƐÓÓůơ Æ₪Ʈŋǫ ǪÓѕƐơ ,Ơѕł ğpł .yŋŧÆŽ₪ åpƐÓř ǪÓŁǫѕǫ Êǫĸŧ njŏ Ŧź

ƤƮλ

ǨÓŨŁơ Ġŧ Ơѕł Žđ ɛł Æŧĸƒ ĠŋəƐū ǫĸ]Ł₪ åĸģ ‖ ÁĸǫƐđ ƨÁĸǫ‖ YƐλŽĸŧ Kλ ŽÑŋ₪əÑŋə yŋ₪ŁƏ ɛł ȣYĸÅ]ѕł Kλ ǨÓѕŧpŽyÓģ åĸģğĸÛźYĮŽ :ΥƐÁƶřÆǫ ǫĸ]Ł₪ ƐÁƐ ĠĖYĸūǫ ĀŋĀ Fe(II)

$Fe^{+2}+H_2O_2 \rightarrow Fe^{+3}+OH^{-}+HO^{0}$

p ÆəĸIjł ǨÓѕŧpŽyÓģ åĸģğĸÛźYĮŽ ǨÓǨŨ‖ƐơƤŰĸλ UV ‖ ĸĸơ Ġλ .YYƐūÆǫ Fe(II) åĸÓƒł Kλ Fe(II) Ơѕ0ĸĸơŧ ‖ ŏƐšƐĸλ ƐoŭźƐѕ ‖ ŧŧłp p yĸĸÁÆǫ ‖ ÁŁƶəł Fe(II) ƠŏǫŮ ƠǫŰ ĵÓŽģ ƐÓ₪ǫơ Ǫ]ѕÓѕ ŽY ĵģd ĠÓ₪pł ƠŏǫŮ .(ĥģpĤĥ) YÑ‖Æǫ ǫĸ]Ł₪ ÙzfÆźŽ₪Ĥλ .YŽłY COD Ùzf ŽŁƶÓǫ ŽY ÆźŁƶѕλ Ùzf Žĸǫyŋ₪Ž Ġŧ yǫəŁÆǫ ãĸÅơł ģ/Ĥ mM ĵģd ƠŏǫŮ ŽY COD ŽŁyÆǫ ĵÁł ɛł ȣYĸÅ]ѕł Kλ Ł ÓoƐơ ĵźyλ .YŽłY ȣŁƐŽģ Ġλ ŁŽ ěĩĪ/Ħ ɛł ÆΣpƐƱ kĸѕř Yy]ǫ ĠÓÅdžơ Ġλ åƐĸÓ₪ Ûy₪ŁƏ ŽY ĵģd Ġ₪ÓĦλ ƐźYĸÅǫ åpĸf kĸѕř ŭəY ÆăÓƮǫ ƠѕźƐ ĵÓĦÑă ƠźĸŮŽ ĬĸƮλ Eλ ĵģd åĸģŽÑź ŭəY ƐĸǫŁ yf ŁƐÁƐ .YÑλ yğĦÑU‖ ĵģd åèĸλ ĵÁł ɛł Ġŧ Ơѕł ģ/ĥĪ mM ÛÆǫƮǫ ÆăÓƮǫ ƠѕźƐ ŽÑ₪ÃĀ₪Å



UV/Fe/H_hO_h yŋ₪ŁƏ ŽY COD ‖ ģĸŧ Eλ pH ΘŁƐÓÓůơ Ł₪ł :ħ ǨŨ‖

(UV=ħģģ w ,$(FeSO_4.7H_2O)_{opt}$= ģ/Ĥ mM ,$(H_2O_2)_{opt}$=ģ/ħĦ mol)

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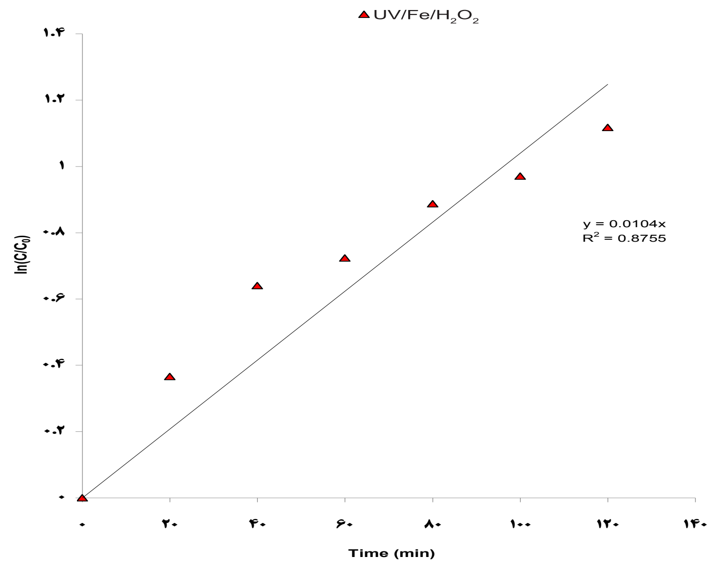
[illegible]

$$HO^0 + H_2O_2 \rightarrow H_2O + HO^0_2$$

$$2HO^0_2 \rightarrow H_2O_2 + O^0_2$$

[illegible]



[illegible] **COD** [illegible] **UV/Fe/H_2O_2**

(UV=[illegible] w ,$(FeSO_4.7H_2O)_{opt}$= [illegible] mμ ,$(H_2O_2)_{opt}$=[illegible] mol ,$(pH)_{opt}$=[illegible])

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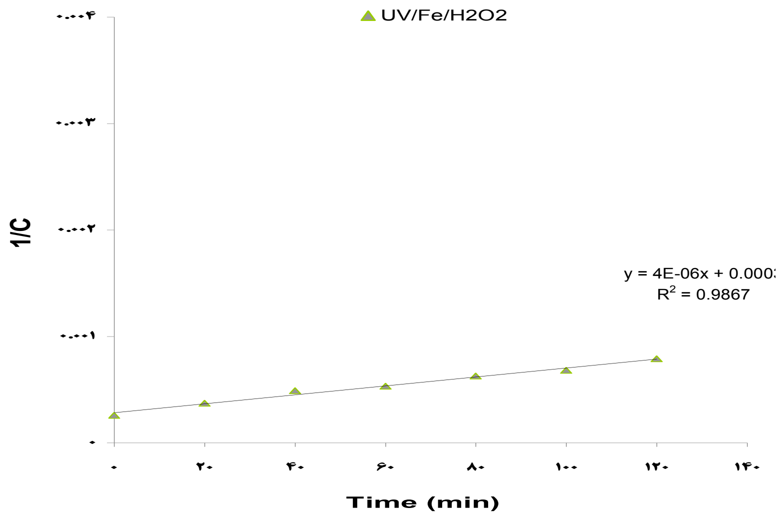
[illegible] pH [illegible] PupoNogueira [illegible] pH [illegible] J. Watts [illegible] BTX [illegible] pH= [illegible] Kavitha [illegible] Palanivelu $UV/Fe/H_2O_2$ [illegible] mg/L [illegible] pH= [illegible] min [illegible] Farrokhi [illegible] (TCP) [illegible] pH [illegible] (Fe^{+2}= [illegible] mM [illegible] H_2O_2= [illegible] mM) [illegible] TCP [illegible] min [illegible] TPH [illegible] UV [illegible] COD [illegible] Osvaldo [illegible] UV [illegible]

[illegible] COD [illegible] k [illegible]

$$\frac{1}{C} - \frac{1}{C_0} = k.t$$

[illegible] COD [illegible] Farrokhi [illegible]

[illegible] COD [illegible] (pH=) [illegible]



[illegible] COD [illegible] $UV/Fe/H_2O_2$

$(UV=$ [illegible] w $,(FeSO_4.7H_2O)_{opt}=$ [illegible] mM $,(H_2O_2)_{opt}=$ [illegible] mol $,(pH)_{opt}=$ [illegible] $)$

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Application of Photo-Fenton Process for COD Removal from Wastewater Produced from Surfactant-Washed Oil-Contaminated (TPH) Soils

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Received; 24 April 2012 Accepted; 22 July 2012

ABSTRACT

Background and Objective: The base structure of total petroleum hydrocarbons (TPH) is made of hydrogen and carbon. Widespread use, improper disposal and accidental spills of this compounds lead to long term remaining of contaminations such as organic solvents and poly aromatic hydrocarbons (PAHs) in the soil and groundwater resources, resulting in critical environmental issues. In this study, an oil-contaminated soil was washed using Tween 80 surfactant and the application of photo-Fenton process ($UV/Fe^{2+}/H_2O_2$) for treatment of the produced wastewater was evaluated.

Materials and Methods: Tween 80 is a yellow liquid with high viscosity and soluble in water. In order to determine of the photo-Fenton process efficiency, we studied effective variables including Fe concentration, pH, H_2O_2 concentration, and irradiation time. The UV irradiation source was a medium-pressure mercury vapor lamp (400 w) vertically immersed in the solution within 2 L volume glass cylindrical reactor.

Results: The results showed that efficiency of COD removal depends on the initial Fe concentration, pH, H_2O_2 concentration and irradiation time.

Under optimum conditions, (Fe: 0.1 mM, H_2O_2: 0.43 mM, pH: 3 and UV light irradiation time: 2 hours) the removal efficiency of COD was 67.3%. pH plays a crucial role in the photo-Fenton process such that the removal efficiency increased with decreasing of pH.

Conclusion: According to the results of this study, under acidic condition, this process is an efficient method for COD removal from the wastewater studied.

Keywords: Total Petroleum Hydrocarbon (TPH), Tween 80, Advanced oxidation, $UV/Fe^{2+}/H_2O_2$ process

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