

DIVISION OF ENVIRONMENTAL CHEMISTRY

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WEDNESDAY EVENING

Environmental Science and Technology: A Tribute to William "Bill" Glaze

Posters

J. L. Gardea-Torresdey, *Organizer*

D. D. Dionysiou, *Presiding*

6:00 - 8:00

192. Effect of oxides to enhance the reactivity of persulfate solution for degradation of diesel-contaminated sand. Y. Kwon, **S -H. Do**, S -H. Kong, K -M. Park

193. Effect of two non-ionic surfactants on PAHs biodegradation in marine sediment under denitrification condition. **X. Lu**, T. Zhang, H. H. P. Fang

194. Efficient degradation of azo dye wastewater with electro-Fenton using the boron modified carbon nanotube cathodes. **Y. Shen**, J. Shi, Y. Zhang, P. Zhu

195. Fenton-like reaction in wastewater. **Y. Lee**

196. Nitrobenzene oxidation by persulfate with magnetite nano particle (MNP). **H -K. Lee**, Y -H. Jo, S -H. Do, S -H. Kong, H -D. Park

197. Photocatalytic behavior of salicylic acid modified TiO₂ for degradation of Bisphenol A. S -M. Chang, **C -T. Chang**

198. Surface molecule-controllable magnetic-dendrimer for environmental applications. **J. W. Jang**, J. W. Park

ABSTRACTS

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Effect of oxides to enhance the reactivity of persulfate solution for degradation of diesel-contaminated sand

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Diesel contamination in subsurface has been known for long-term risks to both environment and public health because of their persistence and toxic characteristics. The efforts to clean up contaminations in subsurface have been proceeded with the applications of various technologies. Remediation technology using persulfate ($S_2O_8^{2-}$) in the aspects of *in situ* chemical oxidations (ISCOs) has been intensively studied to increase the reactivity of persulfate. In this study, the effects of the various types of oxide activators (*i.e.*, goethite (α -FeOOH), hematite (Fe_2O_3), magnetite (Fe_3O_4), magnesium oxide (MgO), and manganese oxide (MnO_2)) to increase the reactivity of persulfate ($S_2O_8^{2-}$) were investigated for the degradation of diesel adsorbed on sand. The results indicated that manganese oxide is the most effective activator with persulfate solution ($S_2O_8^{2-}$) to degrade diesel. Among iron oxides, magnetite was the most reactive activator and higher removal of diesel was observed with increasing amounts of magnetite. Keywords: Persulfate solution, iron oxides, diesel degradation, manganese oxide

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Effect of two non-ionic surfactants on PAHs biodegradation in marine sediment under denitrification condition

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Tween 80 and Triton X-100, two nonionic surfactants, were investigated in this study for their effects on degradation of naphthalene and phenanthrene in sediment under denitrification condition by 70 days batch experiments. Results showed that the addition of Tween 80 effectively enhanced the biodegradation of the above two PAHs (polycyclic aromatic hydrocarbon) while the addition of Triton X-100 inhibited the bacterial activity

and thus the biodegradation. As for the Tween 80, degradation rate of naphthalene, 3.6 mg/g/d was increased 327% at Tween 80 of 1,600*CMC (21.9 g/L) which is quite high dosages compared with that without Tween 80. For phenanthrene, we can conclude that there is a lag phase in the early 30 days. The overall removal efficiency increased from 11.3% without Tween 80 to 40.1% with 480*CMC. High concentration of Tween 80 did not enhance the phenanthrene degradation greatly. For the Triton X-100 effect, the degradation rate of naphthalene decreased from 1.35 mg/kg/d without Triton X-100 to 0.11-0.20 mg/kg/d at various CMCs of Triton X-100. Quantitative real-time PCR analysis showed that the abundance of nahAc gene which is responsible for PAHs degradation increased from 12 at day 0 to 2,255 at day 70 per ng DNA in sediment at 1,600*CMC surfactant addition with the increase of the degradation amount of naphthalene increased, while nahAc gene increased from 6 at day 0 to 1,069 at day 70 copy per ng DNA for the treatment without Tween 80 addition. The results of the investigation confirm that Tween 80 would improve the performance of bioremediation of naphthalene and phenanthrene in marine sediment under denitrifying condition. The study provides new information about nonionic surfactant effect on PAHs biodegradation under denitrification condition and molecular evidence on PAHs biodegradation process.

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Efficient degradation of azo dye wastewater with electro-Fenton using the boron modified carbon nanotube cathodes

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Electro-Fenton oxidation is a promising environmental remediation technology because of its high efficiency in organic pollutants removal and because it is environmentally benign. In order to improve the degradation efficiency of electro-Fenton system, the boron modified carbon nanotube (BCNT) electrode was prepared. For the electro-Fenton degradation of the model pollutant (methyl orange), the BCNT electrode showed faster removal of methyl orange when compared to the CNT electrode. The repeatability test suggested that the stability of the BCNT electrode was very good. The influences of operating parameters including electrolyte concentration, cathodic potential, Fe^{2+} concentration and initial methyl orange concentration were investigated. After 60 min, the removal of methyl orange reached 95%. Moreover, the COD removal was 86%, indicating the mineralization of methyl orange and the intermediates.

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Fenton-like reaction in wastewater

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A distillation method was used to determine total cyanide in which hydrogen cyanide (HCN) was released from samples containing cyanide by means of a reflux-distillation operation under acidic conditions of pH 2 and absorbed in a scrubber containing sodium hydroxide solution. Capture cyanide was determined by spectrophotometer using procedure of pyridine-pyrazole method.

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Nitrobenzene oxidation by persulfate with magnetite nano particle (MNP)

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Persulfate oxidation has been known for the technique that is relatively stable and suitable for the wide ranges of pH conditions and is generally activated under the conditions of heat, photo, and metal-catalysts. During the activation of persulfate anion ($S_2O_8^{2-}$), various types of radicals (*i.e.*, mainly sulfate radical ($SO_4^{\bullet-}$) including hydroxyl radical ($\bullet OH$)) are generated. In this research, synthesized magnetite nanoparticle (MNP) was carefully analyzed, and the effect of MNP expecting to enhance the reactivity of persulfate was evaluated for nitrobenzene oxidation. The preliminary results showed that MNP could accelerate the degradation of nitrobenzene in persulfate system compared to the system with only persulfate. In addition, MNP could activate persulfate as much as ferrous ion to degrade nitrobenzene. This indicated that persulfate could be activated either on the surface of MNP or in aqueous solution. Keywords: persulfate, magnetite nanoparticle (MNP), sulfate radical, hydroxyl radical, nitrobenzene

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Photocatalytic behavior of salicylic acid modified TiO_2 for degradation of Bisphenol A

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In this study, we modified the commercial P25 TiO₂ with salicylic acid through a microwave-assisted method. In addition, the photocatalytic behavior of the surface modified TiO₂ for degradation of bisphenol A (BPA) was examined and the role of the organic modifier on the photocatalysis was clarified. The TGA result indicates that the modified TiO₂ contained 2-3% wt of salicylic acid on the surface. Moreover, the FTIR spectra show that C=O stretching absorption of the salicylic acid red-shift from 1658 to 1609 cm⁻¹. This result reveals that the organic carbon was chemically bonded to surface of TiO₂ through complexation. The modified TiO₂ performed 2.96-fold increases in the kinetic rate constant of the unmodified P25. Dark adsorption reveals that the modified TiO₂ exhibited a high affinity toward BPA under a partition coefficient of 0.15 l/mg. The high adsorption capacity was due to the π-π interaction between salicylic acid and BPA. In addition, the EPR results show that more oxygenated radicals were stabilized in the modified TiO₂ because salicylic acid withdrew the electrons from conduction band of TiO₂ to its aromatic ring through conjugation. The combination effects of surface enrichment for target compounds and inhibited charge recombination resulted in the improved photocatalytic activity of the modified TiO₂.

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Surface molecule-controllable magnetic-dendrimer for environmental applications

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We synthesized the proposed magnetic nanomaterials by coprecipitating ferrous and ferric iron ion solution using sodium hydroxide, and applied these materials as magnetic core to build dendrimer structure upon. Hydrophobic, hydrophilic and both hydrophilic and hydrophobic functional groups were developed using functional molecules, such as ethylene diamine, butane-1,4-diamine, (E)-4-(phenyldiazenyl)phenol, hexanol and various ester species. Therefore, the magnetic dendrimers comprise of magnetic core and hydrophobic, hydrophilic and amphoteric molecules terminal groups, and grow repeatedly. The present technology can be applied to various environmental areas, such as removal of both hydrophilic and hydrophobic contaminants, such as heavy metals, perchlorate, nitrate, organic contaminants, etc. In addition, dendrimers positioning control, recycle and cost-effective magnetic separation will be experimented to enhance field applicability. It can be applied to hybrid environmental technology in connection with bioremediation through its toxicity and environmental impact test. Synthesized surface molecule-controllable magnetic dendrimers were analyzed by ¹H and ¹³C NMR spectroscopy, scanning electron microscope (SEM), size analyzer, and FT-IR. Environmental analysis was performed by using atomic absorption spectrophotometer (AAS), total organic carbon (TOC), and so on.