บันทึกข้อความ

ส่วนราชการ ภาควิชาวิศวกรรมเคมี คณะวิศวกรรมศาสตร์ มหาวิทยาลัยอุบลราชธานี โทร.3343

ที่ ศธ 0529.8.3/ พิเศษ **วันที่** 4 ตุลาคม พ.ศ. 2553

เรื่อง ขออนุมัติเงินสนับสนุนเพื่อนำเสนอบทความทางวิชาการในระดับนานาชาติ

เรียน รองคณบดีฝ่ายวิจัยและบริการ ผ่านหัวหน้าภาควิชาวิศวกรรมเคมี

ด้วยดิฉัน ดร.สุมนา สิริพัฒนากุล อาจารย์ประจำภาควิชาวิศวกรรมเคมี ได้ส่งผลงานวิจัยและได้รับการตอบรับให้นำเสนอบทความ "Hospital Wastewater Treatment Deterioration by Disinfectants: Effects of Types and Concentrations" ด้วยวาจา ในการประชุมทางวิชาการ The 6th International Conference on Environmental Geochemistry in Tropics—Urban Issues ในระหว่างวันที่ 4 ถึง 7 พฤศจิกายน 2553 ณ Chinese Academy of Sciences เมือง Xiamen ประเทศจีน

ดิฉันมีความประสงค์ขออนุมัติเงินสนับสนุน เพื่อนำเสนอบทความทางวิชาการดังกล่าวเป็นจำนวนเงินตามที่จ่ายจริงแต่ไม่เกิน 40,000 บาท (สี่หมื่นบาทถ้วน) ซึ่งดิฉันได้แนบเอกสารประกอบการพิจารณาโดยได้แก่ 1) โครงการประชุมวิชาการระดับนานาชาติเพื่อเสนอผลงานวิจัย 2) จดหมายเชิญและตอบรับร่วมประชุม The 6th International Conference on Environmental Geochemistry in Tropics—Urban Issues 3) รายละเอียดของการประชุม และ 4) บทความฉบับสมบูรณ์ มาพร้อมกันนี้

จึงเรียนมาเพื่อโปรดพิจารณา

(ดร.สุมนา สิริพัฒนากุล)

อาจารย์ประจำภาควิชาวิศวกรรมเคมี

โครงการประชุมวิชาการระดับนานาชาติเพื่อเสนอผลงานวิจัย

1. ชื่องานประชุม The 6th International Conference on Environmental Geochemistry in Tropics—Urban Issues (4 ถึง 7 พฤศจิกายน 2553)

2. สถานที่ Chinese Academy of Sciences เมือง Xiamen ประเทศจีน

3. ผู้ขอรับทุน ดร.สุมนา สิริพัฒนากุล อาจารย์ประจำภาควิชาวิศวกรรมเคมี คณะวิศวกรรมศาสตร์

4. หลักการและเหตุผล

ตามที่ Key Laboratory of Urban Environment and Health, Institute of Urban Environment, Chinese Academy of Sciences ได้จัดการประชุมทางวิชาการ The 6th International Conference on Environmental Geochemistry in Tropics—Urban Issues ในระหว่างวันที่ 4 ถึง 7 พฤศจิกายน 2553 ณ Chinese Academy of Sciences เมือง Xiamen ประเทศจีน

ดร.สุมนา สิริพัฒนากุล ได้ส่งผลงานวิจัยและได้รับการตอบรับให้นำเสนอบทความ "Hospital Wastewater Treatment Deterioration by Disinfectants: Effects of Types and Concentrations" ด้วยวาจา การนำเสนอผลงานดังกล่าวเป็นการเผยแพร่ความรู้ทางด้านการจัดการสิ่งแวดล้อมเมืองในประเทศไทย ซึ่งเป็นปัญหารุนแรงในปัจจุบัน รวมทั้งเป็นการแลกเปลี่ยนความรู้และสร้างเครือข่ายนักวิจัยในระดับนานาชาติ ตลอดจนเป็นการสร้างชื่อเสียงให้กับมหาวิทยาลัยและประเทศไทย

5. วัตถุประสงค์ของโครงการ

- เพื่อเผยแพร่ผลงานวิจัยเรื่อง Hospital Wastewater Treatment Deterioration by Disinfectants: Effects of Types and Concentrations
- เพื่อเข้าร่วมแลกเปลี่ยนความรู้จากวิทยากรผู้เชี่ยวชาญอื่น เพื่อส่งเสริมพัฒนาผลงานวิจัย
- เพื่อศึกษาเรียนรู้วิทยาการสมัยใหม่ เพื่อใช้พัฒนาศักยภาพงานวิจัยและงานสอนต่อไป

6. ระยะเวลาดำเนินงาน

ระยะเวลารวม 9 วัน (รวมวันเดินทาง ตั้งแต่มหาวิทยาลัยอุบลราชธานี) ระหว่างวันที่ 2 ถึง 10 พฤศจิกายน 2553

7. ประโยชน์ที่คาดว่าจะได้รับ

- ได้มีโอกาสเผยแพร่ผลงานวิจัย คณะวิศวกรรมศาสตร์ และมหาวิทยาลัยต่อนักวิชาการจากนานาชาติ
- ได้มีโอกาสเผยแพร่ผลงานวิจัยและแลกเปลี่ยนองค์ความรู้ระหว่างนักวิจัยจากประเทศต่าง ๆ

- ได้มีโอกาสเพิ่มพูนความรู้ทางด้านการจัดการสิ่งแวดล้อมจากงานประชุมนี้

8. งบประมาณ

ประมาณการค่าใช้จ่ายการนำเสนอผลงานวิจัย

รายการ	จำนวนเงิน (บาท)
1. ค่าเดินทางไป-กลับ ชั้นประหยัด (ตามที่จ่ายจริง)	
1.1 เส้นทางในประเทศ อบ.-กท.-อบ.	1,482
1.2 เส้นทางระหว่างประเทศ กท.-เซียะเหมิน-กท.*	14,500
2. ค่าเดินทางภายในต่างประเทศ (ตามที่จ่ายจริง)	1,000
3. ค่าเบี้ยเลี้ยงระหว่างวันที่ 3-8 พฤศจิกายน 2553 (6 วัน)	12,600
4. ค่าที่พัก (50 USD * 4 วัน)**	6,200
5. ค่าลงทะเบียนประชุม (350 USD)**	10,850
6. ค่าพาหนะรับจ้างระหว่างบ้านพักถึงสนามบินในประเทศ	600
7. ค่าธรรมเนียมวีซ่า (จ่ายตามจริง)	0
รวม	**47,232**

* ขอเดินทางด้วยสายการบินนอกประเทศเนื่องจากสายการบินไทย
ไม่มีเที่ยวบินในวันที่ต้องการ

**ประมาณการอัตราแลกเปลี่ยน 1USD = 31 Baht

(ดร.สุมนา สิริพัฒนากุล)
อาจารย์ประจำภาควิชาวิศวกรรมเคมี
คณะวิศวกรรมศาสตร์ มหาวิทยาลัยอุบลราชธานี

The 6th International Conference on
Environmental Geochemistry in Tropics
--Urban Issues
November 4-7, 2010, Xiamen, China

GeoTrop 2010

http://www.xiamenforum.org/geotrop
Voice and Fax: +86-592-6190-778
Email: syu@iue.ac.cn

GeoTrop 2010 Conference Secretariat
Key Laboratory of Urban Environment and Health
Institute of Urban Environment
Chinese Academy of Sciences
1799 Jimei Road
Xiamen 361021, China
Saturday, October 02, 2010

Department of Chemical Engineering
Faculty of Engineering
Ubon Ratchathani University
Ubon Ratchathani 34190, Thailand

Dear Dr. Sumana Siripattanakul,

Thank you very much for submitting your manuscript, entitled as "Hospital Wastewater Treatment Deterioration by Disinfectants: Effects of Types and Concentrations", to the 6th International Conference on Environmental Geochemistry in Tropics—Urban Issues. The conference will take place in Xiamen, China in the Institute of Urban Environment, CAS on Nov. 4-7, 2010.

On behalf of the organizing committees, I am glad to inform you that your manuscript has been accepted as an oral presentation for the GeoTrop 2010 Conference.

If you are an international scientist, please contact us for documents of visa application. We need **passport number,dat e of birth and place**, and **details of affiliation and physical address** for the visa invitation form. Please notice that the Conference committees and Society of Environmental Geochemistry and Health (SEGH) cannot provide financial support to representatives visiting our country for this occasion. All meeting costs (travel, subsistence, registration fee, etc.) will be the responsibility of the individual or the organization sending the representative. Registration, housing, and program information for the conference can be found on our website at https://www.xiamenforum.org/geotrop.

We feel your attendance at this conference will provide you with an excellent opportunity to interact with other scientists, teachers, and researchers internationally in semitropical and tropical countries. This acceptance letter is also severed as an official invitation letter for your participation.

Sincerely yours,

Shen Yu, Ph.D.
Professor

Call for papers:
The deadline for abstract submission for poster and oral presentations has been extended to August 1, 2010. Abstracts should include the objectives, results and conclusion of a study, and should be no more than 300 words. Selected papers will be published in a leading international journal in environmental science and technology. Please mark the corresponding author (*) and the presenter (@) who will attend the conference.

Provisional conference program:
November 4: Registration
November 5: Plenary and symposium sessions
November 6: Inter-conference tour to Hakka Earth Building Complex in Chuxi Village, Yongding County, Fujian Province (http://en.fjta.com)
November 7: Symposium sessions and closing
November 8: Departure

Language:
The working language is English.

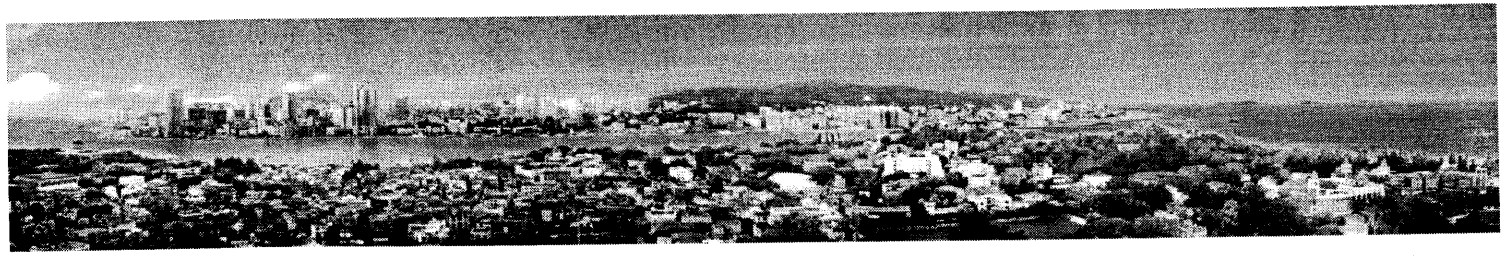
Fees:
Registration fee:
Before September 1, 2010 (Early-birds)
US$300 for regular participants
US$200 for graduate students
On and After September 1, 2010
US$350 for regular participants
US$250 for graduate students

Travel Guide:
Overseas participants can choose their connection to Xiamen in Shanghai, Beijing, Guangzhou, or Hong Kong. Foreign participants who need to apply for a visa to enter China please enclose your passport number and date of birth in the registration form.

Important Deadlines:
Abstract submission: August 1, 2010
Early-bird registration: September 1, 2010
Conference dates: November 4-7, 2010
Cancellation deadlines:

- Full refund before September 1, 2010 (the transaction and administration fees applied)
- Half refund before October 1, 2010 (the transaction and administration fees applied)
- No refund after October 1, 2010.

The time for deadlines: 5:00 pm at Beijing Time



Contact:
Prof. Shen Yu
GeoTrop 2010 Conference Secretariat
Institute of Urban Environment
Chinese Academy of Sciences
1799 Jimei Road
Xiamen 361021, China
Phone: 86-592-619-0778
Fax: 86-592-619-0778
Email: syu@iue.ac.cn
Website: http://www.xiamenforum.org/geotrop

Second Announcement

GeoTrop 2010

The 6th International Conference on

Environmental Geochemistry in Tropics--Urban Issues

November 4-7, 2010, Xiamen, China

Co-organized by
Institute of Urban Environment (IUE)
Chinese Academy of Sciences (CAS)

Society of Environmental Geochemistry and Health (SEGH)

Co-sponsored by
Chinese Academy of Sciences (CAS)

National Natural Science Foundation of China (NSFC)

Hospital Wastewater Treatment Deterioration by Disinfectants: Effects of Types and Concentrations

Sumana Siripattanakul[1,2*], Napajaree Sangsing[1], Pongsatorn Taweetanawanit[1], Warayut Patichot[1]

[1] *Department of Chemical Engineering, Faculty of Engineering, Ubon Ratchathani University, Ubonratchathani 34190, Thailand*

[2] *National Center of Excellence for Environmental and Hazardous Waste Management, Ubon Ratchathani University, Ubonratchathani 34190, Thailand*

**Corresponding author, e-mail sumana.s@ubu.ac.th, jeans_sumana@yahoo.com*

ABSTRACT

This study aims to investigate effect of disinfectants on efficiency of hospital wastewater treatment. Different types and concentrations of the disinfectants were tested to determine their influences to the wastewater treatment system. The duplicate batch experiment (laboratory scale) was conducted for 8 hr. Three commercial disinfectants including Glutaraldehyde (GA), Povidone Iodine (PI), and Eco-friendly biocide (EB), the most three types used in the hospital, were chosen. Synthetic wastewater with initial chemical oxygen demand (COD) of approximately 300 mg/L and acclimated activated sludge of 1,000 mg/L of suspended solids were used. The result showed that after testing for 8 hr, COD removal efficiency from the test with PI was about 43% while the COD removal of other tests (GA, EB, and no disinfectants) were 64-70%. This indicated that PI (inhibition of 48%) substantially affected the wastewater treatment efficiency whereas GA (inhibition of 14%) and EB (inhibition of 5%) just slightly influenced the wastewater treatment system. In later experiment, only PI was focused. For the effect of disinfectant concentrations, the result showed that the tests at PI concentrations of 0.1, 0.2, and 0.3% (of the hospital used concentration) reduced COD by 48, 28, and 22%, respectively (inhibition of 48-60%). A higher concentration resulted in more adverse effect.

KEYWORDS

Disinfectant; Inhibition; Hospital wastewater treatment

INTRODUCTION

It has been known that hospital is one of service facilities producing a large amount of wastewater (Boller, 1997; Chitnisa et al., 2004; Verlicchi et al., 2010). Since hospital wastewater was verified as a major source of emerging pollutants; therefore, in many countries, hospital wastewater treatment system was required. Typical hospital wastewater treatment systems are activated sludge processes (Figure 1). It was commonly found that the treated effluent from the systems did not meet hospital wastewater standard for organic (BOD or COD) removal. One of potential major sources could be biocides including disinfectants contaminating in the wastewater (Chitnisa et al., 2004; Rezaee et al., 2005).

Disinfectants are chemicals used for disinfection of surfaces, instruments and skin. It is known that a large amount and various types of disinfectants are used in hospital, such as halogenated, aldehyde, and phenolic compounds. The disinfectants do not only kill germ for medical purpose but also can cause failure in wastewater treatment

system. Bodik et al. (2008) found that hypochlorite-based disinfectants inhibited municipal wastewater treatment efficiency of 97%.

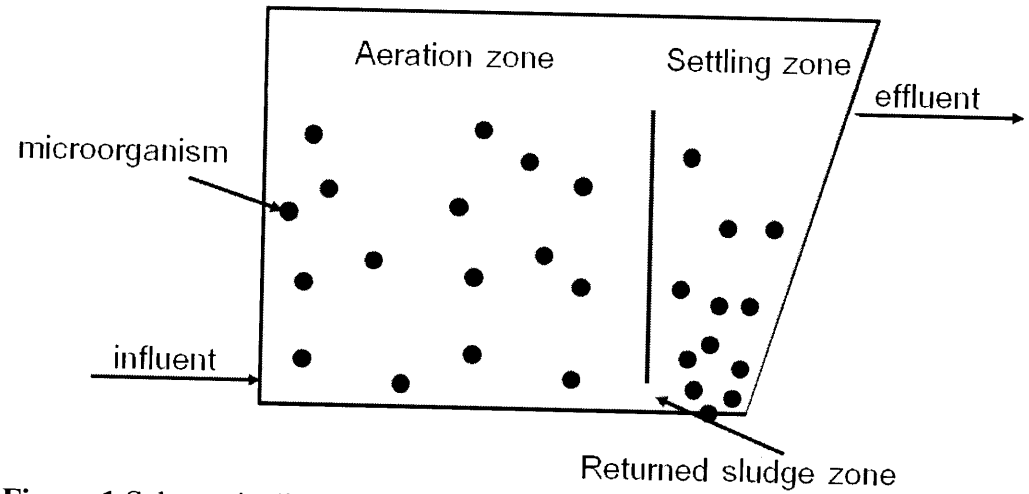


Figure 1 Schematic diagram of typical hospital wastewater treatment

However, to the best of our knowledge, there is no study on effect of disinfectants on hospital wastewater treatment. The aim of this study is to examine influence of disinfectants on hospital wastewater treatment performance. The study includes effects of disinfectant types and concentrations. The tests with wastewater without disinfectant were also conducted for comparative purpose.

METHODS

Synthetic hospital wastewater

Synthetic hospital wastewater was prepared followed wastewater characteristics from a model district hospital in Warinchamrap, Ubonratchathani, Thailand. The wastewater synthesized from $C_{12}H_{22}O_{11}$, $CO(NH_2)_2$, and $Ca(H_2PO_4).H_2O$ at COD:N:P of 100:5:1. The COD and pH values were approximately 300 mg/L and 6.5 to 7.0, respectively. Three types of commercial disinfectants (Glutaraldehyde (GA), Povidone Iodine (PI), and Eco-friendly biocide (EB)) with different concentrations were then added in the synthetic wastewater at concentrations as shown in Table 1.

Table 1 Descriptions of components in wastewater treatment inhibition kinetic tests

Test No.	Test description*	Reactor name	Disinfectant	
			Type	Concentration** (%, v/v)
1	Effect of disinfectant types	TYPE-GA	GA	0.1
		TYPE-PI	PI	0.1
		TYPE-EB	EB	0.1
		TYPE-ND	no disinfectant	0.0 (control)
2	Effect of disinfectant concentrations	CONC-0.1	The worst type from test 1	0.1
		CONC-0.2		0.2
		CONC-0.3		0.3
		CONC-0.0		0.0 (control)

* Activated sludge concentration in reactors was 1,000 mg SS/L

** The concentration used in this study was the ratio of the practical volume and wastewater volume (v/v).

Activated sludge cultivation, acclimatization, and preparation

Municipal activated sludge was used in this study to avoid residue of disinfectants in hospital activated sludge. The activated sludge was cultivated and acclimated in a 30-L reactor for 2 months before application. The reactor was operated in sequencing batch reactor (SBR) mode with hydraulic retention and solid retention times of 1 and 30 days, respectively. Dissolved oxygen concentration (DO) of higher than 1 mg/L was continuously supplied.

The activated sludge from the 30-L reactor of 1,000 mL was centrifuged at 7,000 rpm for 10 min to obtain concentrated cells. The concentrated cells were vigorously resuspended in sterile de-ionized water (DI) of 10 mL. The concentrated cells were used.

Wastewater treatment inhibition kinetic test: effect of disinfectant types

This study focused on the effect of disinfectant types on wastewater treatment inhibition. Based on three-year inventory information given by the model hospital, the three highest utilized disinfectants (GA, PI, and EB) were selected. The experiment aimed for choosing the worst disinfectant based on wastewater treatment performance for later experiment.

Duplicate experiment contained 4 reactors including reactors testing effects of GA, PI, EB, and control (no disinfectant) designated TYPE-GA, TYPE-PI, TYPE-EB, and TYPE-ND, respectively (Table 1). The synthetic wastewater (250 mL) with disinfectant concentration of 0.1% by volume and the concentrated acclimatized activated sludge (or sterile DI) was filled in the reactors. Final activated sludge in the reactors was 1,000 mg SS/L. All reactors were shaken at 150 rpm and 30°C for 8 hr. Dissolved oxygen concentration of higher than 1 mg/L was continuously supplied. Wastewater samples of 10 mL were taken at once in an hour for entire of the experiment to measure soluble COD. Wastewater treatment reaction kinetics and wastewater treatment efficiency were determined. Inhibition of wastewater treatment was then calculated as shown in equation 1 followed Ochoa-Herrera et al (2009).

$$\text{Inhibition (\%)} = 100 \times (\text{Average activity of the reactor}) / (\text{Average activity of the control}) \quad \text{eq. 1}$$

Wastewater treatment inhibition kinetic test: effect of disinfectant concentrations

This part emphasized on the effect of disinfectant concentrations on wastewater treatment inhibition. The worst disinfectant from earlier section was selected. The experiment preliminary figured out relationship of the disinfectant concentrations and the inhibition.

Duplicate experiment contained 4 reactors including reactors testing effects of the selected disinfectant at the concentrations of 0.1, 0.2, 0.3, 0.0 (control) % by volume designated CONC-0.1, CONC-0.2, CONC-0.3, and CONC-0.0, respectively (Table 1). The compositions in the reactors, the reactor operation, and wastewater sampling were analogous to earlier experiment. The result were then determined wastewater treatment kinetics, wastewater treatment efficiency, and wastewater treatment inhibition.

Analytical procedures

COD, SS, and pH were measured according to standard methods (APHAl, 1998). After filtering water sample using GF/C filter glass paper, soluble COD was measured by potassium dichromate digestion method. The filtrate was used for measuring SS whereas pH was measured by using a pH meter (inoLab pH level 1, WTW GmBH, Weilheim, Germany).

RESULTS AND DISCUSSION

Wastewater treatment inhibition kinetic test: effect of disinfectant types

The effect of disinfectant types on wastewater treatment inhibition was determined. Figure 2 presents normalized COD remaining in the synthetic wastewater during the test for 8 hr. Average initial COD from duplicate experiment was 370 mg/L. The trends of COD reduction at the tests with different disinfectants and without disinfectant were similar. The COD value rapidly decreased within the first 4-5 hr and slightly decreased in a later period.

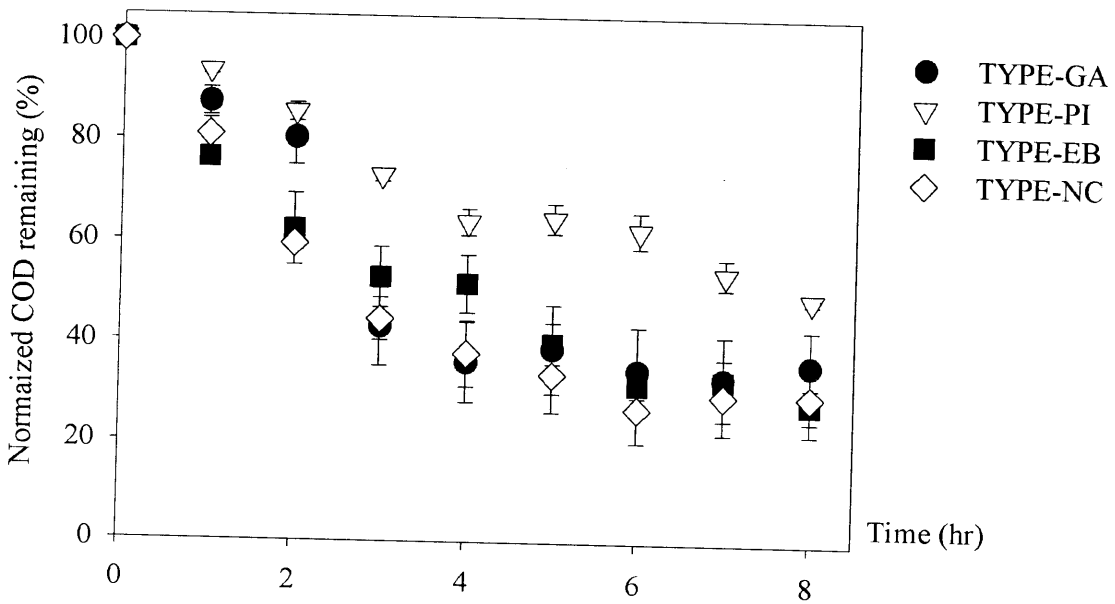


Figure 2 Normalized COD in the effect of disinfectant type test

At the end of the experiment (8 hr), COD reduced for 64, 50, 69, and 70% in the TYPE-GA, TYPE-PI, TYPE-EB, and TYPE-ND reactors, respectively. This indicated that different types of disinfectants could inhibit the wastewater treatment activities differently. The TYPE-ND reactor which was a control (no disinfectant) removed COD for 70% while the other reactors having chemicals decreased COD lower than the control for 1 to 20%.

The wastewater treatment inhibition and kinetics were shown in Table 2. The inhibition by the disinfectants ranged from 5 to 49% of the control. The removal of COD by all reactors well fitted with the first order kinetic reaction at the rate constants of 0.09 to 0.16 hr^{-1}.This obviously proved that the disinfectants played an important role to the activated sludge resulting in lower wastewater treatment

performance. The disinfectants damaged microorganisms by injuring cell wall, membrane, and cytoplasm (Verlicchi et al., 2010).

Table 2 Treatment kinetics and inhibition in the effect of disinfectant type test

Reactor name	Inhibition (% of control)	Wastewater treatment kinetics		
		Equation*	R^2	Rate constant (hr^{-1})
TYPE-GA	14.11	Y = -0.15X+4.49	0.79	0.15
TYPE-PI	47.85	Y = -0.09X+4.60	0.97	0.09
TYPE-EB	4.82	Y = -0.15X+4.50	0.97	0.15
TYPE-ND	Control	Y = -0.16X+4.44	0.87	0.16

* Y = ln COD and X = time

Povidone-iodine affected the treatment efficacies of 3 and 10-time higher than GA and EB. Even though EB chemical structure is confidential, it is obvious that EB is a disinfectant good for the environment. Therefore, it just slightly affected wastewater treatment activity. Between GA and PI, it is known that GA considered as moderate to high efficient disinfectant while PI is moderate efficient disinfectant. However, the wastewater treatment inhibition and kinetics turned out contradictory. It may be because PI was normally used for treatment of skin infection and wound but GA was for instrument disinfection. Therefore, PI concentration applied in the hospital was higher than GA resulting in concentrations (0.1% of used concentration by volume) contaminated in wastewater were different (PI concentration was higher than GA).

Wastewater treatment inhibition kinetic test: effect of disinfectant concentrations

The effect of disinfectant concentrations on wastewater treatment inhibition was determined. Figure 3 presents normalized COD remaining in the synthetic wastewater during the test for 8 hr. In the control reactor (CONC-0.0), the COD value rapidly decreased within the first 6 hr and slightly reduced thereafter. The trends of COD reduction in all tests with disinfectants were similar. The COD value gradually reduced for entire of the experiment. At the end of the experiment (8 hr), COD removal efficiencies of 50, 27, 23, and 85% from the CONC-0.1, CONC-0.2, CONC-0.3, and CONC-0.0 reactors, respectively were observed. This indicated that higher concentration of disinfectants attributed to lower the wastewater treatment. Similar result also found in the previous study (Ochoa-Herrera et al., 2009). The study reported higher fluoride concentrations (5 to 300 mg/L) lessened wastewater treatment efficiency.

The wastewater treatment inhibition and kinetics were shown in Table 3. The inhibition by the disinfectants was between 48 and 61% of the control. The removal of COD by the reactors with disinfectants followed the first order kinetic reaction at the rate constants of 0.03 to 0.09 hr^{-1}.This clearly indicated that the disinfectant concentrations influenced to wastewater treatment performance. Moreover, based on the results from the CONC-0.2 and CONC-0.3 reactors, it could say that the PI concentration of 0.2% or higher were completely inhibited the wastewater treatment activity. The COD value of approximately 20% which was removed may be from microorganism tolerating to PI. However, it is inconclusive; the continued work on antimicrobial resistant community in this case should be performed.

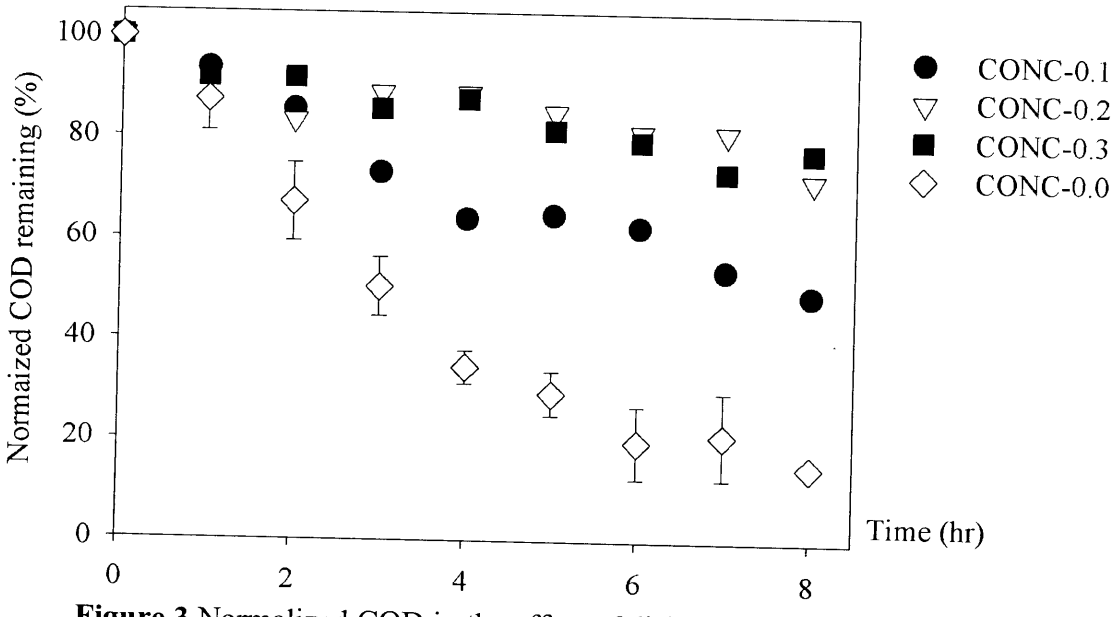


Figure 3 Normalized COD in the effect of disinfectant concentration test

Table 3 Treatment kinetics and inhibition in the effect of disinfectant concentration test

Reactor name	Inhibition (% of control)	Wastewater treatment kinetics		
		Equation*	R^2	Rate constant (hr^{-1})
CONC-0.1	47.85	Y = -0.09X+4.60	0.97	0.09
CONC-0.2	60.42	Y = -0.03X+4.57	0.77	0.03
CONC-0.3	60.71	Y = -0.03X+4.58	0.91	0.03
CONC-0.0	Control	Y = -0.25X+4.64	0.98	0.25

* Y = ln COD and X = time

CONCLUSIONS

It has been known that hospital wastewater treatment systems are not successfully operated. This could be from numerous chemicals used in hospitals including drugs, disinfectants, and laboratory chemicals. Povidone-iodine substantially inhibited the wastewater treatment efficiency (inhibition of 48%) whereas other disinfectants insignificantly influenced the wastewater treatment system. A higher concentration resulted in more adverse effect to wastewater treatment efficiency and microorganism activity. The continued work on wastewater treatment abatement should be performed for solving the problem. Also, the work on disinfectant-tolerated microbial community was recommended for insight information.

ACKNOWLEDGMENTS

This material is based upon work supported by Office of the National Research Council of Thailand. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of Office of the National Research Council of Thailand. The author thanks Warinchamrap Hospital, Ubonratchathani, Thailand for providing the wastewater samples and disinfectant utilization information.

REFERENCES

APHA. 1998. *Standard Methods for the Examination of Water and Wastewater*. 20th ed, American Public Health Asscociation/ American Water Works Association/ Water Environment Federation, Washington DC, USA.

Bodik, I., Gasparikova, E., Dancova, L., Kalina, A., Hutnan, M., and Drtil, M. 2008. Influence of disinfectants on domestic wastewater treatment plant performance. *Bioresource Technology*. 99, 532-539.

Boller, M. 1997. Small wastewater treatment plants-a challenge to wastewater engineers. *Water Science and Technology*. 35, 1-12.

Chitnisa, V., Chitnisa, S., Vaidyaa, K., Ravikanta, S., Patilb., S., and Chitnisa, D.S. 2004. Bacterial population changes in hospital effluent treatment plant in central India. *Water Research*. 38, 441-447.

Ochoa-Herrera, V., Banihani, Q., Leon, G., Khati, C., Field, J. A., and Sierra-Alvarez, R. 2009. Toxicity of fluoride to microorganisms in biological wastewater treatment systems. *Water Research*. 43, 3177-3186.

Rezaee, A., Ansari, M., Khavanin, A., Sabzali, A., and Aryan, M. M. 2005. Hospital wastewater treatment using as integrated anaerobic and aerobic fixed film bioreactor. *American Journal of Environmental Sciences*. 1(4), 259-263.

Verlicchi, P., Galletti, A., Petrovic, M., and Barcelo, D. 2010. Hospital effluents as a source of emerging pollutants: An overview of micropollutants and sustainable treatment options. *Journal of Hydrology*. 389, 416–428.

GeoTrop 2010 Conference, the 6th International Conference on Environmental Geochemistry in Tropics--Urban Issues has extended its abstract submission deadline up to August 1, 2010.

The GeoTrop conference series aims to bring together colleagues from tropical and subtropical countries to exchange and present new information and achievements on urban environmental pollution and related basic environmental chemistry and geochemical research. In the past few decades, urbanization has been a dominant anthropogenic influence on environmental quality in tropical countries and is increasingly challenging environmental tolerances and capacities. Water, air, and soil are suffering from these emerging challenges. Scientists have an important role to play in sustainable and healthy development in tropical cities.

GeoTrop 2010 Conference welcomes presentations (oral and poster) on toxic metals, persistent organic pollutants, hydrological and hydrogeological issues, air, water, and soil pollution, estuarine and near-shore environments as well as more basic research on ecology, soil and sediment, and waters. Participation from non-tropical areas is welcome, where studies are relevant to tropical problems.

To meet the wide and ambitious scope, the committees of **GeoTrop 2010 Conference** have recruited seven keynote speakers distinguished internationally to present plenary talks in the conference. They are:

Dr. Peter M. Groffman
Senior Scientist, Cary Institute of Ecosystem Studies, USA

Title: The Bio-Geo-Socio-Chemistry of Urban Watersheds

Chair Prof. Dr. Ming Hung Wong
Director, Croucher Institute for Environmental Sciences
Hong Kong Baptist University, China

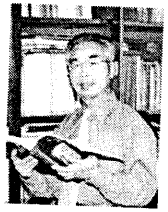
Title: Some Emerging Chemicals Management Issues in Developing Countries and Countries with Economies in Transition

Prof. Dr. Max M. Häggblom
Chair, Department of Biochemistry & Microbiology
Rutgers, The State University of New Jersey, USA

Title: Microbes to the Rescue: Harnessing the Activity of Dehalogenating Bacteria for Cleanup of Contaminated Sediments

Prof. Dr. Kyoung –Woong Kim
Dean, School of Environmental Science and Engineering
Gwangju Institute of Science and Technology, Korea

Title: Arsenic in Groundwater Resources in Hanoi and Hanam Provinces in Vietnam



Prof. Dr. Zhi Hong Cao
Ex-director, Institute of Soil Science, Chinese Academy of Sciences, China

Title: Origin of Chinese Paddy Soils and its Wetland Function for Living Wastewater Treatment

Prof. Dr. Yong Ming Luo
Director, Key Laboratory of Soil Environmental and Pollution Remediation, Institute of Soil Science, Chinese Academy of Sciences, China

Title: Remediation and Sustainable Uses of Soil and Groundwater in Urban Contaminated Sites

Prof. Dr. Andrew Meharg
Chair, Department of Biogeochemistry
University of Aberdeen, UK

Title: E-wastes and Plastics Burning – Multiple Contaminant Sources to Urban Environments