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Hanoi University of Science & Technology

South East Asian Technical University Consortium

Shibaura Institute of Technology

PROCEEDINGS

The 5th South East Asian Technical University Consortium (SEATUC) Symposium

February 24-25, 2011

Hanoi University of Science & Technology, Ha Noi, Viet Nam

HYBRID TWINNING PROGRAM 2010

PREFACE

SEATUC (South East Asian Technical University Consortium) was founded in 2006 with the aims of creating opportunities to exchange collaboration in educational and research activities among its member universities; fostering the exchange of scientific and engineering activities by the member universities through symposia, publications, promotion of research and personnel exchange for the benefit of people in South East Asian countries. This year, the Consortium will organize its 5th Symposium on 24th – 25th February 2011 at Hanoi University of Science and Technology (HUST), Vietnam.

The Symposium this year has broadened from 6 to 14 engineering fields with the total papers of 148. This record number shows the popularity of the Symposium among researchers and students of member institutions and the continuous success of the Consortium.

On behalf of the Organizing Committee, I would like to express my appreciation to Hanoi University of Science and Technology (HUST) for their great effort in hosting the event, and Shibaura Institution of Technology (SIT) for their co-organization in holding the Symposium. My appreciations are also to scientists, researchers and students who have submitted papers and actively participated in the Symposium.

Prof. Dr. Ha Duyen Tu
Vice-President of Hanoi University of Science and Technology
President of SEATUC

Time Table of 5th SEATUC SYMPOSIUM, HUST (Vietnam) Feb. 24th – 25th 2011

DAY 1: 24th February 2011 (Thursday)

TIME	VENUE and EVENT											
09:45 12:00	Venue: SEMINAR ROOM at the 10th Floor, Ta Quang Buu Library, HUST, Hanoi Event: Opening Ceremony of 5th SEATUC Symposium											
12:00 13:00	*Lunch Break at the 10 Floor, Ta Quang Buu Library, HUST*											
	ROOM 811		**ROOM 812**		**Room 813**		**ROOM 814**		**Room 902**			
	OS 12		**OS 04**		**OS 05**		**OS 03**		**OS 03**			
13:00 15:20	SIT	Goro Fujita	SIT	Taisuke Ishii	SIT	Hiroshi Hasegawa	UTM	Syuhaida Ismail	UTM	Azhan Abdul Aziz		
	SIT	Satoshi Matsumoto	SIT	Yoshihiko Ito	SIT	Kanlaya Rattanyu	UTM	Ismail Bin Said	UTM	Bagoes W.		
	SIT	Zulkarnain B.A.N.	SIT	Masanori Muroi	SIT	Krissana Nerakae	UTM	Yendo Afgani (1)	UTM	Didel M. Juliet		
	SIT	Arwindra R.	SIT	Pichitra Uangpairoj	SIT	Makoto Mizukawa	UTM	Yendo Afgani (2)	UTM	Lai, L.Y		
	SIT	Tatsuhiro Mineo	SIT	Takayuki Arimatsu	SIT	M.Azizi A. Rahman	UTM	Alireza Daneshpour	UTM	Hafizul Ridzwan Yahya		
	SIT	Nguyen Duc Tuyen	SIT	Masayuki Kobayashi	SIT	Pham Ngoc Hieu	SIT	Hoko Miwa (1)	UTM	Aliyu Salisu Barau		
	HCMUT	Nguyen P. Khai	SIT	Hiroki Obata	SIT	Phi Nguyen Truong	SIT	Hoko Miwa (2)	UTM	Ho Chin Siong		
15:20 15:40	*Coffee Break*											
15:40 18:00	HUST	Binh Minh Nguyen	SIT	Nobutaka Maezaki	SIT	Tadahiro Hasegawa	**OS 06**		UTM	Farhana Abdullah		
	HUST	Le Minh Thuy	SIT	Kenichi Iwata	SIT	Skulkittiyut Weerachai	SIT	Tatsuhiko Aizawa (1)	UTM	Abdullah Sani A		
	HUST	Luu Hong Viet	SIT	Masahiro Shibata	SIT	Youichi Hanakura	SIT	Tatsuhiko Aizawa (2)	UTM	Abdullah Sani Hj Ahmad		
	OS 14		KMUTT	Dau Hung Anh	SUT	Chaiyapak S.	SIT	Foo Jin Hoe	UTM	Ismail Said		
	HUST	Hoang Thi Linh	KMUTT	K. Saengchan	SUT	Chompunuch Lapo	SIT	Muhammad Zaimi	UTM	Juliana Johari		
	HUST	Pham Duc Duong	HUST	Truong Q. Phong	SUT	Jittima Varagul	SIT	Yuki Kagawa	UTM	Kei Saito		
	HUST	Nhu Phuong Mai	HUST	Nguyen T.X. Sam	HUST	Hoang Vinh Sinh	SIT	Yohei Hirohata	UTM	Ludin, A.N.M		
			HUST	Vu Thi Minh Hang	TNUT	Nguyen T Q Dung	SIT	Nor Akmal Fadil				
18:30	**GALA DINNER at the 10 Floor, Ta Quang Buu Library, HUST**											

OS01: Energy and Environment
OS02:Information and Communication Technology
OS03:Architecture, Urban Planning and Design
OS04:Bioscience and Engineering
OS05:Robotics and Mechanical Engineering
OS06: Materials Science
OS08:Chemical Engineering
OS10:Transportation Engineering
OS12:Electrical Engineering
OS14:Textile Engineering

Time Table of 5th SEATUC SYMPOSIUM, HUST (Vietnam) Feb. 24th – 25th 2011

DAY 2: 25th February 2011 (Friday)

TIME	ROOM 811		ROOM 812		Room 813		ROOM 814		Room 902	
	OS 01		OS 02		OS 10		OS 06		OS 03	
09:00 10:20	SIT	Jun Matsushita	SIT	Eiji Kamioka	HUST	Dinh Manh Cuong	SIT	Hironori Seki	UTM	Azizul, M.F
	SIT	Hiroshi Morita	SIT	Hirotsugu Ishida	HUST	Khong Vu Quang	SIT	Kazuo Inoue	UTM	Mohamed A. Said
	UTM	Amer Nordin Darus	SIT	Itaru Sekita	HUST	Le Minh Thuy	SIT	Keiichi Hagiwara	UTM	Mohammad Ghomeshi
	UTM	Zanariah Jasmani	SIT	Masaomi Kimura	HUST	Ngo Van Hien (1)	KMUTT	Piyapong A.	UTM	Mahmud B.M J.
10:20 10:40	*Coffee Break*									
10:40 12:00	UTM	Farid Nasir Ani	SIT	Michiko Ohkura	HUST	Ngo Van Hien (2)	HUST	Le Tuan	UTM	Zinas zachariah Bako
	UTM	Mohd. Hamdan Bin Hj. Ahmad	SIT	Noboru Horita	HUST	Phu Khanh Nguyen	HUST	D.T.H. Hue	UTM	Sayyed Javad Asad Poor Zavei
	KMUTT	Eknarin A.	SIT	Nurzal E.B. Ghazali	HUST	Pham Huu Tuyen	HUST	Nguyen D. Nam	UTM	Mahdi Torabi
	KMUTT	Suchada C.	SIT	Shuto Murai	HUST	Minh Ngoc Tran	HUST	Le Thi Chieu	UTM	Mohd H. Rasidi
12:00 13:00	*Luch Break at the 10 Floor, Ta Quang Buu Library, HUST*									
13:00 15:20	KMUTT	Tarworn R.	SIT	Sittapong Settapat	HUST	Truong Viet Anh	HUST	P. Quang	UTM	Wan M Z W Abdullah
	ITB	Edwan Kardena	SIT	Yota Kogure	HUST	Quoc Huy Vu	HUST	Nguyen Van Luong	UTM	Nor Fadzila Aziz
	OS 08		HUST	Nguyen Tien Thanh	HUST	Le Thi Thai	HUST	Thai T.T	UTM	Nursuriani Shaffee
	SIT	Benjaporn T.	HUST	Phong H.Pham	HUST	Pham T T Huong			UTM	Nurzuliza Jamirsah
	UTM	Ida I. Muhamad	HUST	Dang Khoa Nguyen	HCMUT	Nguyen T.P. Linh			UTM	Rusli, N.
	UTM	Eraricar Salleh	HUST	Ha Quoc Trung	HCMUT	Nguyen Phi Son			UTM	Sara Izrar Binti Aziz
			KMUTT	Pakorn K.	HCMUT	Tran Van Mien			UTM	Sumaiyah B.O.
15:20 15:40	*Coffee Break*									
15:40 16:40			UTM	Ahmed H. Osman	UETI	Pham H.D. Duc			KMUTT	Chamnarn Tirapas .
			UTM	Mohd. Hamdan Bin Hj. Ahmad) (1)	IHR	Dinh Minh Hai			KMUTT	Nigel Poweri
			UTM	Mohd. Hamdan Bin Hj. Ahmad) (2)					SIT	Junko Tamura
16:45	**Symposium Closing**									

Time Table of Intensive Workshop, HUST (Vietnam) Feb. 24th, 2011

Date: Feb. 24th, 2011
Venue: Room 702, Ta Quang Buu Library, Hanoi University of Science and Technology (HUST), Hanoi, Vietnam

Time	Events
14:00 17:00	Presentations for 9 person The talk is 20 minutes for the presentation

Time Table of Intensive Workshop

- Date: February 24th (Thursday) 14:00－17:00
- Venue: Room 702, Ta Quang Buu Library
  Hanoi University of Science and Technology (HUST)

14:00-14:20 **"Hypophosphite Bath Base Electroless Nickel Ternary and Quaternary Alloy Deposition"**
Muhammad Zaimi, and Kazuhiko Noda, Shibaura Institute of Technology

14:20-14:40 **"A Web-based 3D Visualization to Promote Distance Learning"**
Sittapong Settapat[1], Virasin Archirapatkave[2], Tiranee Achalakul[2], and Michiko Ohkura[1], [1]Shibaura Institute of Technology, [2]King Mongkut's University of Technology Thonburi Thailand

14:40-15:00 **"The Similarity Index of Medicine Names Based on Character Shape Similarity"**
Keita Nabeta[1], Takahiro Imai[1], Masaomi Kimura[1], Michiko Ohkura[1], and Fumito Tsuchiya[2], [1]Shibaura Institute of Technology, [2]International University of Health and Welfare

15:00-15:20 **"A Study on Magnesium Recycling"**
Yohei Chigira, and Seiichi Yoshikubo, Shibaura Institute of Technology

15:20-15:40 **"Technological Trends of Digital Audio Players and Business Model for Future"**
Jyunki Morimoto, Shibaura Institute of Technology

15:40-16:00 **"Recycling of RE-Ba-Cu-O Bulk Superconductors"**
Yotaro Shimpo, Shuichiro Taniguchi, Yoji Ikeda, Naoki Koshizuka, and Masato Murakami, Shibaura Institute of Technology

16:00-16:20 **"New Carbon Material for Higher Rating of Electric Double Layer Capacitor"**
Zulkarnain Bin Ahmad Noorden, Shibaura Institute of Technology.

16:20-16:40 **"Model-Based Design for Service Robot System Development: A Contribution to Society"**
Mohd. Azizi Abdul Rahman, Akira Yasuda, and Makoto Mizukawa, Shibaura Institute of Technology

16:40-17:00 **"Studies on the Age Determination of Architectural Remains"**
Hoko Miwa, Shibaura Institute of Technology

OS 01: Energy and Environment

OS 02: Information and Communication Technology

OS 03: Architecture, Urban Planning and Design

OS 04: Bioscience and Engineering

OS 05: Robotics and Mechanical Engineering

OS 06: Material Science

OS 08: Chemical Engineering

OS 10: Transportation Engineering

OS 12: Electrical Engineering

OS 14: Textile Engineering

PRELIMINARY CHARACTERIZATION OF SORPTIVE PROPERTIES OF PHYTOPLANKTONIC CONSORTIUM IN TROPICAL ENVIRONMENT

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Institut Teknologi Bandung, Jalan Ganesa 10, Bandung 40132, Indonesia

ABSTRACT

Characterization of sorptive properties of phytoplanktonic consortium in tropical environment has been carried out by using phytoplankton consortium collected locally from a stabilization pond of wastewater treatment plant. The sorption parameters including iodine number, methylene blue number, functional groups of raw material of biosorbent, and morphological characteristic of cells surface were investigated. Biosorbent was prepared by oven drying and grinding, resulting powdered biosorbent of 50-mesh (0,300 mm). The iodine number of biosorbent determined by using AWWA 1974-method is 433. Fourier Infra Red Transform (FTIR) study of biosorbent indicated the presence of functional groups of amine, carboxyl, phosphate, and hydroxyl. Those functional groups are known for their role in binding metal ions. The micrographs of scanning electron microscopy revealed that the biosorbent has porous structure indicating its sorption capability. The methylene blue value could not be determined by using conventional method. The sorptive characteristics of phytoplanktonic consortium as shown from the results indicating its potential to be used for the development of a novel, cheap, competitive, and environmental friendly biosorbent for treatment of heavy metal-bearing wastewater.

1. INTRODUCTION

Heavy metals pollutant pose a great threat to the environment and human health because of their nonbiodegradable characteristics, toxicity, and biomagnification in the foodchain [1, 3]. Chronic exposure to heavy metal ions is known to cause serious health problems such as renal dysfunction, liver damage, and some of metal ions are carcinogens and mutagens as well [1, 3]. Therefore, the removal of heavy metal ions from the environment is enormously important [4].

Chemical precipitation, ion exchange, and membrane filtration are some of the conventional methods widely applied for heavy metal removal from water or wastewater [5]. These methods are effective for removal of high concentrations of heavy metal ions, but they are not cost-effective for removing low concentrations (1-100 mg l^{-1}) of the pollutants [6,7,8]. Furthermore, most of these techniques generating yet another problem in the form of toxic sludge [7]. Therefore, there is today a necessary to meet the environmental standards at affordable cost. Biosorption is an emerging technology that can be easily adopted in low cost to remove heavy metals from dilute and large amount of industrial wastewaters [7,9,10].

Phytoplankton biomass demonstrates different affinities and adsorption capacities toward different metals and therefore are strong candidates to be employed as biosorbent materials [11]. To the best of our knowledge, the biosorptive characteristics of phytoplanktonic consortium naturally abundant in nature, particularly in tropical environment, have not been reported. This work investigated some sorptive parameters of biosorbent, including iodine number, methylene blue adsorption, micrographs of scanning electron microscopy

*To whom correspondence should be made

(SEM), and FTIR spectrum of the phytoplanktonic consortium biosorbent.

2. MATERIAL AND METHODS

2.1 Collection of phytoplanktonic biomass

The biomass of phytoplanktonic consortium used in this study was collected from a stabilization pond located at Bandung, Indonesia, by using gradual filtration techniques.

2.2 Preparation of biosorbent

The biomass collected from the pond was washed three times with deionised distilled water in order to remove any residual solution, dried in an oven for 20 h at 60°C, and ground into powder. The powder was sieved by using a 50-mesh sieve (0,300 mm). The sieved powder finer than 0,300 mm was then examined its biosorptive characteristics and compared to those of powdered activated carbon (PAC).

2.3 Determination of iodine number and methylene blue adsorption

The iodine number of the biosorbent was determined by using the method of the American Water Works Association (AWWA B604-74) [12]. The methylene blue adsorption test is carried out by using spectrophotometry method. It is a quick test for substances prepared to adsorp large molecules [13].

2.4 SEM and FTIR Studies

The SEM micrographs of the biosorbent (taken on a model JEOL, JSM 6360 LA) are shown in Fig.1. The FTIR spectrum of the biosorbent was obtained on a Perkin Elmer FTIR (Spectrum GX). The IR spectrum is shown in Fig.2.

3. RESULTS AND DISCUSSION

3.1 Iodine number and methylene blue adsorption

The iodine number is defined as the milligram of iodine molecule that can be adsorbed by 1 gram of carbon when the iodine concentration of the residual filtrate is 0.02 N [12]. It is a measure of the volume present in pores from 10 to 28 Angstrom in diameter [13]. It gives an indication of the internal surface area of the carbon; generally in many adsorbents the iodine number is close to the Brunauer-Emmett-Teller (BET) surface area [14].

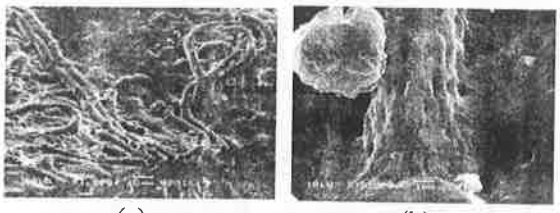
The iodine number of phytoplankton consortium biosorbent resulted in this study is 433 mg g^{-1}, lower than that of powdered activated carbon (800-1300 mg g^{-1}) [15]. The low iodine number of the biosorbent might be due to it is a raw material without any activation processed, different from activated carbon. However, the iodine number of the phytoplankton biomass is significantly higher than that of other biomasses, such as powdered dried biomass of *Acacia* leaf (193 mg g^{-1}) [unpublished data]. This result indicates that the phytoplankton biomass can be used potentially as metal ions biosorbent.

The methylene blue value is defined as the number of mililiters standard methylene blue solution decolorized by 0.1 g of adsorbent [14]. The methylene blue adsorption test gives an indication of adsorption capacity for large molecules having similar sizes to methylene blue molecule and also generally correlates to surface area of adsorbents. The spectrophotometric method applied in this work could not obtain the number of methylene blue adsorbed by the phytoplanktonic biomass due to the interference of chlorophyll content of powdered biomass. However, the low value of physical adsorption of methylene blue indicating the very low surface area of phytoplanktonic cells (below 1 m^2 g^{-1}), was observed in an experiment using fresh cells of *Spirulina* sp. The experimental results showed that physical adsorption was not the main mechanism of metal biosorption by using microalgal cells, it was estimated as only 3.7% of overall biosorption capacity [16].

3.2 Analysis of SEM micrographs and FTIR spectrum

Despite the fact that the methylene blue value of the biomass could not be examined, the sorption capability of the biomass towards large molecules can be inferred from the presence of macropores (>1,000 nm). The SEM micrographs of the biomass show porous structure of the

phytoplanktonic cells with various pore distribution (Fig. 1).



(a) (b)

Fig. 1 (a) SEM micrographs of phytoplanktonic biomass at magnification of 1,000 X; (b) porous

structure of the cells shown at magnification of 10,000 X.

The FTIR spectrum of phytoplanktonic biomass shows that the biomass contains mainly amine, carboxylic, phosphate, and hydroxyl moieties (Fig. 2). Most of biosorption researches reveal that sorption capability of various biosorbent highly dependent on the abundance and availability of those functional groups [16,17,18].

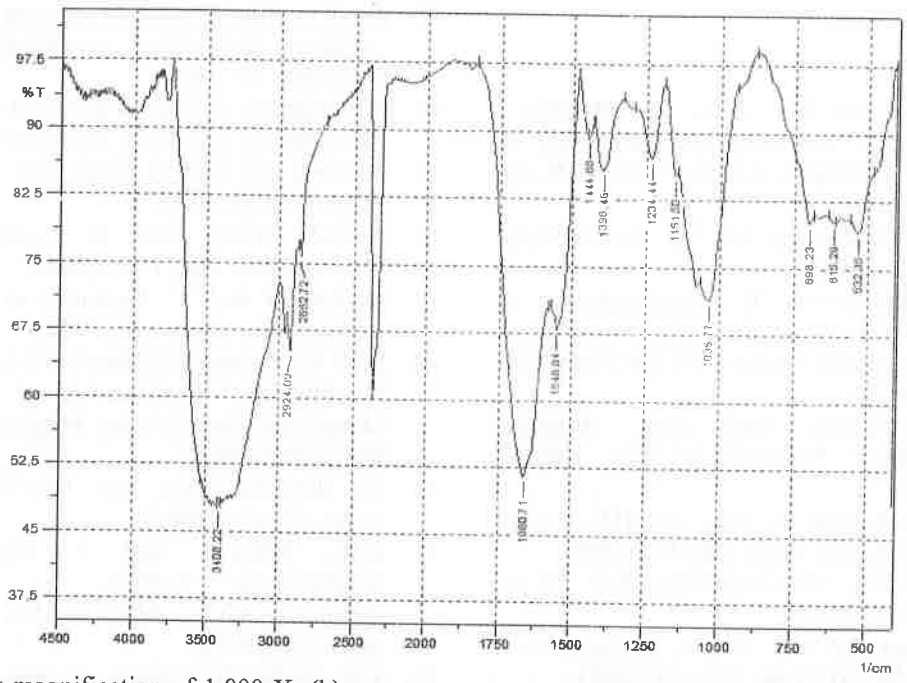


Fig. 2 FTIR spectrum of the phytoplanktonic biomass

The broad band appears at 3408 cm^{-1} in the FTIR spectrum of phytoplanktonic biomass can be assigned to the stretching of NH_2 group [19,22]. The next bands appear at the region between 3200 and 2400 cm^{-1} were attributed to O-H of carboxylic acid [22]. It is well known that both groups play important role on metal ions biosorption [23].

The peak at approximately 1660 cm^{-1} was assigned to C = O stretching frequency. Generally, peaks in the range of 1532 to 1560 cm^{-1} and 1430 to 1443 cm^{-1} are assigned, respectively, to asymmetric and symmetric stretching frequencies of carboxylate moiety [19,20]. The role of this functional group to bind metal cations was observed [11,16,21].

The bands appeared near at 1050-1030 cm^{-1} in fingerprint region was assigned to P-O-alkyl stretching frequency. Moreover, the bands present at the region of 1300-1250 cm^{-1} is attributed to P=O stretching frequency. Therefore, it can be suggested that the phytoplanktonic biomass contains phosphate group. This group is widely recognized for its binding capability towards certain metal ions [11,17]. On the basis of the absorptions intensity, it can be inferred the biomass contains lesser amount of P=O compared with P-O moiety. This is true for IR spectrum of *Chlorella* species as well [11].

4. CONCLUSION

Based on this initial evaluation of biosorptive properties, it can be concluded that the phytoplanktonic consortium biomass in tropical environment has abundance and various functional groups made them well suited for the removal of heavy metal ions in wastewater. Whereas, the low value of iodine number and methylene blue may be lead to the conclusion that physical adsorption is not the main biosorption mechanism of the biomass. Certainly there are still many uncertainties and further study is necessary.

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