AWPP 2010

ASIAN WORKSHOP on POLYMER PROCESSING in VIETNAM AWPP2010

December 7-10, 2010 Hanoi, Vietnam

PROCEEDINGS

Organized by

JSPP

ĐẠI HỌC BÁCH KHOA

SCIENCE AND TECHNICS PUBLISHING HOUSE

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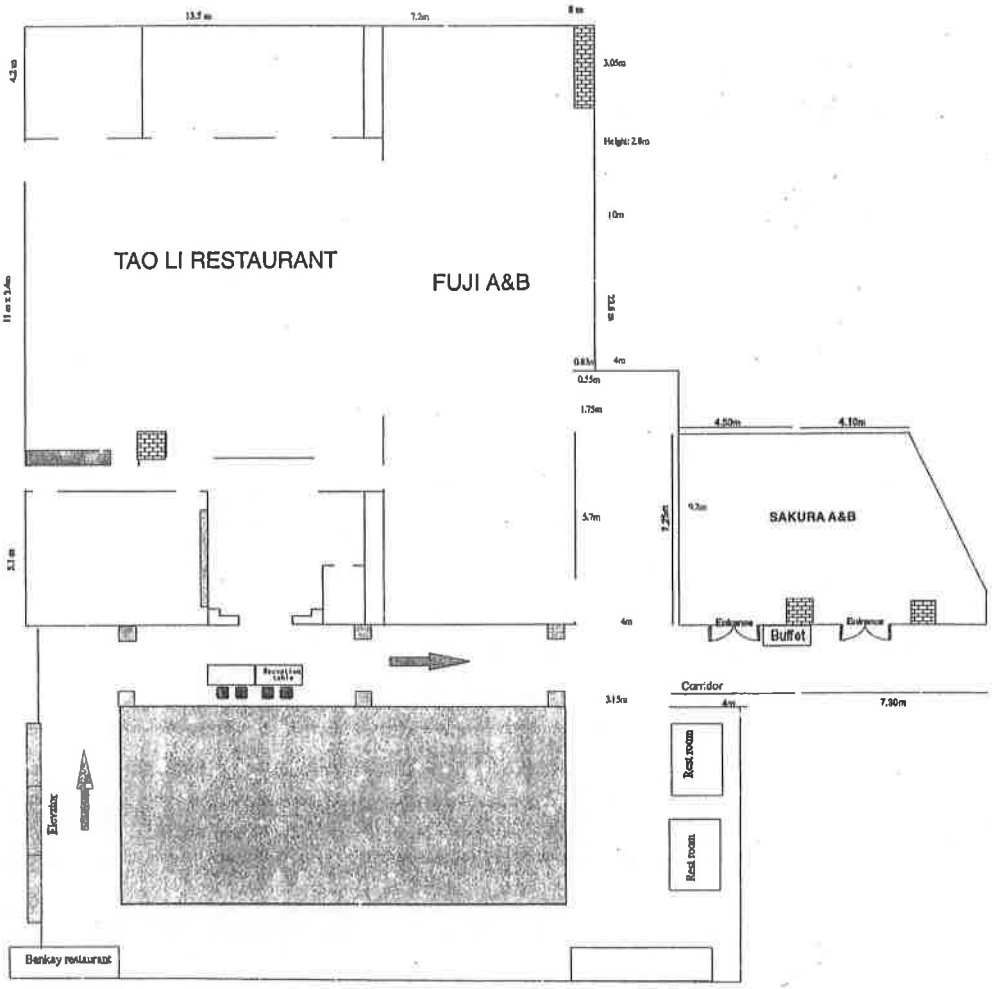
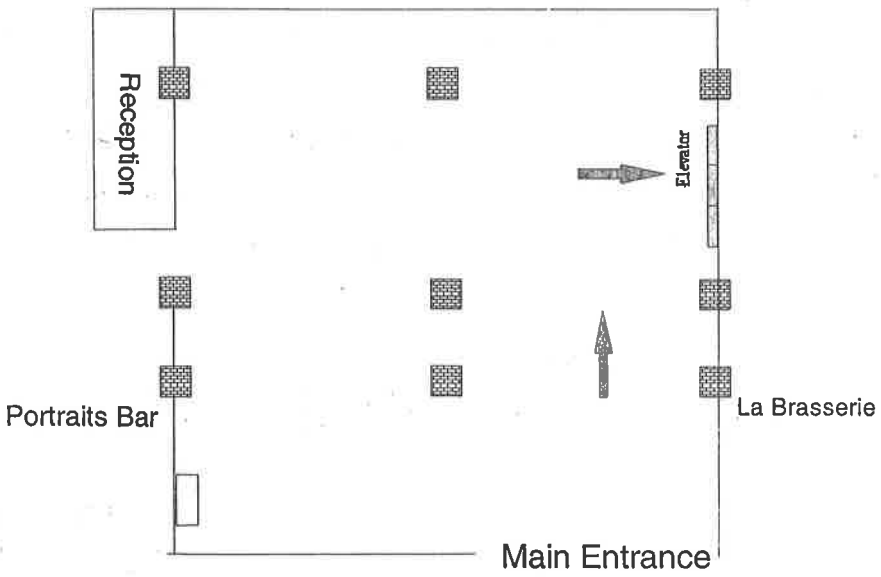


LOBBY FLOOR PLAN



Message from Hanoi University of Science and Technology

Prof. Ha Duyen Tu
Vice-President of Hanoi University of Science and Technology (HUST)

Dear distinguished guests,

Ladies and Gentlemen,

On behalf of Hanoi University of Science and Technology, I would like to extend my warmest welcome to the delegations and participants to HUST to participate in the Asian Workshop on Polymer Processing (AWPP2010).

As you know, this workshop is organized by the Japan Society of Polymer Processing (JSPP) and conducted in many Asian countries in recognition of the importance of this region as a polymer processing hub. Indeed, it is HUST's great honour to have an opportunity to host and co-organize the AWPP2010 with JSPP this year.

Participating in AWPP2010, we have about 100 delegates from Japan, Korea, Thailand, Singapore, Malaysia, Indonesia, Taiwan, and Vietnam. The AWPP2010 will provide an exclusive forum for intellectually stimulating and engaging interactions among the industrialists and academicians to share their recent scientific breakthroughs and achievement in polymer related technologies. This will promote the further development of polymer processing industry and research activities in Asian.

On behalf of HUST, I would like to express my deep gratitude to the hardworking and dedicated organizing committee (Japan and Vietnam). To the exhibitors and advertisers who have contributed to the success of AWPP2010, I also would like to acknowledge my deep appreciation and sincere thanks. I am sure that you will benefit from the deliberation in AWPP2010 and you can have a pleasant visit to Hanoi, Vietnam.

I wish our workshop a great success with sustainable and fruitful achievements.

Thank you very much for your attention.

Message from Co-Chairman of Organizing Committee

On behalf of the Organizing Committee and the International Advisory Committee, I would like to extend a warm welcome to all the participants for their participation in Asian Workshop on Polymer Processing 2010 (AWPP 2010), for the first time held in Hanoi, Vietnam.

Started on 2001 with the support of the other Asian counties, the Japan Society of Polymer Processing (JSPP) has been organizing this workshop in different Asian countries; Thailand (2001, 2006), Singapore (2002), China (2004), Taiwan (2005), Korea (2007), Japan (2008) and Malaysia (2009). In this year, we are pleased to have the 9th workshop in Hanoi, Vietnam with the collaboration of Hanoi University of Science and Technology (HUST). The aim of the AWPP is to share experiences and the latest advancements of science and technology in polymer processing. Most importantly, the AWPP is established to enhance friendships among the researchers and engineers who devote themselves to polymer related research and technology and to develop a global network of polymer processing having technology hubs in Asia.

The AWPP 2010 will consist of two plenary lectures, twelve keynote lectures and thirty-eight oral presentations and more than fifty posters, coming from India, Indonesia, Korea, Malaysia, Taiwan, Thailand, Vietnam and Japan in the following eleven different categories; namely, 1) Alloys, Blends & Composites, 2) Emerging Polymer Processing Technologies, 3) Polymer Modification & Novel Materials, 4) Extrusion & Injection Molding, 5) Fiber Spinning & Film, 6) Nano Technology, 7) Biopolymer & Process Optimization, 8) Petrochemical Technology, 9) Recycle & Environment Techniques, 10) Rheology & Rheometry, 11) Structure, Properties & Their Evaluation. Poster presentations are expected to be an exiting session because the presenters and participants can deeply communicate with each other on their interests.

I would like to express my sincere gratitude to all the organizing committee members on both sides of Japan and Vietnam for their efforts and contributions on the workshop, and to Nagaoka University of Technology Center for Green-Tech Development in Asia for their financial support, and also to the advertisers and industries who have contributed to the success of AWPP 2010. Without their contributions, this workshop will never be realized.

Finally, we hope all the participants have a pleasant stay in Hanoi, and that you will enjoy the workshop programs.

H. Yokoi

Hidetoshi Yokoi

ORAL Presentation Program of AWPP2010

The First Day: Tuesday, December 7, 2010

Time	Fuji Room (2nd floor Hotel Nikko Hanoi)
18:00 – 18:30	Registration
18:30 – 20:00	Light Refreshment

The Second Day: Wednesday, December 8, 2010

Time	Fuji Room (2nd floor Hotel Nikko Hanoi)
08:40 – 09:00	Registration
09:00 – 09:15	Opening Ceremony
09:15 – 09:45	**Overview of Vietnam Rubber Industry and Prospects of Development by 2020** by **Tran Thi Thuy Hoa** (Vietnam Rubber Association)
09:45 – 10:00	Coffee Break & Exhibition

Time		Fuji Room	Sakura Room		Time
10:00 – 10:30	K-01	**Tire Technology for Safety and Environment** **Yukio Nakajima** Kogakuin University, Tokyo, Japan	**A new Paradigm of Materials Processing** **Kyung Hyun Ahn** Seoul National University, Korea	K-02	10:00 – 10:30
10:30 – 10:50	O-01	**The Effect of Adding Polysilane Into Cyclo-Olefin Polymers (II)** **Tokumitsu Katsuhisa** The University of Shiga Prefecture, Japan **Masahiro Yamada, Kana Kobori** Osaka Gas Chemicals CO., LTD., Japan	**Preparation of Protein-free Natural Rubber** **Oraphin Chaikumpollert** **Yoshimasa Yamamoto, Seiichi Kawahara** Nagaoka University of Technology, Japan	O-02	10:30 – 10:50
10:50 – 11:10	O-03	**Measurement of CF/PP Interfacial Shear Strength Using Micro-Droplet Test** **Isamu Ohsawa, Jun Takahashi** **Kiyoshi Uzawa** The University of Tokyo, Japan	**Innovation of Cotton Fabric as the Combination with Hydrolized Fibroin** **Huong Mai Bui** HoChiMinh city University of Technology, Vietnam **Arunee Kongdee** Maejo University, ChiangMai, Thailand	O-04	10:50 – 11:10
11:10 – 11:30	O-05	**Miscibility of Deproteinized Natural Rubber Having Epoxy Group/Polyethylene Glycol** **Warunee Klinklai** Rajamangala University of Technology Thanyaburi, Thailand **Seiichi Kawahara** Nagaoka University of Technology, Japan **Jitladda Sakdapipanich** Mahidol University, Thailand	**Development of Modified Polylactide PLA** **Hiroaki Kishimoto** Kao Corporation Global R&D - Performance Chemicals, Japan **A. Takenaka, H. Moriwaka, H. Enomoto** Kao Corporation, Global R&D Package Development, Japan	O-06	11:10 – 11:30

11:30 – 11:50	O-07	**Feasibility Study on the Use of Chlorinated Epoxidized Natural Rubber Based Materials in Replacement of Chlorinated Polyethylene for Moulded Sheet Application** Anoma Thitithammawong Charoen Nakason, Adam Kaewsare Prince of Songkla University, Thailand	**Relationship Between Thermal Degradation Kinetics and Flame Retardancy of Mineral Filled Thermoplastics** Supaphorn Thumsorn Kazushi Yamada, Y Wei Leong Hiroyuki Hamada Kyoto Institute of Technology, Japan	O-08	11:30 – 11:50
11:50 – 12:10	O-09	**Preparation and Characterization of Soft Nanomatrix Structure by Graft Copolymerization of Butyl Acrylate onto Natural Rubber** Ratchaniwan Sutthangkul Jitladda Sakdapipanich Mahidol University, Thailand Yoshimasa Yamamoto, Seiichi Kawahara Nagaoka University of Technology, Japan	**Global Threat of New POPs (Persistent Organic Pollutants) Contamination by PFCs (Perfluorinated Compounds) and Challenge of Polymer Materials Application for their Control** Shigeo Fujii, Chinagarn Kunacheva STMLD. Senevirathna, Shuhei Tanaka Hidenori Harada, Nguyen Pham Hong Lien Kyoto University, Japan	O-10	11:50 – 12:10
12:10 – 12:30	O-11	**Effect of Various Kinds of Rice Flour on Baking and Rheological Properties of Gluten-free Rice Dough** Keiji Katsuno, Akihiro Nishioka Munenori Iwano, Ken Miyata Go Murasawa, Omonori Koda Yamagata University, Japan	**Effect of Radiation on Toughness Improvement of Polyhydroxybutyrate-co-Hydroxyvalerate with Natural Rubber Blend** Chutamas Maneewong Roungrong Thongtan, Klanarong Sriroth Kasetsart University, Thailand Phiriyatorn Suwanmala Nuclear Research Center, Thailand	O-12	12:10 – 12:30
12:30 – 13:30		Luncheon (Tao-Li Restaurant)			12:30 – 13:30
13:30 – 14:00	K-03	**Krisda Suchiva** President of Thai Polymer society, Thailand	**Twin Screw Extruders Used for Reactive Extrusion** Tadamoto Sakai Shizuoka University, Tokyo, Japan	K-04	13:30 – 14:00
14:00 – 14:30	K-05	**Research Trends for Advanced Adhesives and Eco Bio-Composites** Hyun-Joong Kim Seoul National University, Korea	**Crystalline Structure of Vietnamese Cotton Fibers** Vu Thi Hong Khanh Nguyen Huu Dong, Hua Thuy Trang Hanoi University of Science and Technology, Vietnam	K-06	14:00 – 14:30
14:30 – 14:50	O-13	**Study of Recycled PET Blends Injection Molding** Kazushi Yamada Yew Wei Leong, Hiroyuki Hamada Kyoto Institute of Technology, Japan Shuhei Tamada, Noriaki Kunimune Kunimune Co. Ltd., Osaka, Japan	**Effect of Redox Initiator on Adhesive Performance of Methylmethacrylate-grafted-Natural Rubber Latex** Rohani Abu Bakar Yusniwati Mohamed Yusof Rubber Research Institute of Malaysia, Malaysian Rubber Board	O-14	14:30 – 14:50

14:50 – 15:10	O-15	**The Mechanical Properties of Jute Spun Yarn Reinforced Thermoplastic by Hybrid Micro-Braiding Technique** **Patcharat Wongsriraksa** **Yew Wei Leong, Asami Nakai** Kyoto Institute of Technology, Japan	**The Effect of Mold Surface Condition on Flow Length in Injection Molding Process** **Masaki Otsuka** Corporate Monozukuri Innovation Center, Olympus Co., Japan **Aya Okabe, Hiroshi Ito** Yamagata University, Japan	O-16	14:50 – 15:10
15:10 – 15:30	O-17	**Novel Fabrication of Surface Enhanced Raman Scattering(SERS) Sensor on Polycarbonate by Gas-assisted Hot Embossing Process and Anodic Aluminum Oxide (AAO) Template** **Wei-Yi Chang, Jing-Tang Wu** **Sen-Yeu Yang, Chia-Lin Wu** National Taiwan University, Taiwan **Pei-Kuen Wei** Research Center for Applied Sciences, Academia Sinica, Taiwan	**Study on Numerical Analysis Method for Heat Compression Molding of Polymer Foam** **Atsushi Yokoyama** Kyoto Institute of Technology, Japan	O-18	15:10 – 15:30
15:30 – 15:50	O-19	**Stress Responses of Filled Polymer Melt in Agglomeration Process** **Yousuke Kawasaki** **Yoshiyuki Komada, Hiroshi Suzuki** Kobe University, Japan	**Preparation of Styrene Random Copolymer from Natural Rubber** **Shintaro Shioyama,** **Yoshimasa Yamamoto, Seiichi Kawahara** Nagaoka University of Technology, JST-JICA SATREPS	O-20	15:30 – 15:50
15:50 – 16:00		Coffee Break & Exhibition			15:50 – 16:00
16:00 – 16:30	K-07	**Phan Dinh Tuan** HoChiMinh City University of Technology, Vietnam	**Development of High-strength Polyester Fibers via Modification of Melt Spinning Process** **Takeshi Kikutani** Tokyo Institute of Technology, Japan	K-08	16:00 – 16:30
16:30 – 16:50	O-21	**Evaluation of Stretchability and Resin Designing of Polypropylene for Biaxially Oriented Film** **Satoshi Tamura, Itaru Kuramoto** Prime Polymer Co., Ltd., Chiba, Japan **Toshitaka Kanai** Idemitsu Kosan Co., Ltd., Chiba, Japan	**Visualization Analysis of Irregular Wrinkle Generation Process around Boss Cavity Area in Injection Molding of POM Using High-speed Rotary Runner Exchange System** **Hidetoshi Yokoi, Yoshinori Kanetoh** The University of Tokyo, Japan **Masakazu Ishida** Takahata precision Co.,Ltd., Japan	O-22	16:30 – 16:50
16:50 – 17:10	O-23	**Visualization Analysis of A-symmetric Flow Behavior at Step-change Portion of Injection Mold Using Rotary Runner Exchange System** **Yoshinori Kanetoh, Hidetoshi Yokoi** The University of Tokyo	**How to Control Rheological Properties and Processability for Biomass-Based Poly(3-hydroxybutyrate)** **Masayuki Yamaguchi** Japan Advanced Institute of Science and Technology, Japan	O-24	16:50 – 17:10
17:10 – 17:30	O-25	**Enhanced Ionic Conduction in Supercritical CO_2-Treated Polymer Electrolytes Including Li Salts** **Yoichi Tominaga, Yoshiyuki Oe** Tokyo University of Agriculture and Technology, Japan	**Visualization Analysis of Gate Flow Phenomenon in High Speed Injection Process (Part II)** **Lei-Ti Huang, Yoshinori Kanetoh** **Hidetoshi Yokoi** The University of Tokyo, Japan	O-26	17:10 – 17:30

17:30 – 17:50	O-27	**Effect of Molecular Weight on Scratch Behavior of Injection Molded Polycarbonate (PC)** **Vadee Chivatanasoontorn** Masaya Kotaki Kyoto Institute of Technology, Japan	**Study of the Transparent Thermoplastic Resin with Electron Beam Cross-Linking for Heat Resistant** Tomomi Sano Sumitomo Electric Industries Ltd., Japan **Makoto Nakabayashi** Sumitomo Electric Fine Polymer Inc., Japan **Hiroshi Ito** Yamagata University, Japan	O-28	17:30 – 17:50
17:50 – 18:50	**Poster Presentation**				
18:50 – 19:00	Free time				
19:00 – 22:00	Banquet (Gala Dinner of AWPP2010)				

The Third Day: Thursday, December 9, 2010

Time	Fuji Room (2nd floor Hotel Nikko Hanoi)
08:40 – 09:00	Registration
09:00 – 09:45	**Analysis of Contributing Factors to Production of Highly Transparent Isotactic Polypropylene Extrusion Sheets** by **Toshitaka Kanai** (President of JSPP - Idemitsu Kosan Co.,Ltd. - Japan)
09:45 – 10:00	Break Time & Exhibition

Time		Fuji Room	Sakura Room		Time
10:00 – 10:30	K-09	**The Trend of Lightweight Body Technology and Expectation of Plastic Material for Automobile** **Tomokazu Abe** Honda Engineering Co. Ltd.	**Application of Microfibrillated Cellulose from Bamboo Pulp for Polymer Composite Reinforced by Bamboo Fiber** **Ta Phuong Hoa, Nguyen Manh Cuong** Bui Chuong, Nguyen Huy Tung Polymer Center Hanoi University of Science and Technology	K-10	10:00 – 10:30
10:30 – 11:00	K-11	**Recent Study on the Topology of Colloidal Particles and Film Formation of *Hevea brasiliensis* Natural Rubber** **Jitladda T. Sakdapipanich** Mahidol University, Thailand	**Progress of Dynamic Mold Temperature Control and Its Applications** Shia Chung Chen, Jen-An Chang Chung Yuan Christian University, Taiwan	K-12	10:30 – 11:00
11:00 – 11:20	O-29	**Particle Dispersion Model for Suspension in Polymer Processing** Kouji Masuda, Hiroshi Suzuki Yoshiyuki Komoda Kobe University, Japan	**Novel Approach for CNT Localization on Polymer Surfaces** Howon Yoon, Masayuki Yamaguchi Japan Advanced Institute of Science and Technolog, Japan	O-30	11:00 – 11:20

11:20 – 11:40	O-31	**Fabrication of Nanostructures for Precision Polymer Molding with Anodic Aluminum Oxide Membrane** **Hiroshi Ito, A. Haryu, S. Takahagi T. Takayama** Yamagata University, Japan **T. Kyotani** Tohoku University, Japan	**Effect of Fiber Length on Static and Dynamic Strength of Injection-molded PBS/Bamboo Green Composites** **Kazuya Ohkita** Kagawa Prefectural Industrial Technology Center, Japan **Hitoshi Takagi** The University of Tokushima, Japan **Yeon-Hee Lee, Han-Ki Yoon** Dong-Eui University, Korea	O-32	11:20 – 11:40
11:40 – 12:00	O-33	**Photocatalytic Decolorization Treatment of Textile Dye Wastewater by Using TiO_2 Nanofibers** **Doni Sugiyana, Edwan Kardena Suprihanto Notodarmojo** Institut Teknologi Bandung, Indonesia	**Mechanical Performance and Crystallization Behavior of Nanoscale Rubber Toughen Polypropylene Composites** **Jessada Wongon** Pathumwan Institute of Technology, Japan **Supaphorn Thumsorn** Kyoto Institute of Technology, Japan **Deerek Lerdtitantitayakul** Siam Extek Co., Ltd., Thailand	O-34	11:40 – 12:00
12:00 – 12:20	O-35	**Improving Thermal Resistance of Jute Mats Used for Reinforcing Engineering Thermoplastics** **Smith Thitithanasarn, Yew Wei Leong Kazushi Yamada, Hiroyuki Hamada** Kyoto Institute of Technology, Japan	**Mechanical Properties and Morphology of Natural Rubber Dispersed in Nanomatrix of Polystyrene** **Kenichiro Kosugi, Keiichi Akabori Yoshimasa Yamamoto, Seiichi Kawahara** Nagaoka University of Technology, JST-JICA SATREPS, Japan	O-36	12:00 – 12:20
12:20 – 12:40	O-37	**Melt grafting of Gycidyl Methacrylate on Ethylene Propylene Rubber in the Presence of Comonomer** **Azhar Ahmad** Malaysian Rubber Board, Malaysia **Sahar. Al-Malaika** Aston University, United Kingdom		O-38	12:20 – 12:40
12:40 – 13:00		Closing Remark			
13:00 – 14:00		Luncheon (Hotel Restaurant)			
14:00 – 20:00		Visiting Honda Co. Ltd.			

The Fourth Day: Friday, December 10, 2010

Time	Technical Tour will be a day by Bus - Visiting Garment Company and Halong Bay (World Heritage)
7:00	Go to Garment Company
10:00	Go to Halong Bay
20:00	Arrived Hotel Nikko Hanoi

POSTER Presentation Program of AWPP2010

No	ID	Section	Title	Authors
1	P-01	Alloys & Blends & Composites	**Synthesis and Property of a Novel Polyurethane Crosslinked by Polyrotaxane**	**Megumi Fukushima, Ken Kojio Hiroto Murakami** (Nagasaki University, Japan)
2	P-02	Rheology & Rheometry	**Morphology Development of Polytetrafluoroethylene by Shear Flow in a Molten Polypropylene**	**Mohd Amran Bin Md Ali, Masayuki Yamaguchi** (Japan Advanced Institute of Science and Technology)
3	P-03	Alloys & Blends & Composites	**The mechanical and chemical properties of NBR/H-NBR blend**	**Dong-gug Kang** (Pyunghwa Oilseal Industry Co., Ltd., Korea) **Chul-hee Min, Yang-gon Goo, Kwan-ho Seo** (Kyungpook National University, Daegu, Korea)
4	P-04	Alloys & Blends & Composites	**Multi-functional advantages in natural fiber reinforced composites**	**Hitoshi Takagi** (University of Tokushima, Japan) **Byung-Sun Kim** (Korean Institute of Machinery and Materials, Korea) **Ke Liu, Zhimao Yang** (Xi'an Jiaotong University, China)
5	P-05	Alloys & Blends & Composites	**Influence of chemical reagent on flexural properties of geopolymer composites**	**Xiem Nguyen Thang, Petr Louda, Dora Kroisová** (Technical University of Liberec-Czech Republic) **Oleg Bortnovsky** (Research Institute of Inorganic Chemistry-Czech Republic)
6	P-06	Alloys & Blends & Composites	**Effect of Interfacial treatment on the Mechanical Properties of Biodegradable Composites**	**Satoshi Kobayashi, Risa Nagao** (Tokyo Metropolitan University, Japan)
7	P-07	Alloys & Blends & Composites	**Investigation on Mechanical Behaviour of Jute Fibre and Jute/Polypropylene Microcomposites**	**Doan Thi Thu Loan** (Danang University of Technology-Vietnam) **Edith Maeder** (Leibniz-Institute of Polymer Research Dresden)
8	P-08	Alloys & Blends & Composites	**Development of High Density Polyethylene/Rice Husk Composites**	**Thi thu Loan Doan, Hieu Nguyen** (Danang University of Technology-Vietnam) **Thai Nguyen, Long Truong** (Plastics and Rubber Technology Center) **Son Do, Thao Vo** (HCM City University of Technology- Vietnam) **Thoi Ho** (International Polymer Consultant)
9	P-09	Biopolymer & Process Optimization	**Characterization of associated proteins and phospholipids in natural rubber latex**	**Jitlada Sansatsadeekul Jitladda Sakdapipanich** (Mahidol University, Thailand)

10	P-10	Structure & Properties & Their Evaluation	**Anomalous molecular orientation of polypropylene sheets obtained by T-die extrusion**	**Panitha Phulkerd, Hiroki Hagihara, Masayuki Yamaguchi** (Japan Advanced Institute of Science and Technology, Japan)
11	P-11	Extrusion & Injection Moulding	**Effects of Annealing on Molecular Orientaton of weld line in injection Moldings**	**Koji Yamada, Kiyotaka Tomari** (LIAI Osaka Municipal Technical Research Institute, Japan)
12	P-12	Fiber Spinning & Film	**Method for Clothing Pressure Distribution by Numerical Approach**	**Ishimaru Sonoko, Isogai Yumiko, Matsui Mariko, Negishi Kiyoshi, Nonomura Chisato** (Toyobo Co.,Ltd., Japan) **Yokoyama Atsushi** (Kyoto Institute of Technology, Japan)
13	P-13		**Effection of thermal treatment to micro fiber structurer of PTT and PTT fiber with Ag ions**	**Vu Thi Hong Khanh** (Hanoi University of Science and Technology) **Nguyen Thi Thuy** (University of Economy and Technical, Vietnam)
14	P-14	Fiber Spinning & Film	**Preparation of Ultra-Fine Fibers by Laser-Electrospinning Process**	**Midori Takasaki, Shinya Kinugawa, Kengo Morie, Yutaka Ohkoshi, Toshihiro Hirai** (Shinshu University, Japan)
15	P-15	Nano Technology	**Rheological modification of polypropylene by flexible nanofibers**	**Keiko Fukuda, Masayuki Yamaguchi** (Japan Advanced Institute of Science and Technology, Japan)
16	P-16	Polymer Modification & Novel Materials	**Preparation of Polymer Sheets Modified by Polymeric Nanofibers**	**Doan Vu Anh, Masayuki Yamaguchi** (Japan Advanced Institute of Science and Technology, Japan)
17	P-17	Nano Technology	**Effect of cross-linking agent in roller electrospinning of poly(vinyl alcohol)**	**Dao Anh Tuan, Oldrich Jirsak** (Technical University of Liberec, Czech Republic)
18	P-18	Nano Technology	**Effect of the intrinsic viscosities of polyvinylbutyral solutions on nanofibers morphology**	**Daniela Lubasova, Lenka Martinova** (Technical University of Liberec, Czech Republic)
19	P-19	Nano Technology	**Silver-*N*-carboxymethyl chitosan nanocomposites: synthesis and its antibacterial activities**	**Nguyen Tien An, Pham Thi Bich Hanh, Tran Thi Y Nhi, Do Truong Thien** (Institute of Chemistry-VAST-Vietnam) **Do Thi Nguyet Que** (Hanoi Pharmaceutical University, Vietnam)
20	P-20	Nano Technology	**Formation of nano-rutin in polymer matrix from chitosan**	**Le Thi Hong Nhan, Khuu Chau Quang, Ngo Van Anh , Nguyen Thi Kim Hanh** (University of Technology, Vietnam National University Hochiminh city)
21	P-21	Nano Technology	**Formation of nano-curcuminoids in polymer matrix from chitosan**	**Le Thi Hong Nhan, Nguyen Thi Quynh Nhu, Huynh Huy Tuan** (University of Technology, Vietnam National University Hochiminh city)

22	P-22	Nano technology	**Stability of "submicron curcumin" in gelatin & jelly matrices**	**Le Thi Hong Nhan, Nguyen Minh Thai Le Thuc Hai, Nguyen Thuy Lien** (University of Technology, Vietnam National University Hochiminh city)
23	P-23	Polymer Modification & Novel Materials	**A Study on the Mechanical Properties of Poly(butylene terephthalete) by adding several kinds of PBT elastomer**	**Kenichi Nishizaka, Katsuhisa Tokumitsu** (The University of Shiga Prefecture, Japan)
24	P-24	Polymer Modification & Novel Materials	**Low-Molecular-Weight natural rubber (LNR) as compatibilizer in filled NR**	**Duangruthai Srinun, Jitladda Sakdapicanich** (Mahidol University,Thailand)
25	P-25	Polymer Modification & Novel Materials	**Characterization of Macademia Charcoal**	**Phawasoot Rodgerd, Jitladda Sakdapipanich** (Mahidol University, Thailand)
26	P-26	Polymer Modification & Novel Materials	**Amperometric glucose biosensor based on poly(styrene-acrylic acid) magnetic microspheres/polyaniline nanocomposite film**	**Huy Nguyen Le, Anh Tuan Nguyen** (Hanoi University of Science and Technology) **Binh Hai Nguyen, Lam Dai Tran, Lam Dinh Vu** (Institute of Materials Science-VAST, Vietnam) **Nguyen TuanDung** (Institute of Tropical Technology-VAST, Vietnam)
27	P-27	Polymer Modification & Novel Materials	**Physical and chemical modifications of PDMS for analytical devices fabrication**	**Ba Trung Nguyen , Yuzuru Takamura** (Japan Advanced Institute of Science and Technology, Japan)
28	P-28	Rheology & Rheometry	**Effect of the reological parameters on the melt electrospinning**	**Michal Komarek, Lenka Martinova** (Technical University of Liberec, Czech Republic)
29	P-29	Rheology & Rheometry	**Rheological, dynamic mechanical properties and bound rubber of NBR filled with precipitated silica and TESPT**	**Manuchet Nillawong, Chakrit Sirisinha** (Mahidol University, Thailand)
30	P-30	Structure & Properties & Their Evaluation	**Proton Conduction in Poly(ethylene-co-vinyl alcohol)/ Sulfonated Mesoporous Silica Composite Membranes**	**Yoichi Tominaga, Yuta Chiba** (Tokyo University of Agriculture and Technology, Japan)
31	P-31	Structure & Properties & Their Evaluation	**Structural Effect of Inorganic Fillers on Ionic Conductivity of Composite Polymer Electrolytes**	**Masanori Endo, Yoichi Tominaga** (Tokyo University of Agriculture and Technology, Japan)

32	P-32	Structure & Properties & Their Evaluation	**The study of aging characteristics on rubber gasket for PEMFC stack**	**Dong-gug Kang, Byung-ki Hur, Hyeong-ryeol Jeon** (Pyunghwa Oilseal Industry Co.,Ltd., Korea) **Sung-soo Kim** (Korea Research Institute of Chemical Technology) **Kwan-ho Seo** (Kyungpook National University, Korea)
33	P-33	Structure & Properties & Their Evaluation	**The study of properties in Magnetic Rubber for using of the automotive seals**	**Dong-gug Kang, Dong-hyun Kim,** (Pyunghwa Oilseal Industry Co.,Ltd., Korea) **Dong-won Lee** (PCK Industry Co., Ltd., Korea) **Ju-ho Yun** (Advanced Korea Automotive Technology Institute)
34	P-34	Structure & Properties & Their Evaluation	**Self-organising polymers: synthesis of monodomain liquid crystal elastomers and gels**	**Thi Hong Nhan Le** (University of Technology, Vietnam National University Hochiminh city) **David H. Brown** (The University of Western Australia) **Peter Styring** (The University of Sheffield,England)
35	P-35	Structure & Properties & Their Evaluation	**A model study on effect of glucose to the properties of natural rubber**	**Adun Nimpaiboon** (Mahidol University, Bangkok, Thailand) **Jitladda Sakdapipanich** (Mahidol University at Salaya Campus, Thailand)
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PHOTOCATALYTIC DECOLORIZATION TREATMENT OF TEXTILE DYE WASTEWATER BY USING TiO_2 NANOFIBERS

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ABSTRACT

Photocatalytic study for decolorization of textile dye wastewater has been carried out by using TiO_2 nanofibers made by electrospinning. Annealed TiO_2 nanofibers made by electrospinning has diameter ranging from 200nm to 500 nm. Effect of pH and dye initial concentration was investigated during photocatalytic experiment. Photocatalytic activity of TiO_2 nanofibers was compared to that of TiO_2 nanoparticle film and TiO_2 nanofibers – nanoparticle composite. Photocatalytic decolorization efficiency was found higher at high pH (pH 11) and at low initial dye concentration (10 mg/L).Decolorization rate (k') to azo dye of reactive black 5 by using TiO_2 nanofiber – nanoparticle composite was found 3,95 x 10^{-2} min^{-1}, higher than that of TiO_2 nanofiber (2,60 x 10^{-2} min^{-1}) and TiO_2 nanoparticle film (2,52 x 10^{-2} min^{-1}).

1. INTRODUCTION

Textile industry in Indonesia has been characterized as huge wastewater generation industry with the complexity of pollutant constituent including dyes and surfactants [1]. The existence of color in textile wastewater has been the main issue for long time related to its refractory and unbiodegradable characteristics, especially for biological processes [2]. Coagullation, adsorption and membrane filtration processes were succesfully remove dye substance [3]. However, those systems remove the color without destruction of its dye compound, therefore remain other problems with sludge.

Numerous researches of advanced oxidation processes (AOPs) show the effectiveness of photocatalytic UV/TiO_2 process for degradation of organic dye substances, especially with suspended TiO_2 catalyst [4,5]. However, the suspended catalyst was relatively unpractical for application. Thus, immobilization and nanosized of catalyst were studied intensively in photocatalytic research, although its efficiency less than that of the suspended catalyst system. Due to more catalytic surface area and specific structure, nanofiber based TiO_2 photocatalyst considered to be more effective in process performance and practical aspects. Photocatalytic degradation performance of TiO_2 nanofibers based catalysts for decolorization of textile dye pollutants were studied in this research.

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2. MATERIAL AND METHODS

2.1 TiO_2 nanofibers, TiO_2 nanoparticle films and composite photocatalyst

TiO_2 nanofibers used in this study were made in former research by electrospinning. As-spun nanofibers was coated in glass substrates (25 mm x 65 mm) covered by silicon rubber and annealled at temperature 500°C for 30 minutes. TiO_2 nanoparticle was prepared in former research through sol gel method coated on the glass substrate forming a thin film layers. TiO_2 nanofiber – nanoparticle composites were made by repeating dip coating method to the nanofiber covered glass, Annealing in temperature 500°C for 30 minutes was also done to those remaining catalysts mentioned.

2.2 Photocatalytic experiment

Laboratory batch photocatalytic experiment was carried out by using 1 L photoreactor with 3 x

15 Watt Phillips UV-C lamps, λ 365 nm (Fig. 1). Glass substrates with catalyst were placed horizontally in 400mm x 100mm x 25mm compartment containing dye aqueous solution as synthetic wastewater. Dye stuff used was by reactive black 5 azo dyes (Sigma Aldrich). Synthetic wastewater and the glass substrate with/without catalyst were kept in the dark room for 1 hour to established a adsorption – desorption equilibrium.

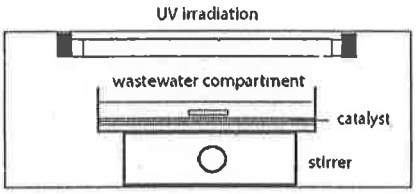

Fig. 1. Photoreactor

2.3 Characterization

Surface morphologies and diameter of TiO_2 nanofibers, nanoparticle films and composite were investigated by scanning electron microscope (JEOL, JSM 6360 LA). Degradation of dye concentration was measured by UV – vis spectrophotometer (Milton Roy 21-D).

3. RESULTS AND DISCUSSION

TiO_2 nanofibers characteristics made by electrospinning were vary depend upon electrospinning conditions during its operation. Electric potential, flow rate and spinnerete – collector gap gave significant effects to nanofibers formation. Optimized condition of those conditions gave a well formed and continous nanofibers.

Fig. 2 shows the SEM images of TiO_2 nanofibers, nanoparticle and composite after annealled at 500°C for 30 min. Annealed nanofibers show diameter ranging from 200 nm to 500 nm due to the removal of organic fraction from precursor nanofibers during high temperature, remaining TiO_2 and SiO_2 crystalline phases. Fig 2b shows that nanoparticle finely formed with diameters less than 50 nm. In order to increase the effective photocatalytic surface area and to enhance the photocatalytic activity, composite TiO_2 was developed as shown in Fig. 2c.

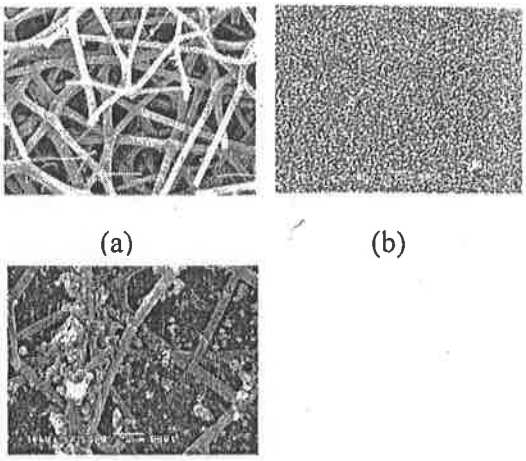

Fig. 2. (a) TiO_2 nanoparticle; (b) TiO2 nanoparticle film; (c) composite

Effect of pH to the photocatalytic reaction was investigated by varied pH condition in photocatalytic decolorization of reactive black 5 dye by using composite TiO_2 nanofibers – nanoparticle film catalyst. Fig. 4 shows the results of pH effect, it was found that optimum dye removal obtained in pH 11 until 99.1%, after UV irradiation for 2 hours. As comparison, after 1 hour UV irradiation, dye removal efficiency in pH 3, 7 and 11 were 71,3%, 63,9% and 94,4%, respectively. It was revealed that pH significantly affects photocatalytic activity, and in this experiment, optimum pH was found in sequence pH 11>pH3>pH7.

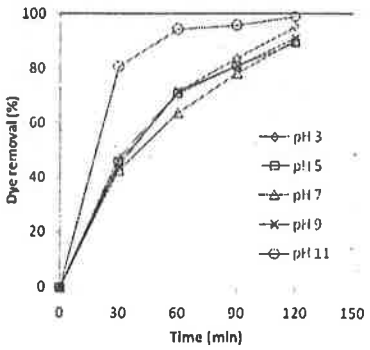

Fig. 4 pH effects (dye conc. 10 mg/L)

Several TiO_2 photocatalytic researches results show that optimum pH for dyes decolorization could be vary depend upon dye types. It stated that the existence of hydroxil radicals (•OH) as the active species, plays a main role in dye degradation, and become a predominant species in neutral or higher pH. Particularly in high pH, •OH easily formed by oxidizing hydroxide ions which available on TiO_2 surface, therefore able

to enhance the photocatalytic activity [6]. Other research mentions that in low pH, TiO_2 surface will positively charged and increasing its adsorption capacity for dye molecules which negatively charged. Thus dyes adsorption on TiO_2 surface could facilitating the organic dye degradation [7].

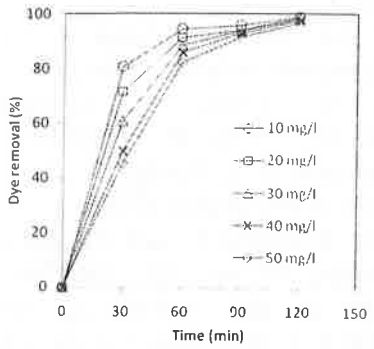

Fig. 5 Initial dye concentration effect (pH 11)

Fig. 5 shows effects of initial dye concentration to photocatalytic activity. It was found that in similar treatment condition (catalyst amount, pH and UV irradiation), dye removal efficiency decreased as the increase of dye concentration in aqueous solution. It is understandable that the higher dye concentration, the more organic substances adsorbed on TiO_2 surface. This adsorbed matters will inhibit UV irradiation, decreasing the photon amount reached by catalyst surface and finally inhibit the formation of •OH. Due to less of •OH formed, dye degradation performance will slightly decreased.

Initial dye adsorption was investigated without UV irradiation for 1 hour using TiO_2 nanofibers, nanoparticle film, composite TiO_2 and bare glass (Fig. 6). It shown that adsorbed dye in maximum dye absorption (wavelength 592 nm) was not in significant amount. Bare glass adsorbed 0.91% from initial dye concentration. TiO_2 nanofibers and nanoparticle film both adsorbed 1.82% of dye. While as, TiO_2 nanofiber – nanoparticle composite adsorbed 2.73%, higher than that of other catalysts.

Adsorption capactiy of catalyst affected by effective surface area and pores structure type [7]. SEM images shows that nanofibers own a macropores structure, in other side nanoparticles own a nanopores structure. Macropores cause the faster adsorption of dye molecules in shorter time, then for longer time dye molecules diffused furthermore into nanopores. Nanofiber – nanoparticle composite has both of macropores and nanopores, causing a higher dye adsorption compared to others.

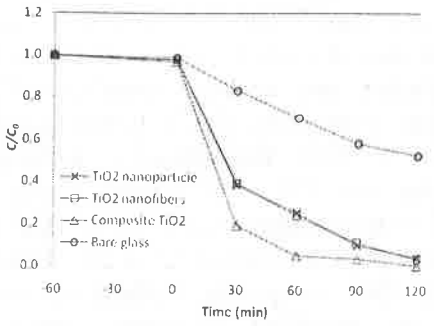

Fig. 6 Photocatalytic degradation

Fig. 6 shows photocatalytic dye degradation as the function of UV irradiation time, with initial dye concentration 10 mg/L and pH 11. After 1 hour of UV irradiation, 75.5% and 74.1% of dye degradation were obtained by TiO_2 nanofiber and nanoparticle film, respectively. Higher dye degradation percentage was obtained by composite TiO_2 with 94.4% after 1 hr of treatment, bare glass also shows a 29.4% dye degradation revealed a fotolysis reaction. After 2 hrs of UV irradiation, the entire catalyst show significant dye degradation more than 95% (99.1% for composite TiO_2). Photocatalytic dye degradation are electron photoexcitation in semiconductor, followed by formation of electron holes pairs on catalyst surface. Very oxidative holes then able to oxidize dyes . H_2O decomposition and holes reaction with OH^- are also play a role in formation of hydroxil radicals, which very powerful in degrading organic dye substances. Photocatalytic mechanism below explain the step of photocatalytic reaction [2,8].

$$\text{Catalyst} + h\nu \rightarrow e^-_{cb} + h^+_{vb} \quad (1)$$
$$H_2O + h^+_{vb} \rightarrow \text{•OH} + H^+ \quad (2)$$
$$O_2 + e^-_{cb} \rightarrow O_2^-\text{•} \quad (3)$$
$$O_2^-\text{•} + H_2O \rightarrow H_2O_2 \quad (4)$$
$$H_2O_2 \rightarrow 2\text{•OH} \quad (5)$$
$$\text{•OH} + \text{dyes} \rightarrow \text{dyes}_{oks} \; (k = 10^9 - 10^{10}\ M^{-1}\ s^{-1}) \quad (6)$$
$$\text{Dyes} + e^-_{cb} \rightarrow \text{dyes}_{red} \quad (7)$$

Reaction constant calculated based on pseudo first order equation (Eq. (8)) [8].

$$\ln\left(\frac{C_0}{C}\right) = kKt = k't \qquad (8)$$

Which r is reaction rate (mg L^{-1} min), C_0 is initial dye concentration (mg L^{-1}), C is dye concentration at t (mg L^{-1}), t is irradiation time, k is reaction rate constant (min^{-1}), and K is adsorption constant (L mg^{-1}). It was calculated that k' of TiO2 nanofibers – nanoparticle composite was 3,95 x 10^{-2} min^{-1}, higher than that of TiO_2 nanofibers (2,60 x 10^{-2} min^{-1}) and TiO_2 nanoparticle film (2,52 x 10^{-2} min^{-1}). It revealed that composite method of catalyst based on nanofiber structure significantly enhance the effectiveness of conventional photocatalyst.

4. CONCLUSION

TiO_2 nanofibers photocatalyst developed by electrospinning (diameter range of 200 – 500 nm after annealed) was effectively applicable for photocatalytic decolorization of textile dye pollutant azo dye reactive black 5. Composite TiO_2 nanofibers – nanoparticle was found enhance decolorization activity (k' = 3,95 x 10^{-2} min^{-1}) of TiO_2 nanofibers and TiO_2 nanoparticle film in photocatalytic process. Optimized photocatalytic process conditions were obtained in high pH (pH 11) and low dye initial concentration (10 mg/L).

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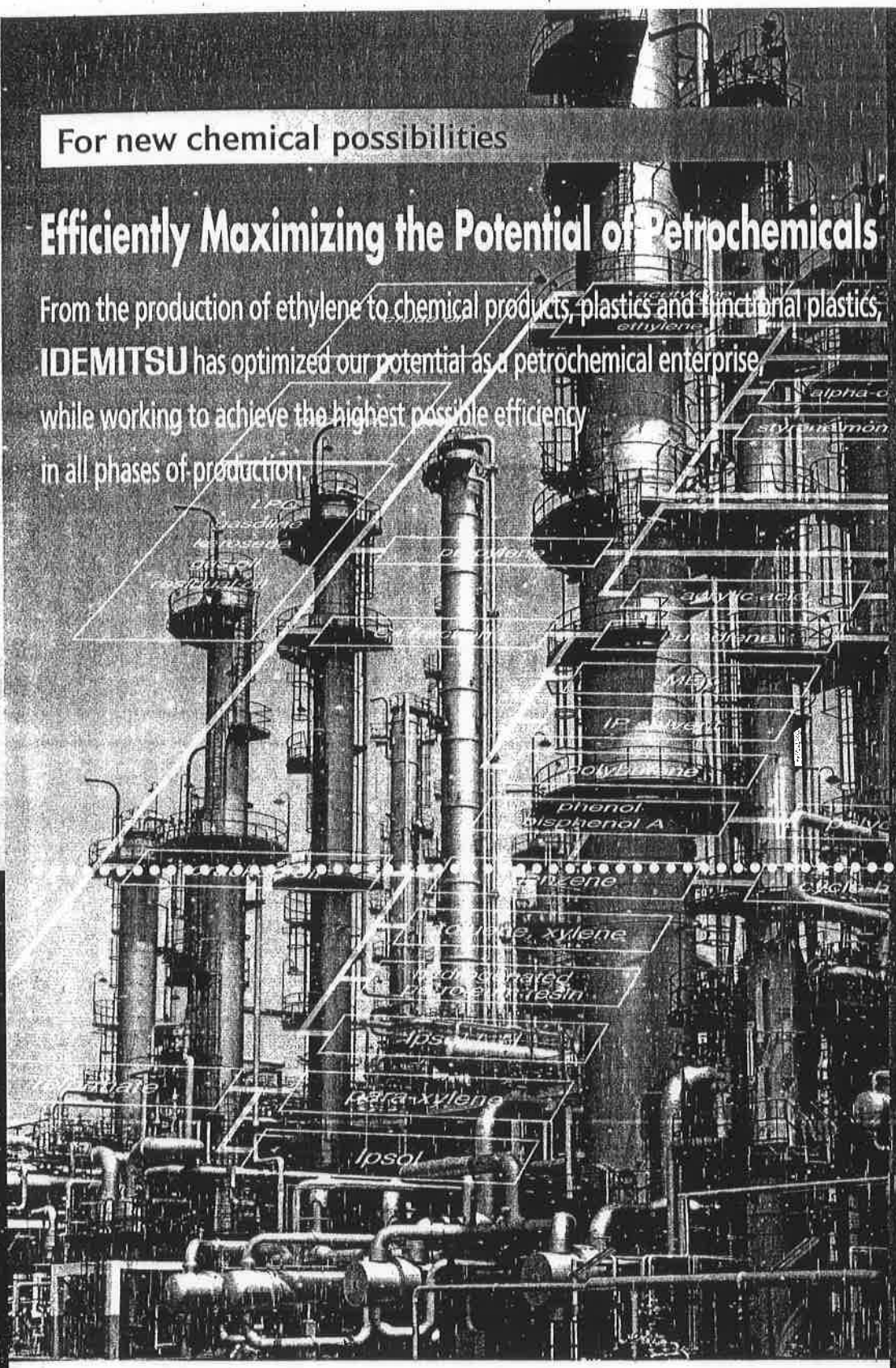

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