

SCIENCE BULLETIN OF JOSAI UNIVERSITY

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PART I ANNUAL REPORTS

1. Abstracts of Papers Published in Journals

MATHEMATICS

Decomposition of Modules

H. Ishibashi

JP Journal of Algebra, Number Theory and Applications, **15**(1), 19–28 (2009)

Our first purpose is to give a sufficient condition for modules over rings to be expressed as a sum or a direct sum of submodules of the modules without any special restriction for modules and rings. Then we will apply the result to various cases of modules and rings.

For example, we will realize a generalization of the fact that an involuntary endomorphism of a module gives rise to a splitting of the module into a direct sum of two submodules.

Also, we shall show that the existence of an idempotent linear endomorphism in a wide meaning allows us to split the underlying module.

ダイナミックプログラミングを用いたファジイメトリッククラスタリング

岩村覚三, 堀口正之*¹, 堀池真琴*² (*¹ 神奈川大学, *² 帝京大学) 数理解析研究所講究録 1630, p. 77–88 (2009)

多次元線形単調ファジイ数に基づくファジイメトリックとダイナミックプログラミング (DP) を用いたファジイメトリッククラスタリングプログラム (FMCP) を C 言語で開発した。その特徴は、与えられた多次元線形単調ファジイ数データを直接用いてファジイメトリッククラスタリングアルゴリズムを実行できることである。IBM NetVista メモリ 1.50 GB クロックタイム Pentium 4 2.00 GHz を用いてファジイ感覚による食品嗜好調査の結果をもとに 20 品目の食品を 3 つのクラスタリングする計算実行結果も報告する。

Discrete time credibilistic processes: Construction and convergences

Masayuki Kageyama*, and Kakuzo Iwamura (* The Institute of Statistical Mathematics, Tokyo) *Information Sciences*, Vol. **179**, 4277–4283 (2009)

In this paper, we discuss a method of constructing a credibilistic process which is a family of fuzzy variables on credibility space. Applying the extension theorem in credibility theory, the finite or infinite horizon credibilistic process is made up from a family of credibilistic kernels. Also, for the Markov case, convergence theorems are given and credibilistic risk models for reward processes are considered, whose risk is completed by

the recursive equation.

λ Credibility

Kakuzo Iwamura, Lixing Yang^{*1}, Makoto Horiike^{*2} (*1 Beijing Jiaotong University, Beijing, *2 Teikyo University)

Journal of Interdisciplinary Mathematics, Vol. 12, 101–114 (2009)

This paper extends credibility measure in uncertainty theory to lambda credibility. Lambda credibility measure is a convex combination of possibility measure and necessity measure. We investigate differences between credibility measure and lambda credibility measure. Finally, we introduce lambda credibility expectation for a triangular fuzzy variables to have an insight on the differences between credibility and lambda credibility.

CHEMISTRY

Analysis of Rotational and Vibrational-Rotational Spectra of HF Based on the Non-Born-Oppenheimer Effective Hamiltonian

Hiromichi Uehara, Kouji Horiai, and Takenori Noguchi

J. Phys. Chem. A, 113, 10435–10445 (2009)

Rotational transitions of HF that are important as a wavenumber standard have been analyzed by simultaneous fitting of the reported rotational and vibrational-rotational transitions plus rotational measurements of the present study with the non-Born-Oppenheimer effective Hamiltonian expressed with the optimal parameters, i.e., the determinable clusters of the expansion coefficients of the correction functions for the breakdown of the Born-Oppenheimer approximation. Since the spectral fit is made with the analytical solution of the Schrödinger equation, one can easily reproduce the fitting procedure. This is the first example of the non-Born-Oppenheimer analysis of a single isotopologue with physically meaningful parameters based on the traditional concept of the molecular constants. Fitting of a data set for HF has generated 15 independent parameter values that include 4 determinable clusters of the expansion coefficients. These 15 parameters are sufficient to generate 41 Y_{ij} coefficients and 72 rotational constants, which provide comprehensive sets of molecular constants of HF.

Computational Study of Excited-State Intramolecular-Proton-Transfer of *o*-Hydroxybenzaldehyde and Its Derivatives

Shin-ichi Nagaoka^{*1}, Hiroyuki Teramae, and Umpei Nagashima^{*2,3} (*1 Ehime University, *2 National Institute of Advanced Industrial Science and Technology, *3 CREST, Japan Science and Technology Agency)

Bull. Chem. Soc. Jpn., **82**, 570–573 (2009)

The excited-state intramolecular-proton-transfer of *o*-hydroxybenzaldehyde and its derivatives (*o*-formyl-substituted phenols) was studied by means of an *ab initio* molecular-orbital method. The computational results are consistent with the experimental fluorescence quantum yield and support the nodal-plane model. The energy difference between the ground state and the lowest excited ($^1(\pi, \pi^*)$) state decreases as the electron-withdrawing property of a substituent bonded to the carbonyl carbon of *o*-hydroxybenzaldehyde becomes stronger. However, the substituent effect does not largely distort the potential energy surface of *o*-formyl-substituted phenols.

Imino-enamine tautomerism and dynamic prototropy in 1-imino-3-amino-1*H*-indens

Yoko Mukano, Mai Momochi, Yuriko Takahashi, Mitsuaki Suzuki, Hidetsugu Wakabayashi, Hiroyuki Teramae, and Keiji Kobayashi

Tetrahedron, **66**, 605–611 (2010)

The tautomeric structures and dynamic prototropic behavior of the products **1** and **2** obtained in the condensation reaction of 1,3-indandione and 2-pyridyl-1,3-indandione with *p*-toluidine, respectively, were investigated by ^1H -NMR spectroscopy and X-ray analysis. In the solid state, compound **1** is in an imino-enamine tautomeric form, whereas in solution it coexists with an imino-imino tautomeric form. Dynamic 1,5-prototropic interconversion of the imino-enamine form was revealed to be very fast at room temperature by temperature-dependent ^1H -NMR spectra. For **2**, the imino-enamine form is the only species present in solution. The hydrogen of the enamine NH is hydrogen-bonded intramolecularly with the nitrogen in the pyridine ring. When the temperature is raised, the NH proton enters into dynamic 1,5-migration, which is accomplished by internal rotation around the pivot bond, which changes the hydrogen-bonding sites. For the condensation product **3** of 2-(2-quinolyl)-1,3-Indandione with *p*-butylaniline, dynamic behavior similar to that found in **2** was observed also in ^{13}C -NMR spectra.

高次元アルゴリズムを用いた分子構造最適化の PC クラスタによる並列処理

寺前裕之, 大田原一成* (* ATR適応コミュニケーション研)

J. Comp. Chem. Jpn., **8**, 31–40 (2009)

The Hamiltonian Algorithm combined with *ab initio* molecular orbital calculation is applied to the optimization of molecular structure. In order to carry out an optimization within a reasonable time frame even in the systems of many atoms, we perform parallel processing of the two-electron integrals by personal computer (PC) cluster consisting of 8 CPU's with Pentium 4 (3.0 GHz) processor. We attempt to clear up the relation between the computation time and the number of CPU's focusing particularly on the reduction of the

elapsed time. The computation time for single-point 3-21G calculations of the molecules of minor tranquilizer drugs having the benzodiazepin or the thienodiazepin backbone are measured. In the calculation of flutoprazepam (**1** : C₁₉H₁₆ClFN₂O), the acceleration ratio of the CPU time and the elapsed time are 4.1 and 4.3 with 4 CPU's, 7.9 and 42.1 with 8 CPU's, respectively. Increasing the number of CPU's achieves an extensive improvement of the elapsed time more than the number of the CPU's used, because calculated two-electron integrals are able to be buffered on the memory of the PC cluster. The number of CPU's needed to buffer the two-electron integrals is estimated through a series of the calculations of the glycine oligomers.

Polycationic States of Oligoanilines Based on Wurster's Blue

A. Ito*¹, D. Sakamaki*¹, H. Ino*¹, A. Taniguchi*¹, Y. Hirao*¹, K. Tanaka*¹, K. Kanemoto*² and T. Kato (*¹ Department of Molecular Engineering, Graduate School of Engineering, Kyoto University, *² Department of Physics, Osaka City University)

Eur. J. Org. Chem., **2009**, 4441-4450 (2009)

Polycations of two oligoanilines based on Wurster's blue, *N,N',N''*-tris[4-(dimethylamino)phenyl]-*N,N',N''*-trimethyl-1,3,5-benzenetriamine and *N,N'*-bis(3-{*N*-[4-(dimethylamino)phenyl]-*N*-methylamino}phenyl)-*N,N'*-dimethyl-*p*-phenylenediamine, have been generated efficiently by a stepwise oxidation procedure. Their redox behavior was characterized in terms of the embedded *p*-phenylenediamine (PD) units and their intramolecular connectivity. EPR analysis of their oxidized species revealed the existence of high-spin species in solution.

Two-Electron Reduction of a Rh-Mo-Rh Dithiolato Complex to Form a Triplet Ground State Associated with a Change in CO Coordination Mode

S. Muratsugu*, K. Sodeyama*, F. Kitamura*, M. Sugimoto*, S. Tsuneyuki*, S. Miyashita*, T. Kato and H. Nishihara* (* Department of Chemistry, Graduate School of Science, The University of Tokyo)

J. Am. Chem. Soc., **131**, 1388-1389 (2009)

We report the first example of a multinuclear metalladithiolene to show a chemically reversible one-step two-electron ($2e^-$) reduction process. The complex [$\{(\eta^5\text{-C}_5\text{Me}_5)\text{Rh}\cdot(\text{S}_2\text{C}_6\text{H}_4)\}_2\text{Mo}(\text{CO})_2$] is a novel trinuclear heterometal complex containing two rhodadithiolene units bridged by Mo(CO)₂ and forming Rh-Mo-Rh bonds.

Spin Crossover by Encapsulation

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Tokyo)

J. Am. Chem. Soc., **131**, 2782–2783 (2009)

We report that square planar Ni(II) and Co(II) complexes show spin crossover upon *encapsulation* by coordination cages of the general structure. The confined cavity of the hosts inhibits changes in the metal coordination number or geometry and promotes configuration change presumably via electronic interactions between the metal dz^2 orbital and the π orbitals of the aromatic cage panels.

High-spin polycationic states of an alternate meta-para-linked oligoarylamine incorporating two macrocycles

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Chem. Commun., 4524–4526 (2009)

High-spin alignment for dicationic, tricationic, tetracationic and hexacationic species of a meta-para-linked oligoarylamine was accomplished by incorporating cyclophane skeletons into the oligomer backbone.

Effect of Tropolone, Azulene and Azulenequinone Derivatives on Prostaglandin E₂ Production by Activated Macrophage-like Cells

Masayuki Nishishiro, Teruo Kurihara, Hidetsugu Wakabayashi and Hiroshi Sakagami* (* Department of Endodontics, Meikai University School of Dentistry)

Anticancer Res., **29**, 379–384 (2009)

We have previously reported that tropolone (1), 2,4-dibromo-7-methoxytropone (2), diethyl 2-chloroazulene-1,3-dicarboxylate (3), 1,3-difluoroazulene (4), 3-morpholino-1,5-azulenequinone (5) and 3,7-dibromo-1,5-azulenequinone (6) inhibited the nitric oxide (NO) production of lipopolysaccharide (LPS)-activated mouse macrophage-like RAW 264.7 cells, with or without the inhibition of inducible NO synthase (iNOS) mRNA and protein expression. In order to confirm the anti-inflammatory potency, possible effects on prostaglandin (PG) E₂ production and the expression of enzymes involved in the arachidonic acid pathway were investigated. Among these six compounds, only compound 3 effectively inhibited the PGE₂ production of the LPS-stimulated RAW 264.7 cells. Western blot analysis demonstrated that compound 3 inhibited phospholipase A₂ (PLA₂), cyclooxygenase (COX)-2 and iNOS proteins only by 12, 45 and 42%, respectively. These data demonstrate the lack of correlation between the extent of inhibition of iNOS protein expression by tropolone or azulene derivatives and that of PGE₂, and suggest the possible anti-inflammatory potency of compound 3.

Tumor-specific Cytotoxicity and Type of Cell Death Induced by Naphtho[2,3-*b*]furan-4,9-diones and Related Compounds in Human Tumor Cell Lines: Relationship to Electronic Structure

Ayako Takano, Ken Hashimoto*¹, Masayuki Ogawa*², Junichi Koyanagi*³, Teruo Kurihara, Hidetsugu Wakabayashi, Hirotaka Kikuchi*⁴, Yukio Nakamura*⁴, Noboru Motohashi*⁵, Hiroshi Sakagami*¹, Katsumi Yamamoto*³ and Akira Tanaka*³ (*³ Pharmaceutical Sciences, Josai University; Division of *¹ Pharmacology and *⁴ Endodontics, Meikai University School of Dentistry, *² Chuoh College of Medical Technology, *⁵ Meiji Pharmaceutical University)

Anticancer Res., **29**, 455-464 (2009)

A total of thirty nine naphtho[2,3-*b*]furan-4,9-diones and related compounds were tested for their cytotoxicity against three human normal oral cells and four human tumor cell lines. 2-Acetylnaphtho[2,3-*b*]furan-4,9-dione [1] was highly cytotoxic to both normal and tumor cells, yielding low tumor-specificity. 2-Acetyl-4,9-dimethoxynaphtho[2,3-*b*]furan [4], the 2-(3-furanoyl)benzoic acids [5, 6] and the 1,4-naphthoquinones [7, 8] showed much reduced cytotoxicity and low tumor-specificity. The introduction of phenoxy [18], isopropylamino [23] or 2-methylpiperidino [33] groups to the 2-position of naphtho[2,3-*b*]furan-4,9-dione yielded compounds that showed the greatest tumor-specificity. These compounds, at twice or four times higher concentrations than CC₅₀, induced the activation of caspase-3, caspase-8 and caspase-9 in the HSC-2 and HL-60 cells, but not so apparently in the HSC-4 cells even after 24 hours incubation and only slightly induced DNA fragmentation in the HL-60 cells. Compound [18] induced the production of annexin-positive cells, but did not induce microtubule-associated protein (GFP)-transfected HSC-2 cells. These data suggested that naphtho[2,3-*b*]furan-4,9-diones may induce the early apoptotic marker, without induction of caspase activation and DNA fragmentation in oral squamous cell carcinoma cell lines. Quantitative structure-activity relationship analysis suggests the applicability of the theoretical calculations such as frontier molecular orbital, dipole moments and hydrophobicity in predicting their cytotoxic activity.

Tumor-specific Cytotoxicity and Type of Cell Death Induced by Benzo[*b*]cyclohept[e][1,4]oxazine and 2-Aminotropone Derivatives

Taichi Narita, Akina Suga, Masaki Kobayashi*¹, Ken Hashimoto*¹, Hiroshi Sakagami*¹, Noboru Motohashi*², Teruo Kurihara and Hidetsugu Wakabayashi (*¹ Department of Endodontics, Meikai University School of Dentistry, *² Meiji Pharmaceutical University)
Anticancer Res., **29**, 1123-1130 (2009)

A total of twenty benzo[*b*]cyclohept[e][1,4]oxazines and their *S*-analogs, and 2-aminotropone derivatives were investigated for their cytotoxicity against three human

normal cells and four tumor cell lines. These compounds showed moderate tumor-specific cytotoxicity. The cytotoxicity was enhanced by bromination at the tropone ring and replacement by formylbenzene. The cytotoxicity of 2-(2-hydroxyanilino)tropone was enhanced by introduction of bromine or isopropyl group to the tropone ring. The presence of a hydroxyl group at ortho or para-position should be necessary for the appearance of cytotoxicity and tumor-specificity. The highly active derivatives, 7-bromo-2-(4-hydroxyanilino)tropone (**1**) and 4-isopropyl-2-(2-hydroxyanilino)tropone (**2**), induced internucleosomal DNA fragmentation and caspase-3, -8 and -9 activation in human promyelocytic leukemia HL-60 cells, but only at concentrations twice or four times higher than CC_{50} values. These compounds induced no discernible DNA fragmentation, and activated caspases much more weakly in human oral squamous cell carcinoma HSC-2 cells. Both **1** and **2** failed to induce the production of acidic organelles, a marker of autophagy, in contrast to the nutritional starvation. These data demonstrated that 2-aminotropones showed relatively higher tumor-specificity than benzo[*b*]cyclohept[*e*][1,4]oxazine, and that 2-aminotropones induced little or no apoptotic cell death in oral squamous cell carcinoma, in contrast to HL-60 cells.

Inhibition of NO Production in LPS-stimulated Mouse Macrophage-like Cells by Benzo[*b*]cyclohept[*e*][1,4]oxazine and 2-Aminotropone Derivatives

Akina Suga, Taichi Narita, Li Zhou*¹, Hiroshi Sakagami*¹, Kazue Satoh*² and Hidetsugu Wakabayashi (*¹ Department of Endodontics, Meikai University School of Dentistry, *² Analysis Center, School of Pharmaceutical Science, Showa University)
International Journal of InVivo Research, **23**, 691-698 (2009)

The aim of this study was to investigate whether a total of twenty benzo[*b*]cyclohept[*e*][1,4]oxazines and their *S*-analogs, and 2-aminotropone derivatives affect the function of activated macrophages. These compounds inhibited the production of pro-inflammatory substances such as nitric oxide (NO) by lipopolysaccharide (LPS)-activated mouse macrophage-like RAW 264.7 cells to different extents. Among them, benzo[*b*]cyclohept[*e*][1,4]oxazin-6(11*H*)-one (**1**) and 7-bromo-2-(4-hydroxyanilino)tropone (**2**) showed the highest inhibitory effects at concentrations that did not affect cellular viability (selectivity index = 74.89 and 54.15, respectively). Western blot and RT-PCR analyses showed that compound **2** inhibited the expression of both inducible NO synthase (iNOS) and cyclooxygenase (COX)-2 at both protein and mRNA levels, whereas compound **1** inhibited only iNOS protein expression. Electron spin resonance (ESR) spectroscopy revealed that both **1** and **2** scavenged nitric oxide (generated from NOC-7) and superoxide anion (generated by HX-XOD reaction) only at much higher concentration. These data suggest that compound **2** but not compound **1** exerts its anti-inflammatory action against macrophages via the inhabitation of iNOS and COX-2 protein expressions.

Reactions of Ninhydrin with Benzo[*b*]thiophenes

Nono Suzue, Rie Ishii, Ryo Kamiya, Hidetsugu Wakabayashi, and Keiji Kobayashi
Heterocycles, **78**, 2467–2475 (2009)

The reaction of ninhydrin with benzo[*b*]thiophene in acetic acid in the presence of a small amount of sulfuric acid afforded a novel fluorenone compound fused to benzo[*b*]thiophene rings. In the reaction using 2,2'-bibenzo[*b*]thiophene, phthalide conjoined in a spiro framework was unexpectedly isolated along with an isocoumarin derivative which is fused to benzo[*b*]thiophene and benzene rings. The product related to the latter was obtained in the reaction of 3,3'-bithiophene with ninhydrin. The structures of these novel heterocycles were supported by spectroscopic studies and X-ray crystallography.

Solid-State Transformation of Achiral Crystals to a Chiral Crystal by Guest Release from Host-Guest Inclusion Crystals of Achiral Host Compound

Hironori Saito, Mitsuaki Suzuki, Hiroshi Miyamae, Naoto Hayashi*, and Keiji Kobayashi
(* Graduate School of Science and Engineering, University of Toyama, Gofuku, Toyama)
Chem. Lett., **38**, 1080–1081 (2009)

Solid-state transformation of achiral crystals into a chiral crystal was induced by thermal guest release from the host-guest inclusion complexes of 2,5-bis(hydroxydiphenylmethyl)thieno[3,2-*b*]thiophene as a host component. The chirality of the resulting guest-free crystals, which are also obtained by recrystallization from dichloromethane, is attributed to conformational freezing of the achiral molecule into a chiral molecular structure in the solid state. In particular, the results for the crystals including acetone as a guest species are of interest, indicating the transformation of a true racemate to a conglomerate in an achiral compound.

Cell Death Induced by Nutritional Starvation in Mouse Macrophage-like RAW264.7 Cells

Hiroshi Sakagami^{*1,2}, Kaori Kishino^{*1}, Osamu Amano^{*3}, Yumiko Kanda^{*4}, Shiro Kunii^{*4}, Yoshiko Yokote, Hiroshi Oizumi^{*5} and Takaaki Oizumi^{*5} (*1 Meikai Pharmaco-Medical Laboratory (MPL), *2 Division of pharmacology, *3 Division of Anatomy, and *4 Laboratory of Electron Microscopy, Meikai University School of Dentistry, *5 Daiwa Biological Research Institute Co., Ltd.)
Anticancer Res., **29**, 343–348 (2009)

Amino acid utilization of mouse macrophage-like RAW 264.7 cells was investigated. During the logarithmic growth stage, RAW 264.7 cells grew very fast, with an approximate doubling time of 11 hours, in DMEM supplemented with 10% heat-inactivated fetal bovine serum. RAW 264.7 cells consumed glutamine at the fastest rate, followed by serine, leucine, isoleucine, arginine, lysine, valine and other amino acids. When the cell density reached a

critical threshold level, cells began to suffer non-apoptotic cell death characterized by mitochondrial damage (revealed by transmission electron microscopy) and a smear pattern of DNA fragmentation (revealed by agarose gel electrophoresis). At this point, glutamine, serine and glucose in the medium were almost completely exhausted, whereas other amino acid remained at more than 40% of their initial concentrations. Based on these data, it is recommended that glutamine, serine and glucose should be supplemented for the long culture of RAW 264.7 cells.

Effect of *Sasa senanensis* Rehder Extract on NO and PGE₂ Production by Activated Mouse Macrophage-like RAW264.7 Cells

Li Zhou^{*1}, Ken Hashimoto^{*2}, Kazue Satoh^{*3}, Yoshiko Yokote, Madoka Kikajima^{*4}, Takaaki Oizumi^{*4}, Hiroshi Oizumi^{*4} and Hiroshi Sakagami^{*1,2} (*1 Meikai Pharmaco-Medical Laboratory (MPL), *2 Division of Pharmacology, Meikai University School of Dentistry, *3 Department of Anatomy, School of Medicine, Showa University, *4 Daiwa Biological Research Institute Co., Ltd.)

in vivo **23**, 773–778 (2009)

Alkaline extract of *Sasa senanensis* Rehder (SE) has shown diverse biological activity. As an extension whether SE affects the function of activated macrophages was investigated. SE inhibited the nitric oxide (NO) production by lipopolysaccharide (LPS)-activated mouse macrophage-like RAW264.7 cells. Western blot and RT-PCR analyses demonstrated that this was due to the inhabitation of inducible NO synthase (iNOS) expression at both protein and mRNA levels. ESR spectroscopy shows that SE dose-dependently scavenged the NO radical produced by NOC-7.

In order to confirm the anti-inflammatory potency, possible effects on prostaglandin (PG)E₂ production and expression of enzymes involved in the arachidonic acid pathway were next investigated. It was found that SE effectively inhibited the PGE₂ production by LPS-stimulated RAW 264.7 cells, although the extent of inhibition of PGE₂ was slightly less than that of NO production. SE inhibited cyclooxygenase (COX)-2 expression at both protein and mRNA levels, but to much lesser extents as compared with those for iNOS expression. SE contained much lower concentration of arginine, precursor of NO, as compared with the culture medium. These data suggest that SE exerts a weak anti-inflammatory activity.

Non-apoptotic Cell Death Induced by Nutritional Starvation in J774.1 Mouse Macrophage-like Cell Line

May Maw Thet^{*1,2}, Yoshiko Yokote, Qing Chu^{*3}, Qin-Tao Wang^{*3}, Kaori Kishino^{*2}, Nozomi Tamura^{*4}, Jun Shimada^{*4}, Osamu Amano^{*5}, Yumiko Kanda^{*6}, Shiro Kunii^{*6}, Fumihiro Takekawa^{*2}, Hajime Hatano^{*2}, Chiyako Shimada^{*2}, Hideo Hasegawa^{*2,7} and Hiroshi Sakagami^{*1,2} (*1 MPL, Divisions of *2 Pharmacology, *4 Oral Maxillofacial Surgery and *5

Anatomy, and *6 Laboratory of Electron Microscopy, Meikai University School of Dentistry, *7 The Japanese Association of Clinical Research on Supplements, *3 Department of Periodontology and Oral Medicine, School of Stomatology. The Fourth Military Medical University, Xi'an, Shaanxi, P. R. China)
Anticancer Res., **29**, 5083–5088 (2009)

The growth and amino acid utilization of a mouse macrophage-like cell line J774.1 was investigated in two different culture media supplemented with 10% fetal bovine serum (FBS). The J774.1 cells grew faster, and consumed glutamin and serine at higher rates in DMEM than in RPMI1640 medium. The consumption of other amino acids was much less, while considerable quantities of alanine, glutamic acid and glycine were induced by the J774.1 cells. When the cells became confluent, serine, but not glutamine, was nearly depleted from the culture medium, followed by cell death characterized by smear DNA fragmentation, slight caspase-3 activation and structural damage of the mitochondria. Serine is required for the growth of mouse macrophage-like cell lines, and DMEM is superior to RPMI 1640 for long-term cell culture.

Frequencies and absorption intensities of fundamentals and overtones of NH stretching vibrations of pyrrole and pyrrole-pyridine complex studied by near-infrared/infrared spectroscopy and density-functional-theory calculations

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Chem. Phys. Lett. **482**, 320–324 (2009)

Near-infrared (NIR)/IR spectra were measured for pyrrole, pyridine and pyrrole-pyridine complex in CCl₄ solutions. The first-overtone of the NH stretching vibration of free pyrrole was observed at 6856 cm⁻¹, but that of pyrrole-pyridine complex was missing or extremely weak. Theoretical calculations of molecular vibrational potentials and dipole moment functions of the NH stretching modes of free pyrrole and pyrrole-pyridine complex elucidated that the transition dipole moment becomes much smaller upon the formation of the complex, resulting in the remarkable intensity decrease in the overtone of the hydrogen-bonded NH group.

Remediation of simulated aquatic sites contaminated with recalcitrant substrates by TiO₂/ozonation under natural sunlight

T. Oyama, I. Yanagisawa^{*1}, Masashi Takeuchi^{*1}, Takayoshi Koike^{*1}, Nick Serpone^{*2} and Hisao Hidaka^{*1} (*1 Frontier Research Center for the Global Environment Science, Meisei University, *2 Dipartimento di Chimica Organica, Università di Pavia)
Appl. Catal. B: Environ. **91**, 242–246 (2009)

The fates of four aquatic contaminants, namely the 2,4-dichlorophenoxyacetic acid herbicide (2,4-D), the bisphenol A endocrine disruptor (BPA), and the sodium butyl-naphthalenesulfonate (BNS) and benzylodicyldemethylammonium bromide (BDDAB) surfactants by the TiO_2 -photoassisted ozonation ($\text{TiO}_2/\text{O}_3/\text{UV}$ method) were investigated indoors under laboratory conditions (super-high-pressure Hg lamp) and outdoors under natural Sunlight. In laboratory experiments the $\text{TiO}_2/\text{O}_3/\text{UV}$ methodology led to significant increases in degradation efficiency relative to ozonation (dark: O_3 ; or under UV light: O_3/UV) and to the TiO_2 -photoassisted method of oxygenated dispersions ($\text{TiO}_2/\text{O}_2/\text{UV}$). Mineralizations of the substrates were monitored by total organic carbon (TOC) assays. The BDDAB surfactant, being most recalcitrant to biodegradation and to the TiO_2 -photoassisted degradation, was mineralized efficiently by the $\text{TiO}_2/\text{O}_3/\text{UV}$ method under natural Sunlight at relatively high concentrations of contaminants (1.0 mM) using a tubular-type photoreactor consisting of Pyrex glass tubes and a solar cell system that supplied the needed electrical power.

PHYSICS

State-selective differential cross section measurements for the one-electron capture processes in the F^{4+} -He, Ne, Ar systems at $E_{\text{lab}} = 45 \text{ eV}$

Y. Itoh and K. Ohtsuki* (* Dep. of Appl. Phys. and Chem., The University of Electro-Communications)

J. Phys. Conf. Ser. **163**, (2009) 012042

The relative state-selective differential cross sections for the charge-transfer processes at very low collision energy were reported in the 14th International Conference on the Physics of Highly Charged Ions (HCI 2008), and this contribution was presented as selected topics. The cross section obtained in $\text{F}^{4+} + \text{He}$ system shows a peak around 0° angle, while those in $\text{F}^{4+} + \text{Ne}$ and Ar collisions at the same collision energy show clear angular thresholds. The strong peak observed in $\text{F}^{4+} + \text{He}$ system is interpreted as due to the glory scattering, and the cross section maximum in $\text{F}^{4+} + \text{Ne}$ and Ar collisions at non-zero angles is due to the rainbow scattering.

2. Books, Reviews and Other Printings

CHEMISTRY

固体有機化学

小林啓二, 林 直人* (* 富山大学)
化学同人, 1-256 (2009)

化学辞典 第2版

小林啓二共同編集および執筆分担 (編集代表 吉村壽次)
森北出版株式会社, 1-1716 (2009)

EARTH SCIENCE

コロラド高原の地質層序 — ザイオン国立公園およびその周辺 —

谷口英嗣, 齋藤洋輔* (* 茗溪学園高等学校)
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Knocker catalogue of the Mineoka ophiolite belt, Boso Peninsula, Japan

Yujiro Ogawa^{*1}, Ryota Mori^{*1,2}, Naoto Hirano^{*1,3}, Akiko Takahashi^{*1,4}, Mia Mohammad Mohiuddin^{*1,5}, Hiroshi Sato^{*1,6}, Toshiaki Tsunogae^{*1}, Masanori Kurosawa^{*1}, Hidetsugu Taniguchi and Tae Chiba^{*1} (*1 Doctoral Program in Earth Evolution Sciences, University of Tsukuba, *2 Mitsubishi Corporation Exploration Co. Ltd, *3 Center for Northeast Asian Studies, Tohoku University, *4 Agency of Royal Affairs, *5 Rajshahi University, Bangladesh, *6 Senshu University)
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古泉一久*¹, 平塚 潤*², 櫛部静二*² (*1 城西大学理学部非常勤講師, *2 城西大学経営学部)
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JVA におけるアンチ・ドーピングムーブメント

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Hiroyuki Teramae, Kazushige Ohtawara^{*1}, Takayoshi Ishimoto^{*2,3}, and Umpei Nagashima^{*2,3}
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寺前裕之, 丸尾容子*, 中村二郎* (* NTT 環境エネルギー研)

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犬塚俊介，紺野東一，尾崎 裕，内山政弘*¹，長澤 浩*² (*1 国立環境研究所，*2 株ニッタ)

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