

# SCIENCE BULLETIN OF JOSAI UNIVERSITY

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城西大学理学部研究報告

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FACULTY OF SCIENCE  
JOSAI UNIVERSITY  
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# **SCIENCE BULLETIN OF JOSAI UNIVERSITY**

**城西大学理学部研究報告**

**Vol. 10 March 2002**

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*PART I ANNUAL REPORTS*

# 1. Abstracts of Papers Published in Journals

## PHYSICS

### Absolute Photoionization Cross section Measurements of $\text{Xe}^+$ Ions in the 4d Threshold Energy Region

Yoh Itoh, Akira Ito<sup>\*1</sup>, Masashi Kitajima<sup>\*2</sup>, Tetsuo Koizumi<sup>\*1</sup>, Takao M. Kojima<sup>\*3</sup>, Hiroshi Sakai<sup>\*1</sup>, Mutsumi Sano<sup>\*4</sup> and Naoki Watanabe<sup>\*5</sup> (\*1 Department of Physics, Rikkyo University, \*2 Department of Physics, Sophia University, \*3 The Institute of Physical and Chemical Research, \*4 Japan Synchrotron Radiation Research Institute, \*5 Institute of Low Temperature Science, Hokkaido University)

*J. Phys. B: At. Mol. Opt. Phys.*, **34**, 3493–3499 (2001)

Using the photon-ion merged-beam technique, we have measured the absolute photoionization cross sections for  $\text{Xe}^{2+}$  and  $\text{Xe}^{3+}$  formation from  $\text{Xe}^+$  at selected energies between 80 and 140 eV, and utilized the absolute data to normalize our previously reported relative cross sections. The structure and energy dependence of the cross sections for  $\text{Xe}^+$  deviate from those of neutral Xe; however, the maximum total cross section for  $\text{Xe}^+$  is, within the experimental error, the same as for Xe.

### Relative Counting Efficiencies of Ion Charge-States by Microchannel Plate

S. Yagi<sup>\*1</sup> T. Nagata<sup>\*1</sup>, M. Koide<sup>\*2</sup>, Y. Itoh, T. Koizumi<sup>\*3</sup> and Y. Azuma<sup>\*4</sup> (\*1 Department of Physics, Meisei University, \*2 Institute for Laser Science, University of Electro-communications, \*3 Department of Physics, Rikkyo University, \*4 Photon Factory, KEK)

*Nucl. Instrum. Methods Phys. Res.* **B183**, 476–486 (2001)

Relative detection efficiencies  $D_{q+}$  of ions with different charges and impact energies in single-ion counting mode with microchannel plates (MCP, Hamamatsu F1094-21S) have been examined for  $\text{Li}^{q+}$ ,  $\text{Ar}^{q+}$ ,  $\text{Ba}^{p+}$  and  $\text{Yb}^{p+}$  ions ( $q=1, 2$  and  $p=1, 2, 3$ ). The incident ion energy ranges from 1.1 to 15 keV. The efficiencies  $D_{q+}$  for a given atom, plotted as a function of incident ion energy  $E_K$  lie on a unique curve. This comes originally from the fact that the secondary electron emission at the input channel-wall of MCP is dominated mainly by kinetic emission processes and little by potential emission processes in the keV energy range. When ions with different charges but the same  $E_K$  value of a given atomic species are detected, almost equal detection efficiencies are ensured as far as  $E_K$  is larger than 4 keV. Nearly equal detection efficiencies for singly and doubly charged ions accelerated by the same voltage are attainable at higher acceleration voltages for heavier ions, e.g., 5 kV for  $\text{Ar}^{2+}$  ions and about 10 kV for  $\text{Ba}^+$  and  $\text{Ba}^{2+}$  ions.

## CHEMISTRY

### Evaluation of Expansion Coefficients from Optimal Fitting Parameters for the Analysis of Spectra of Diatomic Molecules and an Application to LiH

Hiromichi Uehara and J. F. Ogilvie\* (\*Centre for Experimental and Constructive Mathematics, Simon Fraser University)

*J. Mol. Spectrosc.*, **207**, 143–152 (2001)

To evaluate individual expansion coefficients composing fitting parameters of the Born-Oppenheimer corrections to Dunham's coefficients  $Y_j$  that have been given analytically with the  $\Delta_B$  and  $\Delta_\omega$  formalism, we examined the consistency of analytic expressions for those corrections with Watson's assertion of the experimental inseparability of non-adiabatic corrections  $Q_{a,b}(r)$  for a molecule  $AB$ . Derived analytic expressions in terms of optimal fitting parameters for the corrections are essential to evaluate individual expansion coefficients. These expressions also reveal redundancies between empirical correction parameters  $\Delta_{ij}$ . A method of evaluating nonadiabatic vibrational corrections  $Q_{a,b}(r)$  and adiabatic corrections  $S_{a,b}(r)$  separately consistent with Watson's assertion of inseparability is presented and is applied to an analysis of spectral data of LiH. Functions  $Q_{a,b}$  and  $S_{a,b}$  for LiH are thus successfully evaluated;  $S_{H,Li}(r)$  values agree well with those predicted simply by wobble-stretch theory. Experimental values for optimal fitting parameters  $r_{1q}^H$  and  $r_{2q}^H$  are nearly equal to those of  $r_{1q}^{Li}$  and  $r_{2q}^{Li}$ , respectively, in agreement with a theoretical relation  $r_{iq}^a = r_{iq}^b$ .

### Infrared Absorption Spectroscopy of Ar-<sup>12</sup>C<sup>18</sup>O<sub>2</sub>: Change in the Intramolecular Potential upon Complex Formation

Yasushi Ozaki, Kouji Horiai, Toichi Konno, and Hiromichi Uehara

*Chem. Phys. Lett.*, **335**, 188–194 (2001)

An infrared absorption spectrum has been observed and analyzed for an Ar-<sup>12</sup>C<sup>18</sup>O<sub>2</sub> van der Waals (vdW) complex in the range of 2312–2314 cm<sup>-1</sup>. The effective structure of the complex derived from the obtained rotational constants is in essential agreement with the structure estimated from that of Ar-<sup>12</sup>C<sup>16</sup>O<sub>2</sub> based on the isotope effect on the amplitudes of vdW vibrations. The band origin for the Ar-<sup>12</sup>C<sup>18</sup>O<sub>2</sub>  $\nu_4$  mode shows a red shift of 0.4567 cm<sup>-1</sup> with respect to that for <sup>12</sup>C<sup>18</sup>O<sub>2</sub>  $\nu_3$  mode; the change in the intramolecular potential of CO<sub>2</sub> upon complex formation with Ar is determined from the isotope effect on the band-origin shift.

## **Comparative Assessment of the Efficiency of Thin Film Electrodes Fabricated by Three Deposition Methods**

### **Photoelectrochemical Degradation of the DBS Anionic Surfactant**

Hisao Hidaka\*<sup>1</sup>, Kazuhiko Ajsaka\*<sup>1</sup>, Satoshi Horikoshi\*<sup>1</sup>, Toshiyuki Oyama, Kazuo Takeuchi\*<sup>2</sup>, Jincal Zhao\*<sup>3</sup>, Nick Serpone\*<sup>4</sup> (\*1 Frontier Research Center for the Global Environmental Protection, Meisei University, \*2 The Institute of Physical and Chemical Research (Riken), \*3 Institute of Chemistry, Chinese Academy of Sciences, \*4 Department of Chemistry and Biochemistry, Concordia University)

*J. Photochem. Photobiol. A: Chem.* **138**, 185–192(2001)

This study reports on a comparative assessment of the efficiency of TiO<sub>2</sub>/SnO<sub>2</sub>-doped thin film electrodes fabricated by three different deposition methods. Process efficiencies, as measured by the kinetics of degradation, were examined by monitoring the photooxidative fate of two test substrates, namely the anionic surfactant sodium dodecylbenzenesulfonate (DBS) and the model compound sodium benzenesulfonate (BS). Methods chosen to fabricate the TiO<sub>2</sub>/OTE electrodes comprised (1) pulsed laser deposition, (2) deposition of a TiO<sub>2</sub> paste on the OTE plate, and (3) sol-gel deposition. Both DBS and BS are readily photo-oxidized and, under our conditions, were anodically biased at +0.3 V, which generated a photocurrent during the photoelectrolysis. The sol-gel (C) and anatase (B1) electrodes proved especially useful under the +0.3 V bias. In the absence of any bias, however, DBS photodegraded faster on the TiO<sub>2</sub> pasted electrode. Under otherwise similar conditions, pulsed laser rutile TiO<sub>2</sub>/OTE electrode showed very little photoactivity. Some of the characteristics of the TiO<sub>2</sub> film, such as the TiO<sub>2</sub> crystalline form, film thickness, surface roughness, and film transparency appear to have some effect on the overall photodegradative process efficiency.

### **Photooxidative *N*-demethylation of Methylene Blue in Aqueous TiO<sub>2</sub> Dispersions under UV-Irradiation**

Tianyong Zhang\*<sup>1</sup>, Toshiyuki Oyama, Akeo Aoshima\*<sup>1</sup>, Hisao Hidaka\*<sup>1</sup>, Jincal\*<sup>2</sup>, and Nick Serpone\*<sup>3</sup> (\*1 Frontier Research Center for the Global Environmental Protection, Meisei University, \*2 Institute of Chemistry, Chinese Academy of Sciences, \*3 Department of Chemistry and Biochemistry, Concordia University)

*J. Photochem. Photobiol. A: Chem.* **140**, 163–172 (2001)

Methylene blue (MB) is a representative of a class of dyestuffs resistant to biodegradation. Its decomposition was examined in aqueous TiO<sub>2</sub> dispersions under UV-illumination to assess the influence of temperature, pH, concentration of dissolved oxygen (DOC), initial concentration of MB, and light intensity on the kinetics of decomposition. Hypsochromic effects (i.e. blue shifts of spectral bands) resulting from *N*-demethylation of the dimethylamino group in MB occurs concomitantly with oxidative degradation. Measured at constant pH 4 were also the maximum quantity of MB adsorbed on TiO<sub>2</sub>, and the



kinetics of degradation of MB and of TOC removal. Photobleaching of MB solutions takes place at low DOCs and is caused by a reversible reductive process involving photogenerated electrons on  $\text{TiO}_2$ . The rate of degradation of MB remains fairly constant regardless of whether the dispersion was purged with oxygen prior to irradiation or with air during the light irradiation period. The photocatalytic process depends on light intensity, but not on the total light energy absorbed. The photoreaction followed pseudo first-order kinetics even at high MB concentrations (0.3 mM). The temperature dependence of the photodegradation kinetics was assessed ( $E_a=8.9$  kJ/mol), as well as the relative photonic efficiency,  $\xi_r$ , relative to phenol (0.4).

### **Assessment and Influence of Operational Parameters on the $\text{TiO}_2$ Photocatalytic Degradation of Sodium Benzene Sulfonate Under Highly Concentrated Solar Light Illumination**

Tianyong Zhang<sup>\*1</sup>, Toshiyuki Oyama, Satoshi Horikoshi<sup>\*1</sup>, Jincui Zhao<sup>\*2</sup>, Hisao Hidaka<sup>\*1</sup>, and Nick Serpone<sup>\*3</sup>, (\*1 Frontier Research Center for the Global Environmental Protection, Meisei University, \*2 Institute of Chemistry, Chinese Academy of Sciences, \*3 Department of Chemistry and Biochemistry, Concordia University)  
*Solar Energy*, **71**, 305–313 (2001)

Sodium benzene sulfonate (BS) was decomposed in aqueous  $\text{TiO}_2$  dispersions under highly concentrated solar light illumination to examine the photocatalytic characteristics of a parabolic round concentrator (PRO) reactor to degrade the pollutant without visible light absorption. The effects of such operational parameters as initial concentration, volume of the aqueous BS solution, oxygen purging, and  $\text{TiO}_2$  loading on the kinetics of decomposition of BS were investigated. An effective photodegradation necessitates a suitable combination of initial volume and concentration of BS solution. Relative to atmospheric air, oxygen purging significantly accelerates the degradation process at high initial concentrations of BS (0.40 mM or 1.0 mM). Optimal  $\text{TiO}_2$  loading was 9 g litre<sup>-1</sup>, greater than previously reported. Elimination of TOC (total organic carbon) followed pseudo first-order kinetics in the initial stages of the photodegradation process. The relative photonic efficiency for the photodegradation of BS is  $\zeta_{\text{rel}} = 1.0$ .

### **Syntheses of Tetraazabis(tropocoronand)s Containing Hydroxy Group(s) and Conformational Analysis of Their Nickel(II) Complexes in Solution**

Ohki Sato<sup>\*1</sup>, Hideki Chikamatsu<sup>\*1</sup>, Josuke Tsunetsugu<sup>\*1</sup>, Kimio Shindo, Hidetsugu Wakabayashi, and (the late) Tetsuo Nozoe<sup>\*2</sup> (\*1 Department of Chemistry, Faculty of Science, Saitama University, \*2 Tokyo Research Laboratories, Kao Corporation)  
*Heterocycles*, **52** (1), 459–463 (2000)

The stepwise syntheses of one symmetric and three asymmetric tetraazabis-

(tropocoronand)s (**12a–12d**) having two linker chains, with or without a hydroxy group, of the same or different length are reported. The coordination styles of their nickel(II) complexes (**13a–13d**) in solution have also been discussed based on their  $^1\text{H}$  NMR and UV-VIS. spectral data.

### Synthesis and Properties of Tetraazazulenocoronands and Octaazazulenocryptands

Hidetsugu Wakabayashi, Teruo Kurihara, and (the late) Tetsuo Nozoe\* (\*Tokyo Research Laboratories, Kao Corporation)

*Heterocycles*, **54** (1), 87–92 (2001)

Treatment of 1, 3-diformylazulene (**1**) with 1.2 equiv. of  $\alpha, \omega$ -alkanediamines (**3** and **4**) and tris (2-aminoethyl) amine (**5a**) in ethanol for 24 h at room temperature gave tetraazaazulenecoronands (**2** and **9**) and octaazaazulenocryptand (**10**) in one-pot procedure in good yields.

### Convenient Synthesis of 4-Trifluoromethyl-Substituted Imidazole Derivatives

Masami Kawase\*<sup>1</sup>, Setsuo Saito\*<sup>1</sup>, and Teruo Kurihara (\*<sup>1</sup> Faculty of Pharmaceutical Sciences, Josai University)

*Chem. Pharm. Bull.*, **49** (4), 461 (2001)

Mesoionic 4-trifluoroacetyl-1, 3-oxazolium-5-olates (**1**), obtained from the reaction of *N*-acyl-*N*-alkylglycines (**2**) with trifluoroacetic anhydride, react with ammonia to give 4-trifluoromethyl-3, 4-dihydroimidazoles (**3**) in high yields. Dehydration of **3** gives 4-trifluoromethylimidazoles (**4**) in high yields. The novel ring transformation of **1** into **3** occurs via a regioselective attack of ammonia on the C-2 position of the ring.

### Biological Activity of a Fruit Vegetable, “Anastasia Green”, a Species of Sweet Pepper

Noboru Motohashi\*<sup>1</sup>, Teruo Kurihara, Hidetsugu Wakabayashi, Mikako Yaji, Ilona Mucsi\*<sup>2</sup>, Joseph Molnar\*<sup>2</sup>, Shichiro Maruyama\*<sup>3</sup>, Hiroshi Sakagami\*<sup>3</sup>, Hideki Nakashima\*<sup>4</sup>, Satoru Tani\*<sup>5</sup>, Yoshiaki Shirataki\*<sup>5</sup>, and Masami Kawase\*<sup>5</sup> (\*<sup>1</sup> Meiji Pharmaceutical University, \*<sup>2</sup> Faculty of Medicine, Institute of Microbiology, Albert Szent-Gyorgyi Medical University, \*<sup>3</sup> Department of Dental Pharmacology, Meikai University School of Dentistry, \*<sup>4</sup> Department of Microbiology and Immunology, Kagoshima University Dental School, \*<sup>5</sup> Faculty of Pharmaceutical Sciences, Josai University)

*In vivo.*, **15**, 437–442 (2001)

Russian green sweet pepper (Anastasia Green) was successively extracted with hexane, acetone, methanol and 70% methanol and the extracts were further separated into a total of twenty fractions by silica gel or ODS column chromatographies. The extracts and fractions showed higher cytotoxic activity against two human oral tumor cell lines than

against normal human gingival fibroblasts, suggesting their tumor-specific action. Several fractions [H3, H4, A4] reversed the multidrug resistant gene (MDRI) against L5178 mouse T-cell lymphoma more effectively than ( $\pm$ ) verapamil (positive control). All extracts and fractions showed no anti-human immunodeficiency virus (HIV) nor anti-*Helicobacter pylori* activity. These data suggest the medicinal importance of an Anastasia Green extract.

### Biological Activity of kiwifruit Peel Extracts

Noboru Motohashi\*<sup>1</sup>, Yoshiaki Shirataki\*<sup>2</sup>, and Masami Kawase\*<sup>2</sup>, Satoru Tani\*<sup>2</sup>, Hiroshi Sakagami\*<sup>3</sup>, Kazue Satoh\*<sup>4</sup>, Teruo Kurihara, Hideki Nakashima\*<sup>5</sup>, Kristina Wolfard\*<sup>6</sup>, Csilla Miskolci\*<sup>6</sup>, and Joseph Molner\*<sup>6</sup> (\*1 Meiji Pharmaceutical University, \*2 Faculty of Pharmaceutical Sciences, Josai University, \*3 Department of Dental Pharmacology, Meikai University School of Dentistry, \*4 Analysis Center, School of Pharmaceutical Sciences, Showa University, \*5 Department of Microbiology and Immunology, Kagoshima University Dental School, \*6 Faculty of Medicine, Institute of Microbiology, Albert Szent-Gyorgyi Medical Univeresity)

*Phytother. Res.*, **15**, 337–343 (2001)

Various bioactive substances in Kiwifruit extracts were fractionated by organic solvent extractions, followed by silica gel and ODS chromatographies. Both cytotoxic activity and multi-drug resistance reversal activity were found in the less polar fractions. Cytotoxic activity was not always parallel the radical intensity. Antibacterial activity was distributed into various fractions and all fractions were inactive against *Candida albicans* and *H. pylori*. Only 70% methanol extracts showed anti-human immunodeficiency virus activity, and produced a broad ESR signal under alkaline conditions, in a fashion similar to lignin. These fractions also effectively scavenged O<sub>2</sub><sup>-</sup> produced by the xanthine-xanthine oxidase reaction, suggesting a bimodal (pro-oxidant and antioxidant) action. These data suggest a medicinal efficacy of kiwifruit peel extracts.

### Calorimetric study of nickel complex compounds with tmen as a ligand: determination of the energetic parameters for the $\delta$ - $\lambda$ conformational change of the ethylenediamine framework

M. Oguni\*<sup>1</sup>, T. M. Yoshida\*<sup>1</sup>, K. Wada\*<sup>1</sup>, Y. Fukuda\*<sup>2</sup>, N. Ogino, T. Ito, H. Miyamae, K. Sato\*<sup>3</sup> (\*1 Department of Chemistry, Faculty of Science, Tokyo Institute of Technology, \*2 Department of Chemistry, Faculty of Science, Ochanomizu University, \*3 Department of Chemistry, Faculty of Science, Niigata University)

*J. Phys. Chem. Solids*, **62**, 613–618 (2001)

Heat capacities of crystalline  $[\text{Ni}(\text{acac})(\text{tmen})(\text{H}_2\text{O})_2]\text{I}$  and  $[(\text{Ni}(\text{acac})_2(\text{tmen}))]$  were measured with an adiabatic calorimeter in the range 10–300 K, where acac and tmen are acetylacetonate and *N, N, N', N'*-tetramethylenediamine, respectively. Glass transitions

were found at  $(108 \pm 1)$  and  $(126 \pm 1)$  K for the respective compounds. They were interpreted as due to the freezing-in of disorder between the  $\delta$  and  $\lambda$  conformations of tmen moiety. The energy difference ( $\Delta\epsilon$ ) between the two conformations and the activation energy ( $\Delta\epsilon_a$ ) for the conformational change were determined by the analyses of the calorimetric data to be  $(0.87 \pm 0.05)$  and  $(32 \pm 1)$  kJ mol<sup>-1</sup> for the iodide compound, and  $(1.58 \pm 0.05)$  and  $(39 \pm 1)$  kJ mol<sup>-1</sup> for the molecular compound, respectively. It is discussed that  $\Delta\epsilon$  is affected both by the coordination structure of complex and by the presence/absence and species of counter anion while that  $\Delta\epsilon_a$  is determined rather by the interaction of tmen with the other ligands within the complex. X-ray diffraction technique was applied to crystalline  $[\text{Ni}(\text{acac})(\text{tmen})(\text{H}_2\text{O})_2] \text{ClO}_4$  to confirm the above interpretation, and the details are given as an appendix.

### **Heterocyclization of 4-trifluoroacetyl-1, 3-oxazolium-5-olates with 1, 4-bis-nucleophiles**

Masami Kawase\*<sup>1</sup>, Hiromi Koiwai\*<sup>1</sup>, Toru Tanaka\*<sup>1</sup>, Satoru Tani\*<sup>1</sup>, and Hiroshi Miyamae (\*1 Faculty of Pharmaceutical Sciences, Josai University)

*Heterocycles*, **55**, 1919–1926 (2001)

Reactions of aromatic 1,4-bis-nucleophiles such as *o*-phenylenediamine and *o*-aminothiophenol, with mesoionic 4-trifluoroacetyl-1,3-oxazolium-5-olates(**1**) gave regiospecifically seven member trifluoromethylated heterocycles such as 1,5-benzodiazepines(**3**) and 1,5-benzothiazepines(**4**). The reaction with *o*-aminophenol afforded non-cyclized products(**5**). The structures of **3**, **4**, and **5** were established by X-Ray diffraction analysis.

### **Changes in Amino Acid Pool and Utilization during Apoptosis in HL60 Cells Induced by Epigallocatechin Gallate or Gallic Acid**

Hiroshi Sakagami\*<sup>1</sup>, Yoshiko Yokote, Kiso Akahane (\*1 Department of Dental Pharmacology, Meikai University School of Dentistry, Saitama)

*Anticancer Res.*, **20**, 265–270 (2001)

Recent studies have demonstrated the apoptosis-inducing potential of epigallocatechin gallate (EGCG), a major component of green tea, against various cultured cell lines. By using an amino acid analyzer, we investigated here the possible changes in the amino acid pool and utilization during the apoptosis of HL-60 cells induced by EGCG or gallic acid, a structural unit of tannin. Sublethal concentrations of EGCG initially elevated and then reduced the intracellular concentrations of most of amino acids except for glutamic acid and aspartic acid, whereas lethal concentrations of EGCG continuously reduced these amino acid pools during 6 hours. Both sublethal and lethal concentrations of gallic acid initially elevated and then reduced these amino acid pools. Both inducers elevated the intracellular accumulation and production of arginine and extensively reduced the utilization of other amino acids. These data demonstrate that EGCG showed more severe effects on the amino

acid pool and utilization than gallic acid, which may explain, at least in part, the difference in apoptosis-inducing potential between these inducers.

## PHYSICAL EDUCATION

### **A Study of Line-up Analysis in International Women's Volleyball Game's —2000 Olympic Final Qualifications: Japanese Team versus Croatian Team—**

Daisen Shimazu\*<sup>1</sup>, Kyoichi Izumikawa\*<sup>2</sup>, Sotonori Yamamoto\*<sup>3</sup>, Masakazu Akashi\*<sup>4</sup>, Mituru Sakai\*<sup>5</sup>, Takehiko Tahara\*<sup>6</sup>, Satoshi Harada\*<sup>7</sup> (\*1 Japan Women's University, Department of Physical Education, \*2 Kanagawa Institute of Technology, Department of Physical Education, \*3 Kyorin University, Department of Physical Education, \*4 Josai University, Department of Physical Education, \*5 Kyushu Women's Junior College, Department of Physical Education, \*6 Nara University, Department of Physical Education, \*7 Rishou University, Department of Physical Education)

*J. Phy. Ex. Sports.*, 7, 11-20 (2001)

For the Japanese, the probable higher-rank groups were Line-up5 (L-up 5) and 1, while the line-ups to be avoided were L-up2 and 4. For L-up5, which took first place in the estimated total ranking, the best starting rotation phase was expected to be rotation Phase3 (R3) if the Japanese team was on the serving side or R2 if on the receiving side, provided that the Croatian team starts with its rotation R6. With this line-up, it was believed to be essential for the Japanese team to enhance the defensive power of R5, which would give a lower defensive power index, and to maintain the offensive power of R1, which it would give higher offensive power index. It was also required that the team improve the offensive power of R5, which have lower offensive power index when compared to R1, as well as to retain defensive power for R2 and R3 with higher defensive power indexes.

The Japanese team selected L-up 1 and 6 instead of Line-up5 for the match. Line-up1 usually decreases in defensive power index for R3 and R4. These rotation phases chosen by Japan faced R3 and R4 of the Croatian L-up2, as well as, Line-up6 usually decreases in defensive power index for R4. This rotation phases chosen by Japan faced R3 of the Croatian L-up3, which were estimated to be higher in offensive power index. The Japanese team failed to enhance the inferior defensive power of L-up 1 and 6 for these rotation phases, while the Croatian team successfully retained and even improved the strong offensive power for the corresponding rotation phases. We judged that this fact was one of the reasons why the Japanese team failed to win the match. Therefore the next challenge to be addressed should be an analysis of line-ups for cases in which the opposing team is on the servicing side.

This was a guide of volleyball game analysis by strong or weak power of rotation phase and contributive rate of individual player's points or side-out points. But it has need to develop.

Key words; Volleyball, Game analysis, Offensive Power index. Defensive Power index,

B-T model

**A Study of Line-up Analysis in International Women's Volleyball Games — '99 World Cup Women's Games, Japan Team versus China Team —**

Daisen Shimazu\*<sup>1</sup>, Kyoichi Izumikawa\*<sup>2</sup>, Sotonori Yamamoto\*<sup>3</sup>, Masakazu Akasi\*<sup>4</sup>, Mituru Sakai\*<sup>5</sup>, Takehiko Tahara\*<sup>6</sup>, Satoshi Harada\*<sup>7</sup> (\*1 Japan Women's University, Department of Physical Education, \*2 Kanagawa Institute of Technology, Department of Physical Education, \*3 Kyorin University, Department of Physical Education, \*4 Josai University, Department of Physical Education, \*5 Kyushu Women's Junior College, Department of Physical Education, \*6 Nara University, Department of Physical Education, \*7 Rishou University, Department of Physical Education)

*Journal of Volleyball Science*, 3-1, 15-25 (2001)

The authors attempted to extrapolate the best and worst line-up for the Japan women's volleyball team in the '00 Olympic Final Qualification games with China. They used the maximum likelihood method and Brodley-Terry Model to retrospectively investigate the nine games between Japan, Cuba, Russia, Brazil, and China in the '99 World Cup Women's Volleyball Games held in Japan (from November 2 to 16, 66 games in total).

Line-up4 was obtained by the best and Line-up6 was the worst. The starting line-up of the Japan team in line-up4 was R5 with and without the serve. In Line-up6, the starting line-up was R3 with and without the serve, respectively. Line-up6 was the line-up that the Japan team should have avoided. To enhance the team's performance, it was necessary to improve the rotation phase with a low offense index and defense index. High defense index was necessary to maintain. Specifically, R4 R5 and R6 (low offense index), R1 and R2 (low defense index), R3, R5 and R6 (high defense index) were applicable to rotation phases for the Japan team in Line-up4. R6 (18.5%) and R2 (-13) were obtained the most low offense performance by point rate and Net Score each method.

Key words; Volleyball, Game analysis, Offense index, Defense index

**Effects of intake of foods with antioxidant activities in long distance runners.**

Kojiro Ishii\*<sup>1</sup>, Kazuki Takizawa\*<sup>1</sup>, Kazuya Yonezawa\*<sup>2</sup>, Eiji Daigo\*<sup>3</sup>, Noto Suzuki\*<sup>4</sup> (\*1 Grad. School of Edu., Hokkaido Univ., \*2 Grad School of Med, hokkaido Univ., \*3 Kanagawa Univ., \*4 Josai Univ.) & Teruaki Komine (Noevlr Foods Co., Ltd.)

*Advances in Exercise and Sports Physiology*, 6 (4) 160 (2000)

<Objective>

As the oxygen consumption increases due to exercise. The production of active oxygen increases in the body. Hyperoxidation has been reported to cause skeletal muscle injuries, hemolysis, and DNA damages, and intake of foods with antioxidant activities is recommended. In this study oxidation stress in long distance runners during the training

period including a training camp was examined, and the effects of intake of functional food items (fermented grain extracts) with antioxidant activities (AOZ) were evaluated.

〈Methods〉

Study 1: The cholesteryl ester hydroperoxide (CEOOH) and 8-hydroxy-deoxyguanosine (8-OHdG) levels were measured in 14 female college long-distance runners, who were divided into early intake and late intake groups.

Study 2: The CPK, RBC, Ht, Hb, and Fe levels were measured in 29 male long distance runners, who were divided into AOZ and placebo groups.

〈Results and Discussion〉

The CEOOH level was increased at the end of the training camp in both the early intake and late intake groups, indicating accumulation of oxidation stress during the training camp.

Ht, Hb, and Fe showed interaction (intake or no intake X intake period), and the blood profile remained stable in the AOZ group even during the training camp.

Active oxygen produced during intensive endurance training is known to surpass the ability of its elimination. Intake of foods with antioxidant activities is considered to be a preventive measure against oxidation stress.

〈Keyword〉

Endurance Running, Training, Reactive Oxygen Species (ROS)

## 2. Books, Reviews and Other Printing

### MATHEMATICS

**Invariant hyperfunctions on the prehomogeneous vector space acting the group  $GL_n(\mathbf{R}) \times SO_{p,q}(\mathbf{R})$ .**

Representation theory and noncommutative harmonic analysis (Japanese) (Kyoto, 1998)  
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