

References

- Anon 1995. Parallel Food Testing in the European Union: Fish London, UK, International Consumers Research & Testing Limited.
- AOAC. 1990. Official Method of Analysis, Association of Official Analytical Chemists. 15th edition. Arlington. VA.
- Armenta, S., Coelho, N. M. M., Roda, R., Garrigues, S. and de la Guardia, M. 2006. Seafood freshness determination through vapour phase Fourier transform infrared spectroscopy. *Analytica Chimica Acta* **580** (2): 216-222.
- Baugh, P. J. 1993. Gas Chromatography: A Practical Approach New York.
- Béné, A., Hayman, A., Reynard, E., Luisier, J. L. and Villettaz, J. C. 2001. A new method for the rapid determination of volatile substances: the SPME-direct method: Part II. Determination of the freshness of fish. *Sensors and Actuators B: Chemical* **72** (3): 204-207.
- Busto, O., Miracle, M., Guasch, J. and Borrull, F. 1997. Determination of biogenic amines in wines by high-performance liquid chromatography with on-column fluorescence derivatization. *Journal of Chromatography A* **757** (1-2): 311-318.
- Butler, J. N. and Cogley, D. R. 1998. Ionic equilibrium : Solubility and pH Calculations Canada, John Wiley & Sons, INC.
- Cao, L.-W., Wang, H., Li, J.-S. and Zhang, H.-S. 2005. 6-Oxy-(*N*-succinimidyl acetate)-9-(2'-methoxycarbonyl) fluorescein as a new fluorescent labeling reagent for aliphatic amines in environmental and food samples using high-performance liquid chromatography. *Journal of Chromatography A* **1063** (1-2): 143-151.

- Cháfer-Pericás, C., Herráez-Hernández, R. and Campíns-Falcó, P. 2004. Liquid chromatographic determination of trimethylamine in water. *Journal of Chromatography A* **1023** (1): 27-31.
- Chamberlain, T. and Kow, F. 1994. Getting the Best Out of Those Oreos' *Austin Fish* **53** (6): 30-32.
- Chen, Z. and Alexander, P. W. 1997. Potentiometric detection of aliphatic amines by flow injection analysis and ion-interaction chromatography with a metallic copper electrode. *Journal of Chromatography A* **758** (2): 227-233.
- Chien, Y.-C., Uang, S.-N., Kuo, C.-T., Shih, T.-S. and Jen, J.-F. 2000. Analytical method for monitoring airborne trimethylamine using solid phase micro-extraction and gas chromatography-flame ionization detection. *Analytica Chimica Acta* **419** (1): 73-79.
- Choi, S. Y., Chung, M. J. and Sung, N. J. 2002. Volatile N-nitrosamine inhibition after intake Korean green tea and Maesil (*Prunus mume* SIEB. et ZACC.) extracts with an amine-rich diet in subjects ingesting nitrate. *Food and Chemical Toxicology* **40**: 949-957.
- Christian, G. D. 1994. Analytical Chemistry. 5th edition, John Wiley & Sons, Inc.
- Civera, T., Parisi, E., Amerio, G. P. and Giaccone, V. 1995. Shelf-life of vacuum-packed smoked salmon: microbiological and chemical changes during storage. *Arch. Lebensmittelhyg.* **46**: 1-24.
- Dabek-Zlotorzynska, E. and Maruszak, W. 1998. Determination of dimethylamine and other low-molecular-mass amines using capillary electrophoresis with laser-induced fluorescence detection. *Journal of Chromatography B: Biomedical Sciences and Applications* **714** (1): 77-85.

- Dai, G. 1998. A study of the sensing properties of thin film sensor to trimethylamine. *Sensors and Actuators B: Chemical* **53** (1-2): 8-12.
- EEC. 1991. The European Commission Council Regulation No. 91/493/EEC. *Official Journal of the European Communities*.
- EPA method 8070A. 1996. Nitrosamines by Gas Chromatography. Revision 1: 1-15.
- Erickson, M. C. 1993. Compositional Parameters and Their Relationship to Oxidative Stability of Channel Catfish. *Journal of Agriculture Food Chemistry* **41**: 1213-1216.
- Eurachem guide. 1998. The fitness for Purpose of Analytical Methods: A Laboratory Guide to method Validation and Related Topics, update on December,1998.
- Eurachem. 2002. Guide to Quality in Analytical Chemistry. An Aid to Accreditation CITAC (The Cooperation on International Traceability in Analytical Chemistry) and EURACHEM (A Focus for Analytical Chemistry in Europe).
- FDA. 2000. Validation and Verification Guidance for Human Drug Analytical Method. ORA Laboratory Procedure: Document No. ORA-LAB.5.4.5. Food and Drug Administration. Version No. 1.2: 13-14.
- Flórez Menéndez, J. C., Fernández Sánchez, M. L., Fernández Martínez, E., Sánchez Uría, J. E. and Sanz-Medel, A. 2004. Static headspace *versus* head space solid phase microextraction (HS-SPME) for the determination of volatile organochlorine compounds in landfill leachates by gas chromatography. *Talanta* **63** (4): 809-814.
- Gill, T. 1995. Autolytic Changes in Quality and Quality Changes in Fresh Fish. *Food and Agriculture Organization*: 39-50.

- Grob, R. L. 2004. Modern practice of gas chromatography 4th USA, John Wiley & Sons, Inc.
- Hachenberg, H. and Schmidt, A. P. 1977. Gas Chromatographic Headspace Analysis London, Heyden & Sons.
- Hammond, J., Marquis, B., Michaels, R., Oickle, B., Segee, B., Vetelino, J., Bushway, A., Camire, M. E. and Davis-Dentici, K. 2002. A semiconducting metal-oxide array for monitoring fish freshness. *Sensors and Actuators B: Chemical* **84** (2-3): 113-122.
- Harvey, D. 2000. Modern Analytical Chemistry McGraw-Hill International edition, McGraw-Hill Companies.
- Hattula, T. 1995. Effects of Catching Method on Different Quality Parameters of Baltic Herring (*Clupea harengus* L.) *Fish. Res.* **23**: 209-221.
- Herráez-Hernández, R., Cháfer-Pericás, C., Verdú-Andrés, J. and Campíns-Falcó, P. 2006. An evaluation of solid phase microextraction for aliphatic amines using derivatization with 9-fluorenylmethyl chloroformate and liquid chromatography. *Journal of Chromatography A* **1104** (1-2): 40-46.
- Hultin, H. O. 1994. Oxidation of Lipids in Seafoods Chemistry Processing, Technology and Quality
- Industry Focus. Food Market Exchange, Retrieved October 7, 2002, From <http://www.foodmarketexchange.com/datacenter/industry/article>.
- Kawata, A., Kato, S., Hayashi, H. and Hirai, S. 1997. Prominent sensory and autonomic disturbances in familial amyotrophic lateral sclerosis with a Gly93Ser mutation in the SOD1 gene. *Journal of the Neurological Sciences* **153** (1): 82-85.

- Kaykhaii, M., Nazari, S. and Chamsaz, M. 2005. Determination of aliphatic amines in water by gas chromatography using headspace solvent microextraction. *Talanta* **65** (1): 223-228.
- Kim, K. R., Paik, M. J., Kim, J. H., Dong, S. W. and Jeong, D. H. 1997. Rapid gas chromatographic profiling and screening of biologically active amines. *Journal of Pharmaceutical and Biomedical Analysis* **15** (9-10): 1309-1318.
- Korb, B. and Ettre, L. S. 1997. Static Headspace-Gas Chromatography Theory and Practice USA, Wiley-VCH.
- Krzymien, M. E. and Elias, L. 1990. Feasibility study on the Determination of fish Freshness by Trimethylamine headspace analysis. *Food Science* **55**: 1128-1132.
- Kwon, T.-H., Park, S.-H., Ryu, J.-Y. and Choi, H.-H. 1998. Zinc oxide thin film doped with Al₂O₃, TiO₂ and V₂O₅ as sensitive sensor for trimethylamine gas. *Sensors and Actuators B: Chemical* **46** (2): 75-79.
- Lange, J., Thomas, K. and Wittmann, C. 2002. Comparison of a capillary electrophoresis method with high-performance liquid chromatography for the determination of biogenic amines in various food samples. *Journal of Chromatography B* **779** (2): 229-239.
- Larsen, P., Heldbo, J., Jespersen, C. M. and Nielsen, J. 1992. Development of a Method for Quality Assessment of Fish for Human Consumption Based on Sensory Evaluation. *Quality Assurance in the Fish Industry*. 351-358.
- Lewis, R. 1993. Hawley's Condensed Chemical Dictionary 12th New York, Van Nostrand Reinhold.

- Li, X., Zeng, Z., Zhou, J., Gong, S., Wang, W. and Chen, Y. 2004. Novel fiber coated with amide bridged-calix[4]arene used for solid phase microextraction of aliphatic amines. *Journal of Chromatography A* **1041** (1-2): 1-9.
- Lindsay, R. C. 1996. Flavors in Food Chemistry 3rd edition New York, Marcel Dekker.
- Liu, X., Wang, H., Liang, S.-C. and Zhang, H.-S. 2001. Determination of primary and secondary aliphatic amines by N-hydroxysuccinimidyl 4,3,2'-naphthopyrene-4-acetate and reversed-phase high-performance liquid chromatography. *Analytica Chimica Acta* **441** (1): 45-52.
- Long, G. L. and Winefordner, J. D. 1983. Limit of detection a closer look at the IUPAC definition. *Analytical Chemistry* **55**: 712A-724A.
- Loughran, M. and Diamond, D. 2000. Monitoring of volatile bases in fish sample headspace using an acidochromic dye. *Food Chemistry* **69** (1): 97-103.
- Luten, J. B. and Martinsdóttir, E. (1997). QIM: a European tool for fish freshness evaluation in the fishery chain Methods to determine the freshness of fish in research and industry. Proceedings of the Final Meeting of the Concerted Action "Evaluation of Fish Freshness", International Institute of Refrigeration, Paris.
- Mackay D., Shiu W. Y., Ma K.-C. and C., L. S. 2006. Handbook of physical-chemical properties and environment fate for organic chemicals London New York, CRC press Taylor & Francis Group.
- Maris, C., Laplanche, A., Morvan, J. and Bloquel, M. 1999. Static headspace analysis of aliphatic amines in aqueous samples. *chromatography A* **846**: 331-339.

- Meseguer Lloret, S., Molins Legua, C. and Campins Falco, P. 2002. Preconcentration and dansylation of aliphatic amines using C18 solid phase packings: Application to the screening analysis in environmental water samples. *Journal of Chromatography A* **978** (1-2): 59-69.
- Meseguer Lloret, S., Molins Legua, C., Verdú Andrés, J. and Campins Falcó, P. 2004. Sensitive determination of aliphatic amines in water by high-performance liquid chromatography with chemiluminescence detection. *Journal of Chromatography A* **1035** (1): 75-82.
- Miller, J. N. and Miller, J. C. 2000. Statistics and Chemometrics for Analytical Chemistry. 4th England, Ellis Horwood Ministry of Agriculture and Cooperatives. Retrieved April 20, 2002, From [http:// www.oac.go.th](http://www.oac.go.th).
- Mitra, S. 2003. Sample Preparation Techniques in Analytical Chemistry USA, John Wiley & Sons, Inc.
- Mitsubayashi, K. and Hashimoto, Y. 2002. Bioelectronic Sniffer Device for Trimethylamine Vapour Using Flavin Containing Monooxygenase. *IEEE SENSORS 2* (3): 133-139.
- Mitsubayashi, K., Kubotera, Y., Yano, K., Hashimoto, Y., Kon, T., Nakakura, S., Nishi, Y. and Endo, H. 2004. Trimethylamine biosensor with flavin-containing monooxygenase type 3 (FMO3) for fish-freshness analysis. *Sensors and Actuators B: Chemical* **103** (1-2): 463-467.
- Mohammed-Ziegler, I., Poór, B., Kubinyi, M., Grofcsik, A., Grün, A. and Bitter, I. 2003. Spectroscopic study on the complex formation of chromogenic bridged calixarenes with aliphatic amines. *Journal of Molecular Structure* **650** (1-3): 39-44.

- Namiésnik, J., Jastrzebska, A. and Zygmunt, B. 2003. Determination of volatile aliphatic amines in air by solid phase microextraction coupled with gas chromatography with flame ionization detection. *Journal of Chromatography A* **1016** (1): 1-9.
- Niranjan, R. S., Londhe, M. S., Mandale, A. B., Sainkar, S. R., Prabhumirashi, L. S., Vijayamohanan, K. and Mulla, I. S. 2002. Trimethylamine sensing properties of thorium-incorporated tin oxide. *Sensors and Actuators B: Chemical* **87** (3): 406-413.
- Official Method of Analysis, A. o. O. A. and Chemists, t. e., AOAC, Arlington, VA, 1990, pp. 869-870.
- Olafsdóttir, G., Martinsdóttir, E., Oehlenschläger, J., Dalgaard, P., Jensen, B., Undeland, I., Mackie, I. M., Henehan, G., Nielsen, J. and Nilsen, H. 1997. Methods to evaluate fish freshness in research and industry. *Trends in Food Science & Technology* **8** (8): 258-265.
- Olafsdóttir, G., Nesvadba, P., Di Natale, C., Careche, M., Oehlenschläger, J., Tryggvadóttir, S. V., Schubring, R., Kroeger, M., Heia, K., Esaiassen, M., Macagnano, A. and Jørgensen, B. M. 2004. Multisensor for fish quality determination. *Trends in Food Science & Technology* **15** (2): 86-93.
- Pacquit, A., Frisby, J., Diamond, D., Lau, K. T., Farrell, A., Quilty, B. and Diamond, D. 2007. Development of a smart packaging for the monitoring of fish spoilage. *Food Chemistry* **102** (2): 466-470.
- Pacquit, A., Lau, K. T., McLaughlin, H., Frisby, J., Quilty, B. and Diamond, D. 2006. Development of a volatile amine sensor for the monitoring of fish spoilage. *Talanta* **69** (2): 515-520.
- Pawliszyn, J. 1999. Applications of solid phase microextraction UK.

- Perkin Elmer. 1995. Gas chromatography AutoSystem XL GC User's Manual USA.
- Pollution Control Department. Chemical Data Bank, Retrieved December 7, 2006,
From <http://msds.pcd.go.th>.
- Poole, C. F. and Schuette, S. A. 1984. Contemporary Practice of Chromatography. 1st
USA, Elsevier Science.
- Raymond, P. W. 1998. Introduction to Analytical Gas Chromatography 2nd New
Jersey, Cherry Hill.
- Rodríguez López, M., González Alvarez, M. J., Miranda ordieres, A. J. and Tuñón
Blanco, P. 1996. Determination of dimethylamine in groundwater by liquid
chromatography and precolumn derivatization with 9-
fluorenylmethylchloroformate. *Journal of Chromatography A* 721 (2): 231-
239.
- Sacher, F., Lenz, S. and Brauch, H.-J. 1997. Analysis of primary and secondary
aliphatic amines in waste water and surface water by gas chromatography-
mass spectrometry after derivatization with 2,4-dinitrofluorobenzene or
benzenesulfonyl chloride. *Journal of Chromatography A* 764 (1): 85-93.
- Sadok, S., Uglow, R. F. and Haswell, S. J. 1996. Determination of trimethylamine
oxide in seawater and small volumes of seafood tissue extract using flow
injection analysis. *Analytica Chimica Acta* 334 (3): 279-285.
- Saja, R. d., Souto, J., Rodríguez-Méndez, M. L. and de Saja, J. A. 1999. Array of
lutetium bisphthalocyanine sensors for the detection of trimethylamine.
Materials Science and Engineering: C 8-9: 565-568.
- Scheppers Wercinski, S. A. and Pawliszyn, J. 1999. Solid phase microextraction
theory New York Marcel Dekker.

- Staelens, N., Reyniers, M.-F. and Marin , G. B. 2002. Langmuir–Hinshelwood–Hougen–Watson rate equations for the transalkylation of methylamines. *Chemical Engineering* **90**: 185–193.
- Sukpeng, P. (2001). Analysis of volatile Hydrocarbon Compounds in Frozen Seafood by Gas Chromatography. Thailand, Prince of Songkla **Master of Science Thesis in Analytical Chemistry: 88.**
- Sveinsdottir, K., Hyldig, G., Martinsdottir, E., Jorgensen, B. and Kristbergsson, K. 2003. Quality Index Method (QIM) scheme developed for farmed Atlantic salmon (*Salmo salar*). *Food Quality and Preference* **14** (3): 237-245.
- Swartz , M. E. and Krull, I. S. 1997. Analytical method development and validationNew York, Marcel Dekker, INC.
- Takao, Y., Nakanishi, M., Kawaguchi, T., Shimizu, Y. and Egashira, M. 1995. Semiconductor dimethylamine gas sensors with high sensitivity and selectivity. *Sensors and Actuators B: Chemical* **25** (1-3): 375-379.
- Tang, H., Yan, M., Ma, X., Zhang, H., Wang, M. and Yang, D. 2006. Gas sensing behavior of polyvinylpyrrolidone-modified ZnO nanoparticles for trimethylamine. *Sensors and Actuators B: Chemical* **113** (1): 324-328.
- Teerlink, T., W.T. Hennekes, M., Mulder, C. and Brulez, H. F. H. 1997. Determination of dimethylamine in biological samples by high-performance liquid chromatography. *Journal of Chromatography B: Biomedical Sciences and Applications* **691** (2): 269-276.
- Tibor, C. and Esther, F. 1999. Chromatography in food Science and Technology, Technomic.

- Timm, M. and Jørgensen, B. M. 2002. Simultaneous determination of ammonia, dimethylamine, trimethylamine and trimethylamine--oxide in fish extracts by capillary electrophoresis with indirect UV-detection. *Food Chemistry* 76 (4): 509-518.
- Tipler, A. 1993. Gas chromatographic instrumentation and considerations New York: Oxford University Press
- U.S. Department of Health and Human Services, Food and Drug Administration, Center for Drug Evaluation and Research (CDER), Center for Veterinary Medicine (CVM), Guidance for Industry, Bioanalytical Method Validation, May 2001, 22 pp.
- US EPA (8021B, December, 1996) Aromatic and halogenated volatiles by gas chromatography using photoionization and/or electrolytic conductivity detectors. 1-19.
- Veciana-Nogues, M. T., Albala-Hurtado, M. S., Izquierdo-Pulido, M. and Vidal-Carou, M. C. 1996. Validation of a gas-chromatographic method for volatile amine determination in fish samples. *Food Chemistry* 57 (4): 569-573.
- Vilhelmsson, O. 1997. The state of enzyme biotechnology in the fish processing industry. *Trends in Food Science & Technology* 8 (8): 266-270.
- Wang, Z. Y., Xiao, C. H., Wu, C. and Han, H. 2000. High-performance polyethylene glycol-coated solid phase microextraction fiber using sol-gel technology. *Chromatography A* 893: 157-168.

- Xian-En, Z., Yu-Lin, L., Jin-Mao, Y., Yong-Jun, L. and You-Rui, S. 2007. Pre-column Derivatization-High Performance Liquid Chromatography for the Determination of Aliphatic Amines with Fluorescence Detection and Mass Spectrometry Identification. *Chinese Journal of Analytical Chemistry* **35** (6): 779-785.
- You, J., Zhao, X., Suo, Y., Wang, H., Li, Y. and Sun, J. 2006. 2-(2-Phenyl-1H-phenanthro-[9,10-d]imidazole-1-yl)-acetic acid (PPIA) and its application for determination of amines by high performance liquid chromatography with fluorescence detection and identification with mass spectroscopy/atmospheric pressure chemical ionization. *Analytica Chimica Acta* **565** (2): 168-177.
- Zhang, A., Mithchell, S. and Smith, R. 1998. Dimethylamine formation in the rat from various related amine precursors. *Food Chem Toxico* **36**: 923-7.
- Zhang, Z., Xu, K., Xing, Z. and Zhang, X. 2005. A nanosized Y2O3-based catalytic chemiluminescent sensor for trimethylamine. *Talanta* **65** (4): 913-917.
- Zhao, C., Pan, Y., Ma, L., Tang, Z., Zhao, G. and Wang, L. 2002a. Assay of fish freshness using trimethylamine vapour probe based on a sensitive membrane on piezoelectric quartz crystal. *Sensors and Actuators B: Chemical* **81** (2-3): 218-222.
- Zhao, S., Wei, P. and Chen, S. 2000. Enhancement of trimethylamine sensitivity of MOCVD-SnO2 thin film gas sensor by thorium. *Sensors and Actuators B: Chemical* **62** (2): 117-120.
- Zhao, Y.-Y., Cai, L.-S., Jing, Z.-Z., Wang, H., Yu, J.-X. and Zhang, H.-S. 2003. Determination of aliphatic amines using N-succinimidyl benzoate as a new derivatization reagent in gas chromatography combined with solid phase microextraction. *Journal of Chromatography A* **1021** (1-2): 175-181.

Zhao, Y.-Y., Jing, Z.-Z., Wang, H., Zhang, H.-S. and Yu, J.-X. 2002b. N-Hydroxysuccinimidyl phenylacetate as a novel derivatizing reagent for aliphatic amines in gas chromatography. *Analytica Chimica Acta* **468** (2): 255-261.

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Scholarship awards during Enrollment

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List of Publications and Presentations

Poster presentations

1. Boonlata, J., Kanchanasri, P. and Thavornagool, P. Development of New Chromatographic Technique for "Labelled Pathways: Synthesis, Characterization and Transdermal" The 32nd Congress on Science and Technology of Thailand (STT 2004) Queen Sirikit National Convention Center, Bangkok, October 8-12, 2004.
2. Boonlata, J., Kanchanasri, P. and Thavornagool, P. Simple Technique for Control Release Determination The 3rd PERCH-CIC Annual Meeting Bangkok (PERCH-CIC Congress V), Pattaya, Thailand, May 6-9, 2007.