PROCEEDINGS OF SPIE

Sensing for Agriculture and Food Quality and Safety X

Moon S. Kim Kuanglin Chao Bryan A. Chin Byoung-Kwan Cho Editors

17–18 April 2018 Orlando, Florida, United States

Sponsored and Published by SPIE

Volume 10665

Proceedings of SPIE 0277-786X, V. 10665

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

The papers in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. Additional papers and presentation recordings may be available online in the SPIE Digital Library at SPIEDigitalLibrary.org.

The papers reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from these proceedings:

Author(s), "Title of Paper," in Sensing for Agriculture and Food Quality and Safety X, edited by Moon S. Kim, Kuanglin Chao, Bryan A. Chin, Byoung-Kwan Cho, Proceedings of SPIE Vol. 10665 (SPIE, Bellingham, WA, 2018) Seven-digit Article CID Number.

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510618411

ISBN: 9781510618428 (electronic)

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445

SPIE.org

Copyright © 2018, Society of Photo-Optical Instrumentation Engineers.

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/18/\$18.00.

Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.



Paper Numbering: Proceedings of SPIE follow an e-First publication model. A unique citation identifier (CID) number is assigned to each article at the time of publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online and print versions of the publication. SPIE uses a seven-digit CID article numbering system structured as follows:

- The first five digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc. The CID Number appears on each page of the manuscript.

Contents

V	Authors
vii	Conference Committee
SESSION 1	HYPERSPECTRAL AND MULTISPECTRAL IMAGING FOR FOODS
10665 02	Study of visible imaging and near-infrared imaging spectroscopy for plant root phenotyping [10665-1]
10665 04	Continuous gradient temperature Raman spectroscopy of unsaturated fatty acids: applications for fish and meat lipids and rendered meat source identification [10665-3]
SESSION 2	SENSING FOR FOOD QUALITY AND SAFETY I
10665 09	Detection of color dye contamination in spice powder using 1064-nm Raman chemical imaging system [10665-7]
SESSION 3	SENSING FOR FOOD QUALITY AND SAFETY II
10665 OC	Direct surface-scanning detection of pathogenic bacteria using a wireless biosensor [10665-10]
10665 0D	Capture and identification of Salmonella Typhimurium from large volumes of water using phage filter [10665-11]
10665 0E	The combination of magnetoelastic (ME) wireless biosensing with surface swab sampling [10665-12]
10665 OF	Reconfigurable instrument for measuring variations of capacitor's dielectric: an application to olive oil quality monitoring $[10665-13]$
SESSION 4	HIGH THROUGHPUT INSPECTION
10665 0G	Non-targeted and targeted Raman imaging detection of chemical contaminants in food powders [10665-14]
10665 OJ	Development of high speed dual-camera system for batch screening of aflatoxin contamination of corn using multispectral fluorescence imaging [10665-17]

SESSION 5	VISIBLE AND NEAR INFRARED IMAGING FOR FOODS
10665 OK	Rapid and non-destructive detection of aflatoxin contamination of peanut kernels using visible/near-infrared (Vis/NIR) spectroscopy [10665-18]
10665 OM	Miniature near infrared spectroscopy spectrometer and information and communication technologies to guarantee the integrity of the EU high added-value "acorn Iberian pig ham" (IP) [10665-20]
	POSTER SESSION
10665 ON	Isolation of highly selective phage-displayed oligopeptide probes for detection of <i>listeria</i> monocytogenes in ready-to-eat food [10665-22]
10665 00	Capture of bacterial pathogens in liquid streams by multiple layers of phage based biomolecular filter [10665-23]
10665 OR	Olive fruit ripening evaluation and quality assessment by hyperspectral sensing devices [10665-26]
10665 OS	Kiwifruits ripening assessment by portable hyperspectral devices [10665-27]
10665 OT	Non-destructive method to detect artificially ripened banana using hyperspectral sensing and RGB imaging [10665-28]
10665 OU	Signal recovery for compressive spectrometers [10665-29]
10665 OY	Study of near-infrared imaging spectroscopy for the inspection of peeled potato tubers [10665-33]

Authors

Numbers in the index correspond to the last two digits of the seven-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first five digits reflect the volume number. Base 36 numbering is employed for the last two digits and indicates the order of articles within the volume. Numbers start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B...0Z, followed by 10-1Z, 20-2Z, etc.

Arnold, Thomas, 02, 0Y B.S., Mithun, OT Bae, Abigail, 09 Bhatnagar, Deepak, OJ, OK Bhavsar, Karan, OT Bhowmick, Broieshwar, OT Bodner, Gernot, 02 Bonifazi, G., OR, OS Broadhurst, C. Leigh, 04 Castillo, Encarnacion, OF Chao, Kuanglin, 04, 09, 0G Chen, I-Hsuan, OC, OD, OE, ON, OO Chen, Kevin, 0U

Chin, Bryan Allen, OC, OD, OE, ON, OO

Cho, Byoung-Kwan, 0G Chowdhury, Arijit, 0T DeBiasio, Martin, 0Y De Pedro, E., 0M Dhakal, Sagar, 09, 0G Du, Songtao, OC, OD, OE, ON, OO Fearn, Tom, 0M

Garcia, Antonio, OF Garrido-Varo, Ana, 0M Gasbarrone, R., OR, OS Gupta, Kavya, OT Han, Deok, 0J

Horikawa, Shin, OC, OD, OE, ON, OO

Hruska, Zuzana, OJ, OK Huang, Li-Ren, OU

Huang, Tung-Shi, 0E, 0N, 0O

Juarez, Santiago, OF Kim, Moon S., 04, 09, 0G Kimbahune, Sanjay, OT Kincaid, Russell, OJ

Kung, H. T., 0U Liu, Yongliang, 0K

Liu, Yuzhe, 0C, 0D, 0E, 0N, 0O Lu, Chih-Cheng, 0U

Lu, Xu, 0C, 0D, 0E, 0O Meyer-Baese, Anke, OF Morales, Diego P., OF Mukhopadhyay, Shalini, OT

Nguyen, Julie K., 04

Ortiz-Gomez, Inmaculada, 0F Pérez-Marín, Dolores, 0M Qin, Jianwei, 04, 09, 0G Rajasekaran, Kanniah, OJ, OK Ramezanpour, Christopher, OJ

Riccioli, Cecilia, 0M

Romero, Francisco J., OF Salinas-Castillo, Alfonso, OF Schmidt, Walter F., 04 Serranti, S., OR, OS Shinde, Sujit, OT Suh, Sang-Jin, ON Tahmassebi, Amirhessam, OF Tao, Feifei, OK Xi, Jianguo, 0E, 0N, 0O Yao, Haibo, OJ, OK

Conference Committee

Symposium Chair

Robert D. Fiete, Harris Corporation (United States)

Symposium Co-chair

Jay Kumler, JENOPTIK Optical Systems, LLC (United States)

Conference Chairs

Moon S. Kim, USDA Agricultural Research Service (United States)
Kuanglin Chao, USDA Agricultural Research Service (United States)
Bryan A. Chin, Auburn University (United States)
Byoung-Kwan Cho, Chungnam National University
(Korea, Republic of)

Conference Program Committee

Arun K. Bhunia, Center for Food Safety Engineering, Purdue University (United States)

Suming Chen, National Taiwan University (Taiwan)

Stephen R. Delwiche, USDA Agricultural Research Service (United States)

Ki-Bok Kim, Korea Research Institute of Standards and Science (Korea, Republic of)

Naoshi Kondo, Kyoto University Graduate School of Agriculture (Japan)

Kurt C. Lawrence, USDA Agricultural Research Service (United States) **Kangjin Lee**, National Academy of Agricultural Science

(Korea, Republic of)

Alan M. Lefcourt, USDA Agricultural Research Service (United States)

Changying (Charlie) Li, The University of Georgia (United States)

Renfu Lu, USDA Agricultural Research Service (United States)

Bosoon Park, USDA Agricultural Research Service (United States)

Yang Tao, University of Maryland, College Park (United States)

Yankun Peng, China Agricultural University (China)

Gang Yao, University of Missouri-Columbia (United States)

Haibo Yao, Mississippi State University (United States)

Yibin Ying, Zhejiang University (China)

Seung-Chul Yoon, USDA Agricultural Research Service (United States)

Session Chairs

- 1 Hyperspectral and Multispectral Imaging for Foods Seung-Chul Yoon, USDA Agricultural Research Service (United States)
- Sensing for Food Quality and Safety IShin Horikawa, Auburn University (United States)
- 3 Sensing for Food Quality and Safety IIShin Horikawa, Auburn University (United States)
- 4 High Throughput Inspection **Xu Lu**, Auburn University (United States)
- Visible and Near Infrared Imaging For Foods
 Byoung-Kwan Cho, Chungnam National University
 (Korea, Republic of)