한빛사 논문

✉ **강태준**   Taejoon Kang

한국생명공학연구원

📄 CV File 1 MB

Multiplex Detection of Foodborne Pathogens using 3D Nanostructure Swab and Deep Learning-Based Classification of Raman Spectra

Authors and Affiliations ⌃

Hyunju Kang [1,2], Junhyeong Lee [3], Jeong Moon [1,4], Taegu Lee [3], Jueun Kim [5,6], Yeonwoo Jeong [1], Eun-Kyung Lim [1,7,8], Juyeon Jung [1,8], Yongwon Jung [2], Seok Jae Lee [6], Kyoung G. Lee [6], Seunghwa Ryu [3], Taejoon Kang [1,8]

[1]Bionanotechnology Research Center, Korea Research Institute of Bioscience and Biotechnology (KRIBB), 125 Gwahak-ro, Yuseong-gu, Daejeon, 34141, Republic of Korea.
[2]Department of Chemistry, Korea Advanced Institute of Science and Technology (KAIST), 291 Daehak-ro, Yuseong-gu, Daejeon, 34141, Republic of Korea.
[3]Department of Mechanical Engineering, KAIST, 291 Daehak-ro, Yuseong-gu, Daejeon, 34141, Republic of Korea.
[4]Department of Biomedical Engineering, University of Connecticut Health Center, Farmington, CT, 06032, USA.
[5]Department of Energy Resources and Chemical Engineering, Kangwon National University, 346 Jungang-ro, Samcheok, Gangwon-do, 25913, Republic of Korea.
[6]Division of Nano-Bio Sensors/Chips Development, National NanoFab Center (NNFC), 291 Daehak-ro, Yuseong-gu, Daejeon, 34141, Republic of Korea.
[7]Department of Nanobiotechnology, KRIBB School of Biotechnology, University of Science and Technology (UST), 217 Gajeong-ro, Yuseong-gu, Daejeon, 34113, Republic of Korea.
[8]School of Pharmacy, Sungkyunkwan University (SKKU), 2066 Seobu-ro, Suwon, Gyeonggi-do, 16419, Republic of Korea.

H.K., J.L., J.M., and T.L. contributed equally to this work.
CORRESPONDING AUTHORS : Kyoung G. Lee, Seunghwa Ryu, Taejoon Kang

Abstract

Proactive management of foodborne illness requires routine surveillance of foodborne pathogens, which requires developing simple, rapid, and sensitive detection methods. Here, a strategy is presented that enables the detection of multiple foodborne bacteria using a 3D nanostructure swab and deep learning-

based Raman signal classification. The nanostructure swab efficiently captures foodborne pathogens, and the portable Raman instrument directly collects the Raman signals of captured bacteria. a deep learning algorithm has been demonstrated, 1D convolutional neural network with binary labeling, achieves superior performance in classifying individual bacterial species. This methodology has been extended to mixed bacterial populations, maintaining accuracy close to 100%. In addition, the gradient-weighted class activation mapping method is used to provide an investigation of the Raman bands for foodborne pathogens. For practical application, blind tests are conducted on contaminated kitchen utensils and foods. The proposed technique is validated by the successful detection of bacterial species from the contaminated surfaces. The use of a 3D nanostructure swab, portable Raman device, and deep learning-based classification provides a powerful tool for rapid identification (≈5 min) of foodborne bacterial species. The detection strategy shows significant potential for reliable food safety monitoring, making a meaningful contribution to public health and the food industry.

논문정보

목록

댓글 0　　　　　　　　　　　　　　　　　　　　댓글 등록하러 가기

댓글 내용을 입력해주세요(로그인 필요)

0 / 1500

취소

댓글등록

관련 링크

- **강태준님 전체 논문보기**

- **연구자 키워드**

- **연구자 ID**

  ⓘD   ORCID ｜ 0000-0002-5387-6458

  Web of Science Research ID(Publons)AAS-1967-2020

  ☑ Lab/개인 홈페이지

  ☑ Google Scholar

  ☑ PubMed

- **관련분야 연구자보기**

  바이오센싱 및 나노바이오물질

- **소속기관 논문보기**

한국생명공학연구원　｜　나노종합기술원　｜　한국과학기술원

- **관련분야** 논문보기

바이오센싱 및 나노바이오물질

- **해당논문** 저자보기

강현주 (한국생명공학연구원, KAIST)
이준형 (KAIST)
문정 (한국생명공학연구원, UConn Health Center)
이태구 (KAIST)
이경균 (나노종합기술원)
류승화 (KAIST)

- **관련분야** 논문보기