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Standoff Raman detection of economically motivated adulteration in food

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Contamination of food within the supply chain can have far reaching consequences which include large-scale disease epidemics as well as loss of consumer confidence in the supply chain itself. The nature and source of contamination can be diverse and include bacteria, agrochemicals, industrial wastes and chemicals used in food processing. Food contamination can be accidental or a deliberate act of terror. Clearly, no single technique can be responsive for detecting all of these contaminants in the food-supply chain. A standoff Raman technique has been developed by us to detect economically motivated adulteration in common food items like olive oil, honey and flour. Unlike the traditional Raman approach, this technique remains largely unexplored for food sciences applications and has the potential to detect food contaminants/adulterants which could be toxic or laced with biological pathogens from a safe, non-contact distance of several meters. The technique is thus important for field and forensic applications needing minimum sample preparation protocol. Using a 785 nm Raman spectrometer coupled to a small telescope, the technique was characterized for standoff distances in the range of 1-10 meters and for typical concentrations of 1-10% used in economically-motivated adulteration. Adulteration of extra virgin olive oil with canola and grape seed oils was detected from near-contact and standoff distances up to 1 meter. Depending on the distance, the sensitivity for detecting adulteration was 2-5%. Likewise, feasibility of detecting adulteration of honey with high-fructose corn syrup and rice syrup was demonstrated. Adulteration in other food items like milk and flour was also investigated. For its potential for field application in the area of food security, the technique was demonstrated to the Customs and Border Protection (CBP) personnel at the US-Canada border in Champlain, New York.

Biography

Anup Sharma is a Professor of Physics at Alabama A&M University, USA. He holds MS degree from the Indian Institute of Technology and PhD from Columbia University. His research in lasers and optics encompasses several areas including fabrication of chemical sensors. In recent projects funded by DHS and NSF, he has developed a technique for detecting adulteration in food from a distance of several meters. He has guided several PhD students and is a recipient of a Career Award from the National Science Foundation.

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