

Rapid Detection of Adulteration in Refining Ghee and Edible Oil Based on Arduino

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Abstract: Food adulteration occurs when the quality of food is purposely diminished through the introduction of unnatural or unnecessary ingredients or through the elimination of beneficial ones. This is commonly done to enhance a food item's volume or decrease its price. Indicators of the quality of edible oils include their fatty acid composition and content. Using quantitative measurement of palmitic acid, stearic acid, arachidonic acid, and behenic acid, this study set out to establish a quick determination method for quality detection of edible oils. The Arduino-based food detection system presented here forms the basis of this paper. The suggested system relies on a combination of detection and recognition algorithms. The algorithm's primary utility is in determining whether or not food has gone bad and alerting the user accordingly. The usage of Arduino, a microcontroller board, in conjunction with programming and sensors is the focus of this article.

Keywords: Arduino uno, MQ3 sensor, LDR, DHT11 sensor

REFERENCES

- [1]. Munoz, R., Sivret, E. C., Parcsi, G., Lebrero, R., Wang, X., Suffet, I. M., & Stuetz, R. M. (2010). Monitoring techniques for odour abatement assessment. *Water Research*, 44, 5129–5149.
- [2]. Loutfi, A., Coradeschi, S., Mani, G. K., Shankar, P., & Rayappan, J. B. B. (2015). Electronic noses for food quality: A review. *Journal of Food Engineering*, 144, 103–111.
- [3]. Tohidi, M., Ghasemi-Varnamkhasti, M., Ghafarinia, V., Bonyadian, M., & Mohtasebi, S. S. (2018). Development of a metal oxide semiconductor-based artificial nose as a fast, reliable and nonexpensive analytical technique for aroma profiling of milk adulteration. *International Dairy Journal*, 77, 38–46.
- [5]. Ashish Kumar Singh and Neelam Verma, "Quartz Crystal Microbalance Based Approach for Food Quality" *Current Biotechnology*, 2014, 3, 000-000
- [6]. Hayes, J.; Dublin City Univ., Dublin; Pacquit, A.; Crowley, K.; Kim Lau "Web-based colorimetric sensing for food quality monitoring" *Sensors*, 2006.
- [7]. Wen-Ding Huang, Sanchali Deb, Young-Sik Seo, Smitha Rao, Mu Chiao, and J. C. Chiao, "A Passive Radio Frequency pH Sensing Tag for Wireless Food-Quality Monitoring" 2010 IEEE.
- [8]. Ashish Kumar Singh and Neelam Verma, "Quartz Crystal Microbalance Based Approach for Food Quality" *Current Biotechnology*, 2014, 3, 000-000
- [9]. Syeda Erfana Zohora, A. M. Khan, A. K. Srivastava, Nisar Hundewale International, "Electronic Noses Application to Food Analysis Using Metal Oxide Sensors: A Review" *Journal of Soft Computing and Engineering (IJSCE)* ISSN: 2231-2307, Volume-3, Issue-5, November 2013.
- [10]. Ayari Fardin, Esmaeil Mirzaee-Ghaleh, Hekmat Rabbani, Kobra Heidarbeigi. Detection of the Adulteration in Pure Cow Ghee by Electronic Nose Method (Case Study: Sunflower Oil and Cow Body Fat). *International Journal of Food Properties* 2018; 21(1): 1670-79.

- [11]. Gandhi Kamal, Anil Kumar, Darshan Lal. Solvent Fractionation Technique Paired with Apparent Solidification Time (AST) Test as a Method to Detect Palm Olein and Sheep Body Fat in Ghee (Clarified Milk Fat). *Indian J Dairy Sci* 2018; 71(3): 246-51.
- [12]. Gaopu Pei, Gao Haiyan, Shi Bolin, Zhao Lei, Wang Houyin, Zhi Ruicong, et al. Information Variation Feature and Discriminant Capabilities of Electronic Nose for Typical Adulteration Honey Identification. *Transactions of the Chinese Society of Agricultural Engineering* 2015; 31.
- [13]. Ghasemi-Varnamkhasti, Mahdi, Seyed Saeid Mohtasebi, Maryam Siadat, Jesus Lozano, Hojat Ahmadi, et al. Aging Fingerprint Characterization of Beer Using Electronic Nose. *Sensors and Actuators B: Chemical* 2011; 159(1): 51-59.
- [14]. Ghasemi-Varnamkhasti, Mahdi, Mar'ia Luz Rodríguez-Méndez, Seyed Saeid Mohtasebi, Constantin Apetrei, Jesus Lozano, Hojat Ahmadi, et al. Monitoring the Aging of Beers Using a Bioelectronic Tongue. *Food Control* 2012; 25(1): 216-24.
- [15]. Karami Hamed, Mansour Rasekh, Esmaeil Mirzaee Ghaleh. Application of the E-Nose Machine System to Detect Adulterations in Mixed Edible Oils Using Chemometrics Methods. *Journal of Food Processing and Preservation* 2020; 44(9): e14696.
- [16]. Kaushik Jain RJ, Rai P. Therapeutic Potential of Cow Derived Products - a Review. *International Journal of Pharmaceutical Sciences and Research* 2016; 7(4): 1383.
- [17]. Kumar Amit. Detection of Adulterants in Ghee. *NDRI, Karnal* 2008.
- [18]. Kumar Anil, Shreya Tripathi, Nidhi Hans, Pattnaik HSN, Satya Narayan Naik. Ghee: Its Properties, Importance and Health Benefits. *Lipid Universe* 2018; 6: 6-14.
- [19]. Okur Salih, Mohammed Sarheed, Robert Huber, Zejun Zhang, Lars Heinke, Adnan Kanbar, et al. Identification of Mint Scents Using a QCM Based E-Nose. *Chemosensors* 2021; 9(2): 31.
- [20]. Patel Akashamrut M. Validation of Methods for Detection of Ghee Adulteration with Animal Body Fat. *NDRI* 2011.
- [21]. Rani Anupama, Vivek Sharma, Sumit Arora, Darshan Lal, Anil Kumar. A Rapid Reversed-Phase Thin Layer Chromatographic Protocol for Detection of Adulteration in Ghee (Clarified Milk Fat) with Vegetable Oils. *Journal of Food Science and Technology* 2015; 52(4): 2434-39.
- [22]. Ren Ruibo, Kechao Han, Pinhui Zhao, Jingtao Shi, Lei Zhao, Dongxing Gao, et al. Identification of Asphalt Fingerprints Based on ATR-FTIR Spectroscopy and Principal Component-Linear Discriminant Analysis. *Construction and Building Materials* 2019; 198: 662-68.
- [23]. Roy Mrinmoy, Yadav BK. Electronic Nose for Detection of Food Adulteration: A Review. *Journal of Food Science and Technology* 2021, 1-13.
- [24]. Saha Pradip, Santanu Ghorai, Bipan Tudu, Rajib Bandyopadhyay, Nabarun Bhattacharyya. Optimization of Sensor Array in Electronic Nose by Combinational Feature Selection Method. In *Sensing Technology: Current Status and Future Trends*. Springer 2014; II: 189-205.
- [25]. Sainis Nachiket, Durgesh Srivastava, Rajeshwar Singh. Feature Classification and Outlier Detection to Increased Accuracy in Intrusion Detection System. *International Journal of Applied Engineering Research* 2018; 13(10): 7249-55.
- [26]. Saleem M. Fluorescence Spectroscopy Based Detection of Adulteration in Desi Ghee. *Journal of Fluorescence* 2020; 30(1): 181-91.
- [27]. Sanaeifar Alireza, Seyed Saeid Mohtasebi, Mahdi Ghasemi-Varnamkhasti, Hojat Ahmadi. Application of MOS Based Electronic Nose for the Prediction of Banana Quality Properties. *Measurement* 2016; 82: 105-14.
- [28]. Shen Fei, Qifang Wu, Anxiang Su, Peian Ang T, Xiaolong Shao, Bing Liu. "Detection of Adulteration in Freshly Squeezed Orange Juice by Electronic Nose and Infrared Spectroscopy. *Czech Journal of Food Sciences* 2016; 34(3): 224-32.
- [29]. Śliwińska, Magdalena, Paulina Wiśniewska, Tomasz Dymerski, Waldemar Wardencki, Jacek Namieśnik. Application of Electronic Nose Based on Fast GC for Authenticity Assessment of Polish Homemade Liqueurs Called Nalewka. *Food Analytical Methods* 2016; 9(9): 2670-81.

- [30]. Tohidi Mojtaba, Mahdi Ghasemi-Varnamkhasti, Vahid Ghafarinia, Seyed Saeid Mohtasebi, Mojtaba Bonyadian. Identification of Trace Amounts of Detergent Powder in Raw Milk Using a Customized Low-Cost Artificial Olfactory System: A Novel Method. Measurement ~43~ The Pharma Innovation Journal <http://www.thepharmajournal.com> 2018; 124: 120-29.
- [31]. Upadhyay Neelam, Ankit Goyal, Anil Kumar, Darshan Lal. Detection of Adulteration by Caprine Body Fat and Mixture of Caprine Body Fat and Groundnut Oil in Bovine and Buffalo Ghee Using Differential Scanning Calorimetry. International Journal of Dairy Technology 2017; 70(2): 297-303.
- [32]. Wadodkar Uday R, Jagjit Punj Rath S, Amrisha Shah C. Evaluation of Volatile Compounds in Different Types of Ghee Using Direct Injection with Gas Chromatography Mass Spectrometry. The Journal of Dairy Research 2002; 69(1): 163.
- [33]. Wang Jia-Ying, Qing-Hao Meng, Xing-Wei Jin, Zhe-Hua Sun. Design of Handheld Electronic Nose Bionic Chambers for Chinese Liquors Recognition. Measurement 2021; 172: 1