Chapter 7
Electronic Noses in Food Analysis

Runu Banerjee Roy  
Jadavpur University, India

Rajib Bandyopadhyay  
Jadavpur University, India

Bipan Tudu  
Jadavpur University, India

Nabarun Bhattacharyya  
Centre for Development of Advanced Computing, India

ABSTRACT

Food quality evaluation is a tedious job as it can be sensed either by its flavor, taste, or appearance. Sensory evaluation for food quality determination is very complex and depends on biological sensor systems and is subject to high variability depending on taster’s mood, physical state, etc. Moreover, as it is purely subjective, the observations may vary for different tasters. For food industries the instrumental means for quality monitoring has significant appreciations which are repeatable, accurate, and reliable. Electronic nose is an array of sensors that senses based on aroma of samples. For the last two decades, electronic nose has been applied in several domains of applications in food analysis, for example, food quality monitoring based on seasonal effect, ageing, geographical origin, fermentation, etc. This chapter aims to focus on different domains of application of electronic nose in food analysis.

INTRODUCTION

Olfaction or odour sensing is considered to be a conversion of chemical information into an electrical signal. This chemical information carried through is essentially a code in live organic system and the perception with discrimination is by stimulation of the olfactory nerve. In artificial systems, type, intensity, occurrence of odours individually or collectively are to be considered for coding which is possible through a model made a priori to be exploited for the purpose. Certain types of sensations known as
Electronic Noses in Food Analysis

Chemesthetic ones such as burning, piquancy, prickling, stinging, tingling etc. stimulate the trigeminal nerve and ‘pungency’ is the result of such sensations.

Mechanism of human olfaction is a special chemical process affected by odorants or odour molecules which interact with special receptors in the olfactory epithelium located at the top of the nasal cavity (Rosenblith, 1961). These are molecules with widely variant structures each of which is responsible for a characteristic odour designated as the signature of the chemical (Amoore, 1952). Minor variations in the structure can lead to large change in the odour quality and signature. Human olfactory system can detect around 10000 complex odours because of the existence of the range of receptor types in the nose (Buck and Axel, 1991). Size and shape of molecules of the chemicals are correlated to its odour quality (Amoore and Venstrom, 1967). There are other postulates of odour quality as well as quantity (Wright, 1966). Odour threshold specified in parts per billion (ppb) is determined by the number of molecules excited. In terms of ppb, the threshold of hydrogen sulphide i.e. rotten egg is 1.1 ppb (Chastrette, 1997). Threshold is also determined / correlated by the molecular weight, volume, hydrogen bonding ability, cross-sectional area, partition co-efficient and many other such parameters (Breen, 1992). Science of olfaction in humans involving physiology, anatomy, bio-physics, molecular biology (Serby and Chobar, 1992) has demonstrated that, like all other sensing systems, excitation produces an electrical signal which is transmitted for exciting the brain.

The Objective of this chapter is to find the application of electronic nose for food quality determination. The quality of food is dependent on several issues like climate and soil where the crops developed, the processing techniques those are employed to convert from raw to edible, storage conditions and ageing of food samples, fermentation conditions if the food is taken after fermentations etc. Electronic nose is an instrument which is eligible to detect food quality considering above conditions. This chapter is an attempt to find out the applications of electronic nose in all these areas.

The next section describes basic architecture of electronic nose, sensor technologies of electronic nose and use of electronic nose in different applications. After that the chapter focuses to the main focus of this chapter – application of electronic nose in food quality evaluation. The different sections under this header explain application of electronic nose for food quality evaluation based on different features. A generalized discussions and recommendation is there followed by a future scope of research. The chapter concluded with a conclusion.

Electronic Nose

Since time immemorial, five physiological sensory organs of the humans have been in use for detection and identification of parameters relevant and significant to societal and individual perspective. Sensing and perception through these organs are done through biological, physiological, chemical processes involving finally the brain as the Central Processing Unit (Pearce et al., 2003). With rapid growth in electronic hardware technology and spurt of software-based computation and processing, standardized identification through artificial sensors like electronic eyes, electronic ears etc. have been quite common since the eighties of the last century. The sensor technology of artificial olfaction had its beginnings with the invention of the first gas multisensor array in 1982 (Persaud and Dodd, 1982). Advances in aroma-sensor technology, electronics, biochemistry and artificial intelligence made it possible to develop devices capable of measuring and characterizing volatile aromas released from a multitude of sources for numerous applications. These devices, known as electronic noses, were engineered to mimic the mammalian olfactory system within an instrument designed to obtain repeatable measurements, allow-
17 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the product's webpage:

www.igi-global.com/chapter/electronic-noses-in-food-analysis/202709?camid=4v1


Recommend this product to your librarian:

www.igi-global.com/e-resources/library-recommendation/?id=78

Related Content

Contemporary Low Power Design Approaches
www.igi-global.com/chapter/contemporary-low-power-design-approaches/155052?camid=4v1a

Optimal Expansion and Reconstruction of Heat Supply Systems: Methodology and Practice
www.igi-global.com/article/optimal-expansion-and-reconstruction-of-heat-supply-systems/101720?camid=4v1a

A State of Art Critique Review of Role of Optimization in NDTS for Effective Condition Monitoring
www.igi-global.com/chapter/a-state-of-art-critique-review-of-role-of-optimization-in-ndts-for-effective-condition-monitoring/212312?camid=4v1a

A WDO Framework for Optimal Deployment of DGs and DSCs in a Radial Distribution System Under Daily Load Pattern to Improve Techno-Economic Benefits