Nezha El Bari et al., J Biosens Bioelectron 2014, 5:3
http://dx.doi.org/10.4172/2155-6210.S1.022

OMICS Group Conferences
Accelerating Scientific Discovery

3rd International Conference and Exhibition on
Biosensors & Bioelectronics
August 11-13, 2014 Hilton San Antonio Airport, San Antonio, USA

Classification of honey according to the geographical and floral origins and detection of its adulteration by using a voltammetric electronic tongue

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This paper reports first the effectiveness of a voltammetric electronic tongue to classify honey samples from different geographical origins and then from different floral origins. The second study is focused on discriminating pure honey from adulterated one and sugar syrup. The employed sensor array was formed by seven working electrodes, coupled with a counter electrode and an Ag/AgCl reference electrode. The qualitative analysis has been carried out by means of suitable pattern recognition methods namely Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA). While performing PCA and LDA on the normalized database corresponding to honeys of different countries, it was possible to distinguish correctly the eight kinds of honeys. Indeed, 75.69% of the total variance has been obtained by using PCA analysis leading to good discrimination of honeys and 100% of the correct classification has been reached by LDA classifier. Using PCA and LDA on the database corresponding to honeys of different floral origins, evident differentiation between the honeys is observed; it was found that the first three principal components (PCs) accounted for 81.84% of the information in the dataset generated by the electronic tongue. A satisfactory accuracy 84.5% was reached when applying LDA technique. Furthermore, in the second study, we have demonstrated the ability of the electronic tongue to discriminate between pure honeys, adulterated one and sugar syrup. The three first PCs permitted to represent 81.05% of the information in the database and allowed to recognize correctly the tested samples. An accuracy of 93.2% success rate in the classification of the honey clusters was achieved by the cross-validated LDA technique. Thus, this work demonstrates another time, how the electronic tongue coupled with suitable pattern recognition methods is practical technique to discriminate and identify honeys from different geographical and floral origins and also its ability to prevent fraud and adulterations practices.

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