

Portable E-tongue based on modified screen-printed electrodes coupled with chemometrics for food authenticity assessment

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In the context of the research activities undertaken within the "Strengthening of the Italian Research Infrastructure for Metrology and Open Access Data in support to the Agrifood" project (METROFOOD-IT) we performed a preliminary study aimed at evaluating the potential of arrays of screen-printed electrodes modified with gold nanoparticles, copper nanoparticles, graphene, carbon nanotubes and conducting polymers for the detection of food adulteration. For this purpose, the discrimination of tomato cultivars of different economic value in both fresh and canned products was taken into consideration.

Exploiting the catalytic properties of composite materials consisting of poly(3,4-ethylenedioxythiophene) including metal nanoparticles with respect to the oxidation of antioxidants (ascorbic acid) (1) and sugars (glucose and fructose), promising results in the classification of prized tomatoes, such as "datterind" PGI (Protected Geographical Indication), compared to the less valuable and cheaper varieties were achieved.

With the aim of developing and validating classification models for food adulteration control, multivariate and artificial intelligence techniques were applied to the potentiostatic and potentiodynamic datasets. Simultaneous acquisition of the signals was enabled and speeded up by a smart and portable multi-channel potentiostats (2) specially designed within the project.

Keywords: Portable e-tongue, food authenticity, chemometrics, artificial intelligence

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References

- [1] A. Bello, M. Giannetto, G. Mori, R. Seeber, F. Terzi, C. Zanardi, Optimization of the DPV potential waveform for determination of ascorbic acid on PEDOT-modified electrodes, *Sens. Actuators B Chem.* 2007, 121 430-435.
- [2] A. Boni, V. Bianchi, S. Fortunati, M. Giannetto, M. Careri, I. De Munari, A Stand-Alone Portable Potentiostat With Parallel Channels for Smart Electrochemical Analyses, *IEEE Trans Instrum Meas.* 2023, 72, 75001.