Graphene nanocomposites as high sensitivity multispecies food sensor for advanced analytics

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Analysis of complex mixtures, especially food and wine is vital for certifying product value and quality. As in food, wine too is a complex mixture of compounds present in variable concentrations. Among its components, the dominants ones include water, ethanol, glycerol, sugars, organic acids, polyphenols and various ions apart from flavor compounds.

The food and beverage industries require sophisticated analytical methods to fulfil the prerequisites for quality assessment. A handful of compounds need to be analysed simultaneously and selectively using a range of methods including gas/liquid chromatography, spectrophotometry and enzymatic test kits. However, the use of expensive equipment and time-consuming procedures with methods requiring chemicals of major concern render these methods unfavourable.

A novel multispecies non-enzymatic sensor was developed for simultaneous detection and measurement of glucose, ethanol and glycerol using nickel nanoparticles supported on nitrogen doped graphene (Ni-NGr). The sensor was fabricated from a mixture of graphene oxide, nickel nitrate and uric acid via facile thermal annealing. The Ni-NGr nanocomposite was shown to have enhanced electro-catalytic activity owing to the synergetic effects of Ni and N-graphene. The developed sensor displayed a wide linear response with high sensitivity for the simultaneous detection of key components in commercial food samples with excellent stability and recovery metrics [1,2]. An example detection mechanism and sensor responses are shown in Figure 1.

References

[1] Shabnam, L., Faisal, S.N., Roy, A.K., Haque, E., Minett, A.I., Gomes, V.G. Electrochim Acta. 224 (2017) 295-305
[2] Shabnam, L., Faisal, S.N., Roy, A.K., Haque, E., Minett, A.I., Gomes, V.G. Food Chem. 221 (2017) 751-759.
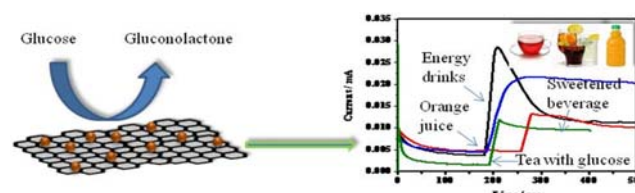
Figures

Figure 1: Analytics for food samples