Determination of carbohydrates in sugarcane bagasse employing a voltammetric electronic tongue formed by GCE/MWCNT/Metals oxy-hydroxide modified electrodes

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Abstract: The biomass consisting of sugarcane bagasse is a byproduct of the process of producing sugar and ethanol. New applications to make the most of bagasse have been developed, among them we can highlight the production of biofuels (ethanol) of second generation. The second generation ethanol is produced from the carbohydrates released from the cell wall of bagasse and straw of sugarcane [1]. Accurate measurement of the carbohydrates content present in the samples of sugarcane bagasse is very important, because its quantification is directly linked to the production of second generation ethanol. Classical methods for the determination of carbohydrates in biomass will be using the chromatographic technique, which allow individual identification of carbohydrates, but these require specific equipment, laboratory conditions and/or trained people. The use of sensors is a desired way to solve such problems, but there are not perfectly ideal sensors for all applications. A new methodology in the use of sensors entails multiple sensing devices plus advanced data treatment of the information generated. This is known as electronic tongue, and it is a highly versatile approach capable of simultaneously monitoring the level of different analytes and/or counterbalancing potential interferents. Main goals of this work are then the application of a voltammetric electronic tongue formed by glassy carbon electrodes modified with multi-walled carbon nanotubes decorated using metals oxy-hydroxide towards the analysis of carbohydrates (galactose, glucose, xylose and mannose) in biomass (sugarcane bagasse). As such, it combines the responses from an array of voltammetric GCE/MWCNT/Metals oxy-hydroxide sensors (Cu, Ni, Co, Au, Pd), plus an advanced response model obtained using artificial neural networks (ANN) [2]. Since the departure data is highly complex, providing each sensor in the array a complete voltammogram, initial pretreatment of the data is also necessary, for which different compression methods are evaluated**.** Simultaneous determination of galactose, glucose, xylose and mannose is therefore feasible, by simple cyclic voltammetry and optimized data treatment.

Table1: Demonstration of cross-sensitivity ($A.mol^{-1}.L$) found for the sensors used in the electronic tongue showing it is feasible for resolution of carbohydrates (galactose, glucose, xylose and mannose)

	Glucose	**Xylose**	**Galactose**	**Mannose**
Copper	0.0492	0.0519	0.0581	0.075
Gold	0.0067	0.0065	0.0053	0.0062
Palladium	0.0172	0.0122	0.0309	0.0143
Nickel	0.0364	0.0369	0.0462	0.0415
Cobalt	0.0768	0.0654	0.0705	0.0661

References

[1] SLUITER, J. B. et. al. J. Agric. Food Chem. v. 58, 2010, p. 9043-9053.
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