GREEN PREPARATION AND APPLICABILITY OF CHITOSAN/CARBON BASED NANOMATERIAL IN SUNSET YELLOW ELECTROCHEMICAL DETECTION

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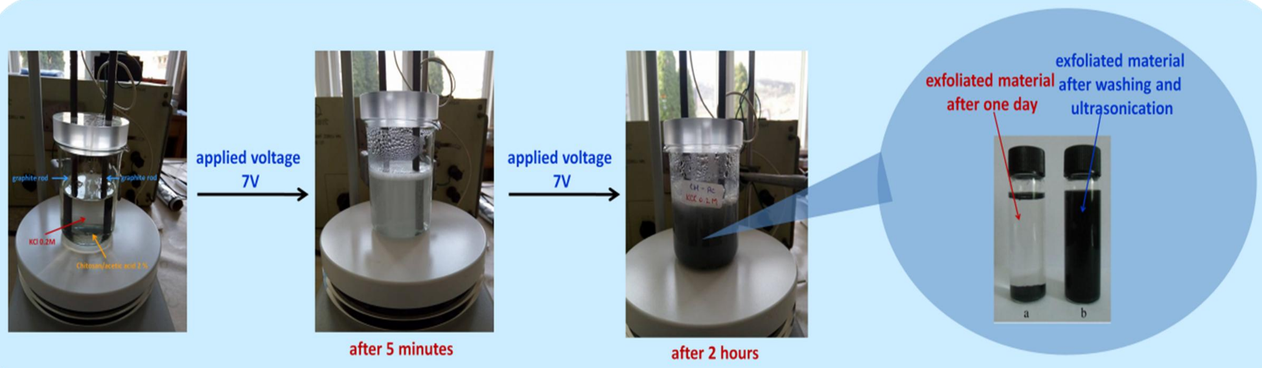
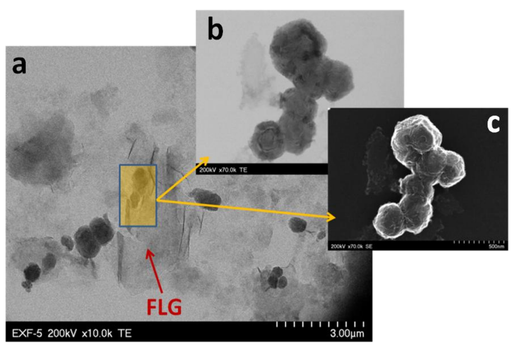
Food additives are normally used in processed foodstuff to enhance appearance, flavor, taste, color, texture, nutritive value and preservation. Synthetic colorants containing azo functional groups (N=N) and aromatic ring structures have been widely used to replace natural food color in food industry. However, it is necessary to note that such synthetic colorants are able to affect human health being pathogenic, particularly when they are excessively consumed. Therefore, their detection in a rapid, sensitive and simple manner is quite important for human health and food safety. The main goal of this study was to provide a facile, rapid, inexpensive way for the green, one-step and large-scale preparation of chitosan/carbon based nanomaterial, through electrochemical exfoliation of graphite rods, without the use of any organic solvent. Moreover the applicability of chitosan/carbon based-glassy carbon modified electrodes for accurate detection and quantification of Sunset Yellow from commercially available food related products was tested.

NANOCOMPOSITE PREPARATION

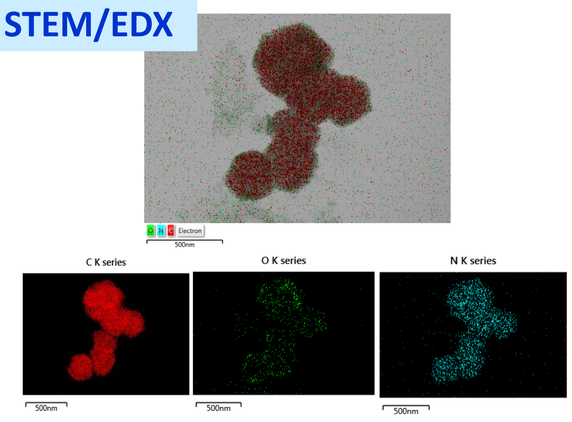


NANOCOMPOSITE CHARACTERIZATION

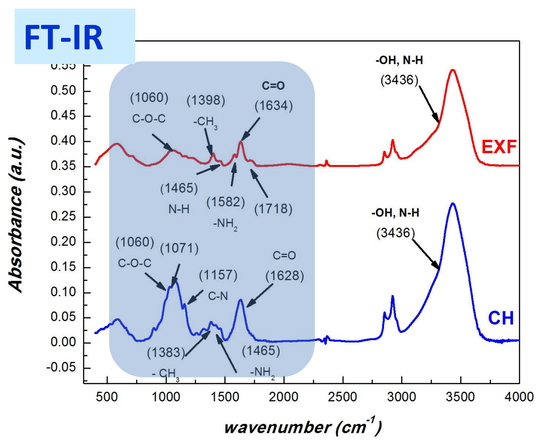
TEM/SEM analysis



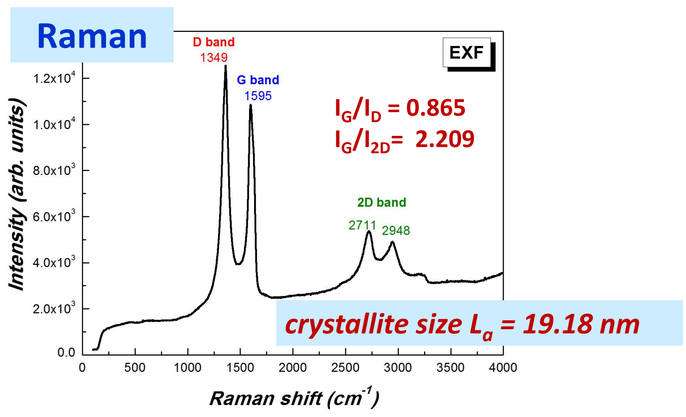
STEM/EDX



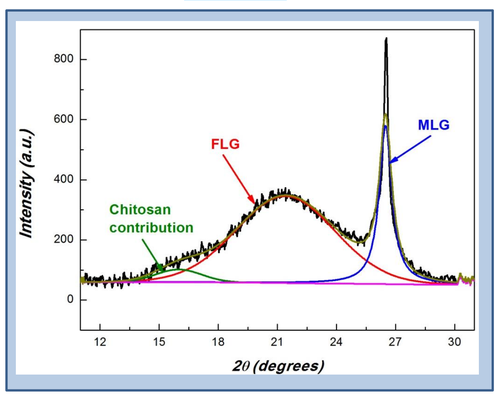
FT-IR

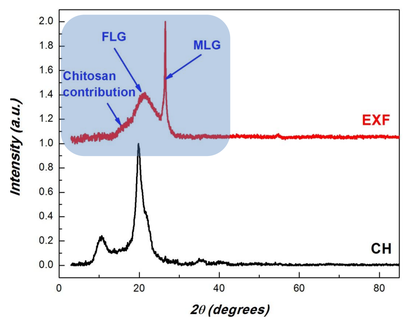


Raman



XRD



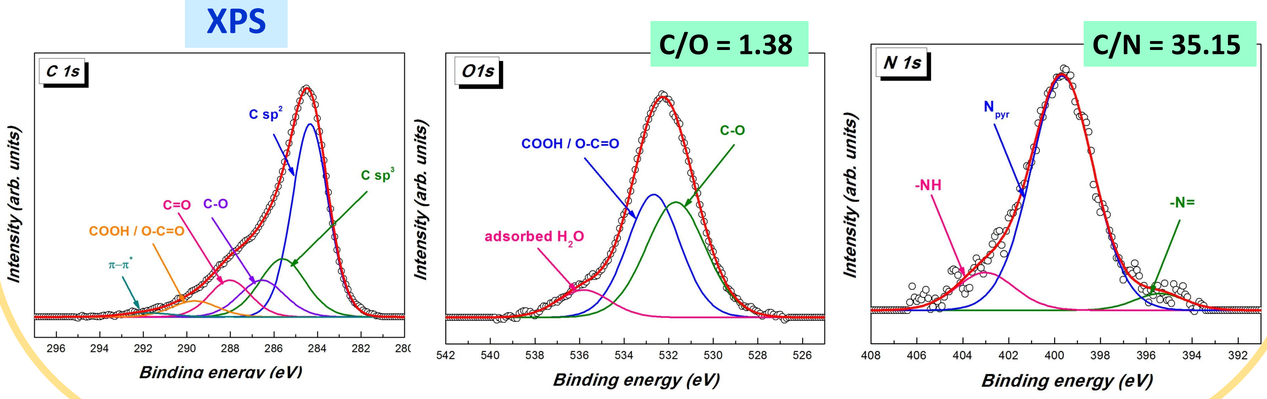


FLG – 2 layers (73.75%) d = 4.14 Å
MLG - 26 layers (22.38%) d = 3.36 Å
chitosan contribution (3.87%)

XPS

C/O = 1.38

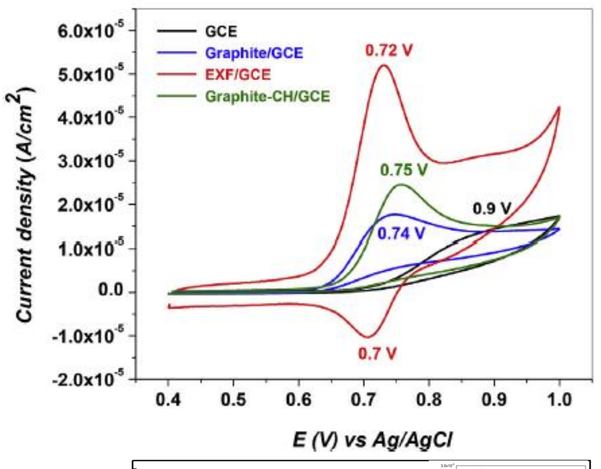
C/N = 35.15



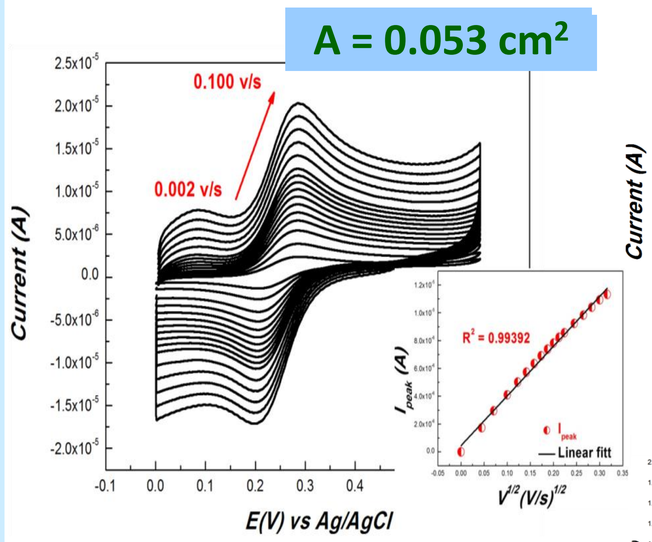
ELECTROCHEMICAL STUDIES

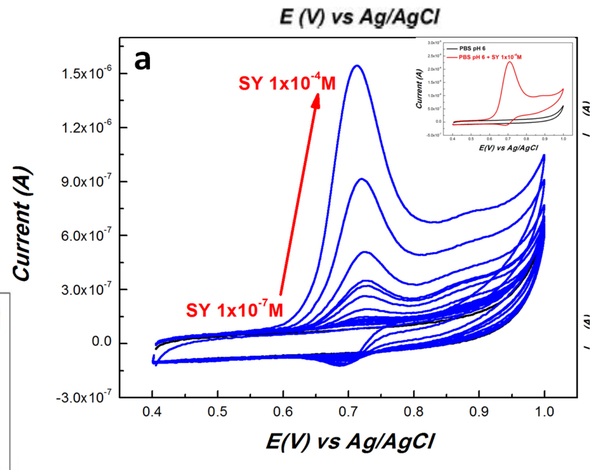
Electrode modification and active area determination

Electrochemical SY detection

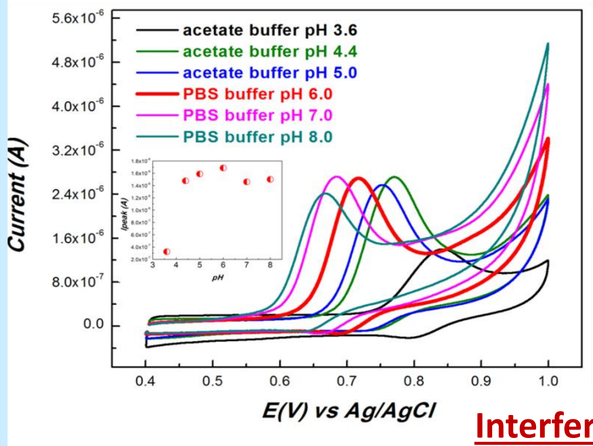


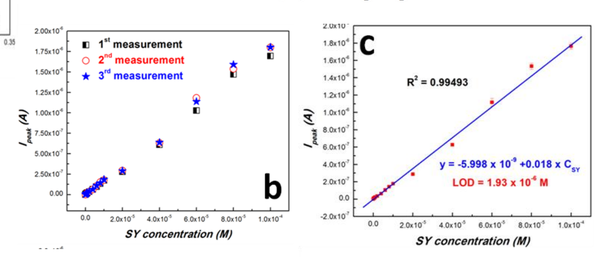
A = 0.053 cm²





Influence of supporting electrolyte and solution pH value



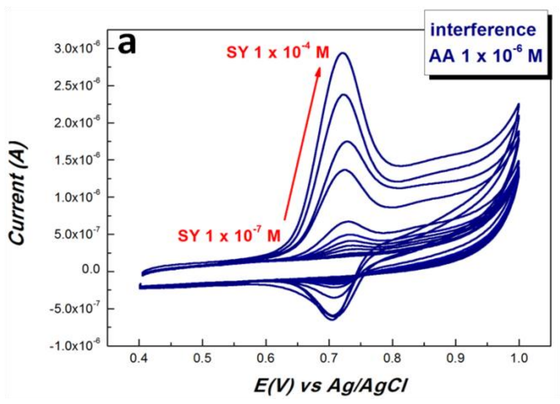


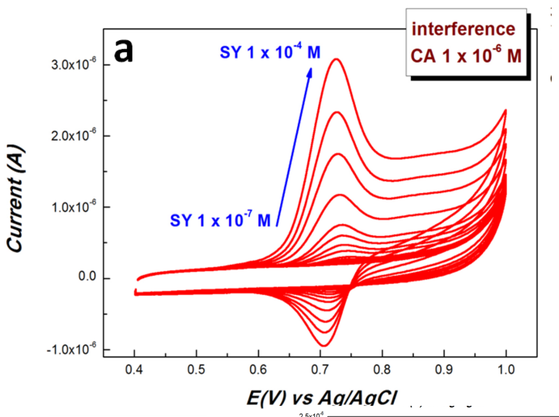
detection limits
6.79×10^{-8} - 1.93×10^{-6} range

Real sample analysis

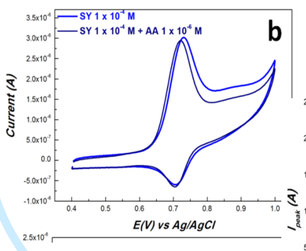
Sample	Added (M)	Found (M)	Recovery (%)
Tap water	1×10^{-4}	0.96×10^{-4}	96.58
	6×10^{-5}	5.82×10^{-5}	97.00
	1×10^{-5}	0.92×10^{-5}	92.65

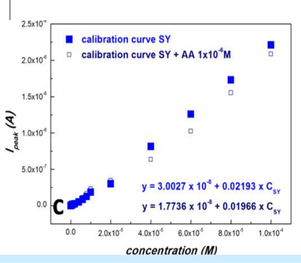
Interference studies



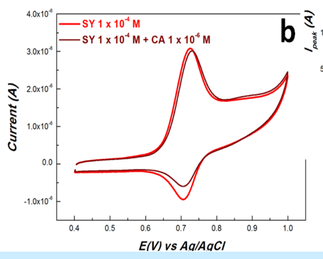


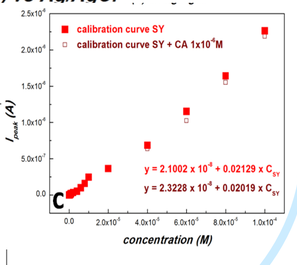
acetic acid





citric acid





The obtained nanocomposite was characterized from morphological and structural point of view. The XRD investigation indicate that the obtained material appears as a mixture of few-layer graphene (FLG - 73.75%), multi-layer graphene (MLG - 22.38%) and a small chitosan contribution (3.87%). The potential application of EXF/GCE for the determination of SY in laboratory solutions and real samples was tested . As expected, the modified electrode EXF/GCE promotes the SY oxidation and exhibits superior performances in terms of peak current density, wide linear range (1×10^{-7} - 1×10^{-4} M), and low Limit of Detection LOD = 2.08×10^{-7} M) compared to the bare electrode

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