A factorial design for optimization of the analytical variables on the development of a genoassay for the transgenic soybean detection

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At the laboratory, analytical method optimizations are performed to achieve the maximum sensitivity and selectivity. Routinely, this procedure is carried out by optimizing one-factor-at-a-time approach until there is no further improvement, where each experimental parameter is optimized separately and independently of the other factors.

Alternatively, factorial design involves simultaneous optimization of all parameters (factors) simultaneously. Moreover, the design of experiments involving factorial design has proved to be a powerful tool in analytical chemistry being a simple, efficient, and statistically valid method for optimizing analytical procedures [1].

In this work, a 2-level Plackett–Burman experimental design [2,3] was applied to screen for the important analytical parameters associated to the development of an electrochemical nanomagneto genoassay that influence transgenic Round-Up Ready Soybean (RRS) detection.

Superparamagnetic core/shell iron oxide/gold (Fe_3O_4@Au) nanoparticles were used as a platform for the design of the genoassay. Briefly, the construction of this assay involved four steps: i) Fe_3O_4@Au surface modification *via* binary self-assembled monolayers (SAMs), ii) covalent immobilization of aminated DNA capture probes, iii) hybridization of the complementary DNA sequence by using a sandwich format assay, and iv) chronoamperometric signal detection.

The effect of the following factors, Fe3O4@Au amount, SAM thiol ratios, SAM immobilization time, DNA capture probe (CP) concentration, DNA-CP immobilization time, temperature and time of the homogenous and heterogeneous hybridization on the genoassay were evaluated using a 24 run Plackett-Burman design with two blocks representing each a DNA target level and results are discussed.

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