Validated electrochemical and chroma-tographic quantifications of some antibiotic residues in pharmaceutical industrial waste water.

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Abstract

Realistic implementation of ion selective electrodes (ISEs) into environmental monitoring programs has always been a challenging task. This could be largely attributed to difficulties in validation of ISE assay results. In this study, the electrochemical response of amoxicillin trihydrate (AMX), ciprofloxacin hydrochloride (CPLX), trimethoprim (TMP), and norfloxacin (NFLX) was studied by the fabrication of sensitive membrane electrodes belonging to two types of ISEs, which are polyvinyl chloride (PVC) membrane electrodes and glassy carbon (GC) electrodes. Linear response for the membrane electrodes was in the concentration range of 10ī5ï10ī2 mol/L. For the PVC membrane electrodes, Nernstian slopes of 55.1, 56.5, 56.5, and 54.0 mV/decade were achieved over a pH 4ï8 for AMX, CPLX, and NFLX, respectively, and pH 3ï6 for TMP. On the other hand, for GC electrodes, Nernstian slopes of 59.1, 58.2, 57.0, and 58.2 mV/decade were achieved over pH 4ï8 for AMX, CPLX, and NFLX, respectively, and pH 3ï6 for TMP. In addition to assay validation to international industry standards, the fabricated electrodes were also cross-validated relative to conventional separation techniques; high performance liquid chromatography (HPLC), and thin layer chromatography (TLC)-densitometry. The HPLC assay was applied in concentration range of 0.5ï 10.0 εg/mL, for all target analytes. The TLC-densitometry was adopted over a concentration range of 0.3ï1.0 εg/band, for AMX, and 0.1ï0.9 εg/band, for CPLX, NFLX, and TMP. The proposed techniques were successfully applied for quantification of the selected drugs either in pure form or waste water samples obtained from pharmaceutical plants. The actual waste water samples were subjected to solid phase extraction (SPE) for pretreatment prior to the application of chromatographic techniques (HPLC and TLC-densitometry). On the other hand, the fabricated electrodes were successfully applied for quantification of the antibiotic residues in actual waste water samples without any pretreatment. This finding assures the suitability of the fabricated ISEs for environmental analysis.

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