Electric field driven extraction of drugs from untreated human plasma across hollow polymer inclusion membrane

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ABSTRACT

A new electric field driven microextraction approach based on the use of a hollow polymer inclusion membrane (HPIM) is demonstrated for the first time. The HPIMs were prepared by casting a solution of the desired proportions of cellulose acetate (CTA) as base polymer, tris(2-ethylhexyl)phosphate (TEHP) as plasticizer and di-(2-ethylhexyl)phosphoric acid (D2EHPA) as carrier in dichloromethane. A glass capillary tubing with 1 mm I.D. was dipped into the solution at a depth of 3 cm for 5 s and quickly lifted-out prior drying under gentle air flow. Three basic drugs namely methamphethamine, amphethamine, and 3,4-methylenedioxy-N-methylamphetamine present in the human plasma were selected as targeted analytes. By applying voltage of 300 V across the HPIM, the model analytes could be transported from the sample solution to the aqueous acceptor solution with high efficiency within 10 min. Comparison was made with electromembrane extraction using a supported liquid membrane. The new developed method showed comparable against reference method and is a simple, feasible, and cost effective microextraction technique.

| Polymer inclusion membrane | Electromembrane extraction | plasma | electric field |

Effect of Crystal Phases of Titanium Dioxide on the Photocatalytic Activity of Titanium Dioxide-Reduced Graphene Oxide Composites for Degradation of Phenol

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ABSTRACT

Titanium dioxide (TiO_2) with different crystal phases generally exhibit different physical properties and photocatalytic performance. However, the effect of different phases of TiO_2 on the photocatalytic activity of titanium dioxide-reduced graphene oxide (TiO_2-rGO) composites prepared by photocatalytic reduction method is still unknown. In the present study, TiO_2 with different phases (anatase (A), rutile (R), and mixture of anatase-rutile (A-R)) was modified with different amounts of graphene oxide (GO) loading, which were 0.5, 1, 3 and 5 wt%, via photocatalytic reduction method under 8 W UV lamp for 24 hours irradiation. The obtained composites were characterized by X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR) and fluorescence spectroscopy. Transmission electron microscopy (TEM) was also used to investigate the morphology of the selected composite sample. The XRD patterns and FTIR spectra revealed that all the TiO_2-rGO composite samples were successfully synthesized without disrupting the structure of TiO_2. Fluorescence spectroscopy revealed the role of rGO on the TiO_2-rGO composite, while TEM-EDS confirmed the presence of both TiO_2 and rGO and their respective morphologies. All TiO_2 samples showed good photocatalytic activity for phenol degradation under UV irradiation for 3 hours. The presence of rGO improved the activity of bare TiO_2(A-R), where the enhancement observed on bare TiO_2(A-R) was much higher than those on bare TiO_2(A) and TiO_2(R). This good improvement might be due to the presence of rGO in the composite that suppressed the electron-hole recombination of bare TiO_2(A-R), as supported by the fluorescence spectra. Among all of the samples, the TiO_2(A-R)-rGO composite with GO loading amount of 3 wt% showed the highest percentage degradation of phenol. The higher activity on the TiO_2(A-R)-rGO composite as compared to the TiO_2(A)-rGO and TiO_2 (R)-rGO composites might be caused by the synergistic effect of anatase-rutile phases. This study clearly showed that the presence of rGO enhanced the activity of TiO_2 and different crystal phases of TiO_2 affected the photocatalytic performance of obtained TiO_2-rGO composites.

| Titanium dioxide | Reduced graphene oxide | Crystal phases | Synergistic effect | Phenol |