

## Novel Magnetic Biosorbents, based on Chitosan Embedded Halloysite Nanotube; an Alternative Approach to Reduce Complications of Gastric Lavage in Suicidal Patients

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**SUMMARY.** Use of toxic concentration of para-phenylenediamines (PPD) for suicide has become a serious problem in all over the world, which can be reduced by preparing absorbable magnetic microspheres. The aim of present studies was to prepare three types of magnetic iron oxide ( $\text{Fe}_3\text{O}_4$ ) adsorbents having chitosan (CTS), naturally occurring halloysite nanotubes (HNTs) and their combination by co-emulsion precipitation. Effect of different concentrations of CTS, HNTs and  $\text{Fe}_3\text{O}_4$ , their contact time with PPD, effect of different temperature and pH on adsorption were calculated. Magnetization was confirmed by vibrating sample magnetometer (VSM) which was ranged from 13.99 to 24.55 emu/g. Clear peaks of Fe and O was confirmed by energy dispersive X-ray spectroscopy (EDS). Interestingly, morphology of magnetic microspheres (FeHC7) was hollow spherical considered ideal for adsorption ( $1085.47 \pm 5.2$  mg/g at 40 °C in pH 3.5) of PPD. Prepared FeHC7 microspheres can be considered as alternative approaches to reduce the complications of the gastric lavage in suicidal patients in emergency conditions.

**RESUMEN.** El uso de concentraciones tóxicas de parafenilendiaminas (PPD) para el suicidio se ha convertido en un problema grave en todo el mundo, que puede reducirse mediante la preparación de microesferas magnéticas absorbibles. El objetivo de los presentes estudios fue preparar tres tipos de adsorbentes de óxido de hierro magnético ( $\text{Fe}_3\text{O}_4$ ) que tengan quitosano (CTS), nanotubos de halloysita (HNT) de origen natural y su combinación por precipitación en coemulsión. Se calculó el efecto de diferentes concentraciones de CTS, HNT y  $\text{Fe}_3\text{O}_4$ , su tiempo de contacto con PPD, el efecto de diferentes temperaturas y pH sobre la adsorción. La magnetización se confirmó mediante un manómetro de muestra vibrante (VSM) que varió de 13,99 a 24,55 emu/g. Los picos claros de Fe y O se confirmaron mediante espectroscopía de rayos X de dispersión de energía (EDS). Curiosamente, la morfología de las microesferas magnéticas (FeHC7) era esférica hueca considerada ideal para la adsorción ( $1085,47 + 5,2$  mg/g a 40° C en pH 3,5) de PPD. Las microesferas de FeHC7 preparadas se pueden considerar como enfoques alternativos para reducir las complicaciones del lavado gástrico en pacientes suicidas en condiciones de emergencia.

**KEY WORDS:** adsorbent, chitosan, halloysite nanotubes, magnetic microspheres, para-phenylenediamines.

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