catalysts

Synthesis of a Novel Adsorbent Based on Chitosan Magnetite Nanoparticles for the High Sorption of Cr (VI) ions: A Study of Photocatalysis and Recovery on Tannery Effluents

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Table S1. Elemental analysis of MCH and MC-TDPD sorbents.

Sorbent	**C [%]**	**N [%]**	**H [%]**	**O [%]**	**S [%]**
MCH	34.65	3.98	4.97	27.14	
MC-TDPD	37.09	5.63	5.15	32.96	1.11

Table S2. Modeling of uptake kinetics [1-3].

Model	Equation	Parameters	Ref.
PFORE	$q(t) = q_{eq,1}(1 - e^{-k_1 t})$	$q_{eq,2}$ (mmol g^{-1}): sorption capacity at equilibrium k_1 (min^{-1}): apparent rate constant of PFORE	[2]
PSORE	$q(t) = \frac{q_{eq,2}^2 k_2 t}{1 + k_2 q_{eq,2} t}$	$q_{eq,2}$ (mmol g^{-1}): sorption capacity at equilibrium k_2 (g $mmol^{-1}$ min^{-1}): apparent rate constant of PSORE	[2]
RIDE	$\frac{q(t)}{q_{eq}} = 1 - \sum_{n=1}^{\infty} \frac{6\alpha(\alpha+1)\exp\left(\frac{-D_e q_n^2}{r^2} t\right)}{9 + 9\alpha + q_n^2 \alpha^2}$ With q_n being the non-zero roots of $\tan q_n = \frac{3\, q_n}{3 + \alpha q_n^2}$ and $\frac{m\, q}{V\, C_0} = \frac{1}{1 + \alpha}$	D_e(m^2 min^{-1}) : Effective diffusivity coefficient	[1]

(m (g): mass of sorbent; V (L): volume of solution; C_0 (mmol L^{-1}): initial concentration of the solution).

Table S3. Modeling of sorption isotherms [4,5].

Model	Equation	Parameters	Ref.
Langmuir	$q_{eq} = \frac{q_{m,L} C_{eq}}{1 + b_L C_{eq}}$	$q_{m,L}$ (mmol g^{-1}): Sorption capacity at saturation of monolayer b_L (L $mmol^{-1}$): Affinity coefficient	[5]
Freundlich	$q_{eq} = k_F C_{eq}^{1/n_F}$	k_F and n_F: empirical parameters of Freundlich equation	[4]
Sips	$q_{eq} = \frac{q_{m,S} b_S C_{eq}^{1/n_S}}{1 + b_S C_{eq}^{1/n_S}}$	$q_{m,L}$, b_S and n_S: empirical parameters of Sips equation (based on Langmuir and Freundlich equations)	[5]

Akaike Information Criterion, AIC:

$$AIC = N \ln\left(\frac{\sum_{i=0}^{N}\left(y_{i,exp.} - y_{i,model}\right)^2}{N}\right) + 2N_p + \frac{2N_p\left(N_p + 1\right)}{N - N_p - 1}$$

Where N is the number of experimental points, N_p the number of model parameters, $y_{i,exp.}$ and $y_{i,model}$ the experimental and calculated values of the tested variable.

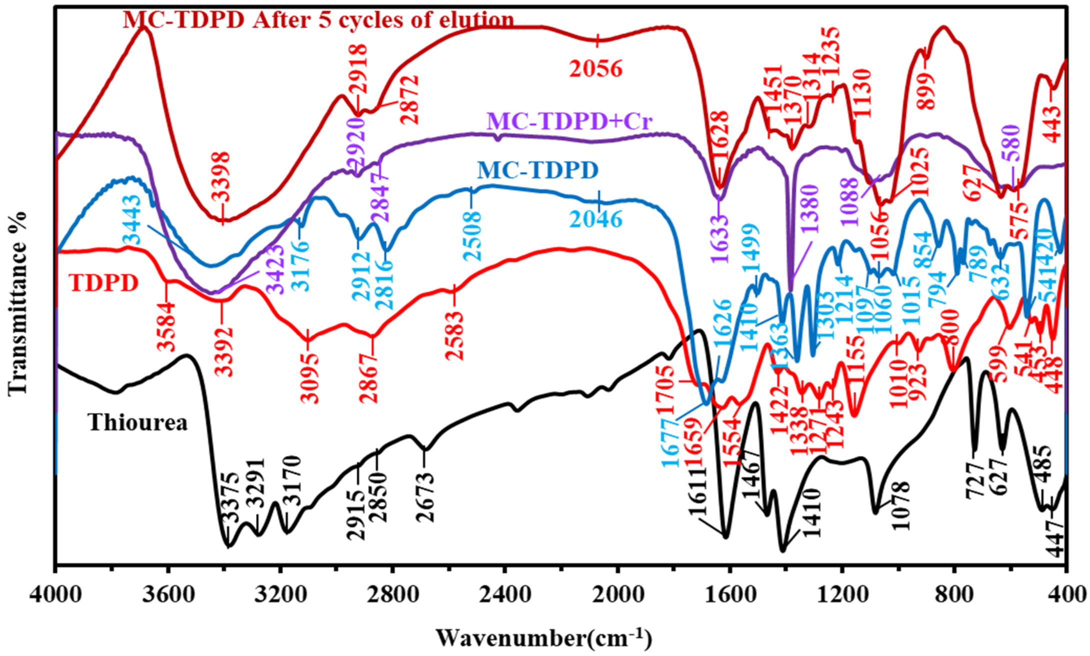

Figure S1. FTIR spectra of thiourea, TDPD, MC-TDPD, after sorption and after five cycles of sorption desorption.

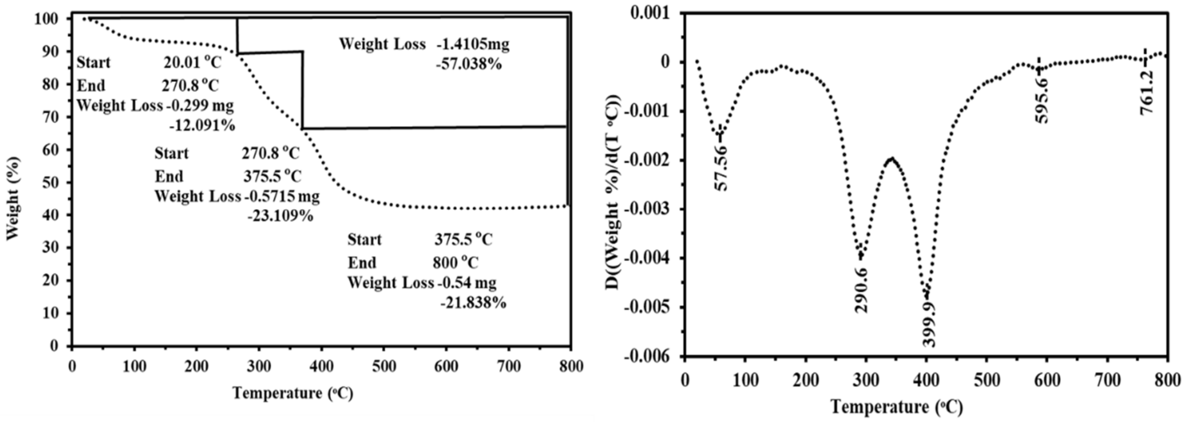

Figure S2. TGA and DrTG analyses of MC-TDPD sorbent T: 23-800 °C.

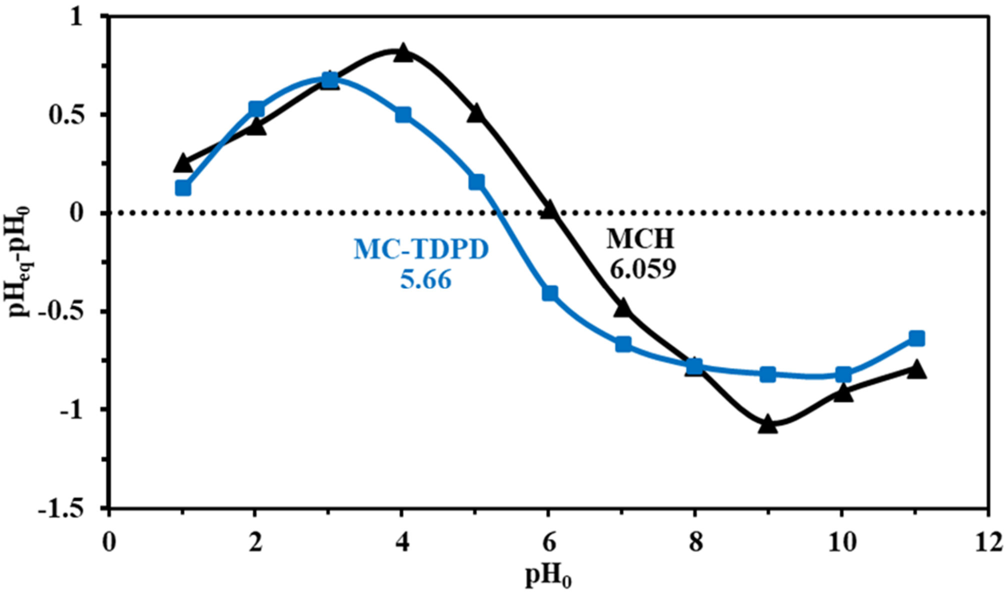

Figure S3. pHpzc of the MCH and MC-TDPD sorbents in range of pH 1-14.

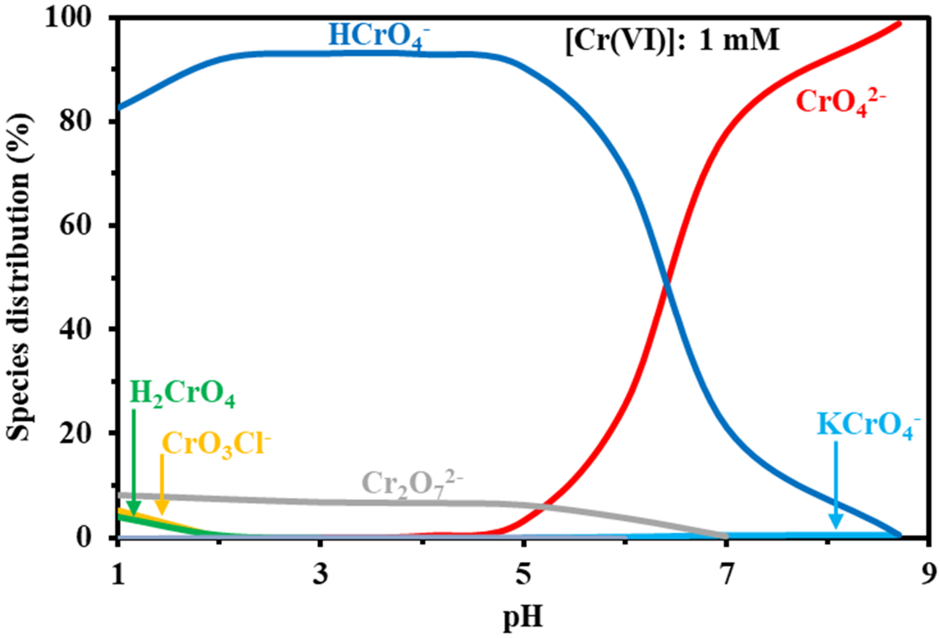

Figure S4. Cr(VI) species at pH 1-9.

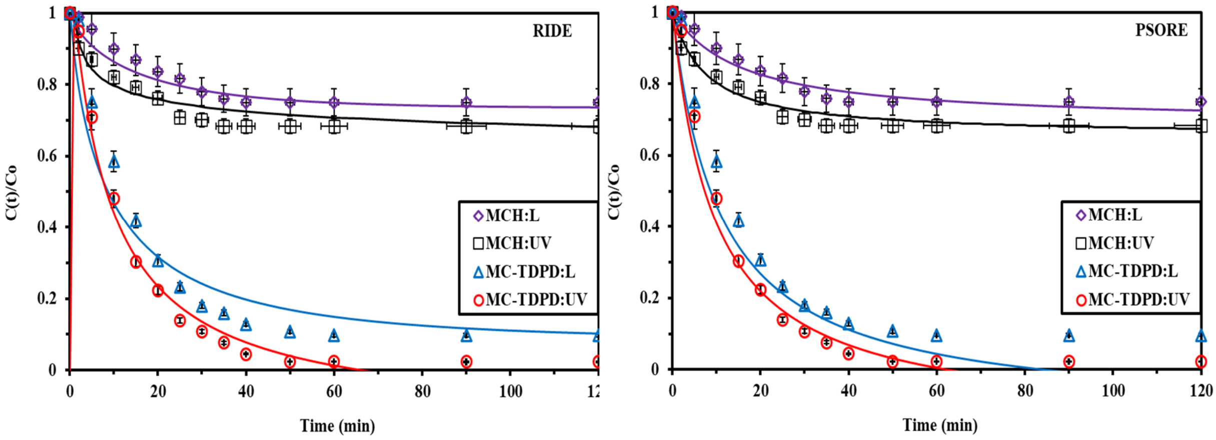

Figure S5. Cr(VI) uptake kinetics using MCH, MC-TDPD in light and UV condition- Modeling with the PSORE and RIDE.

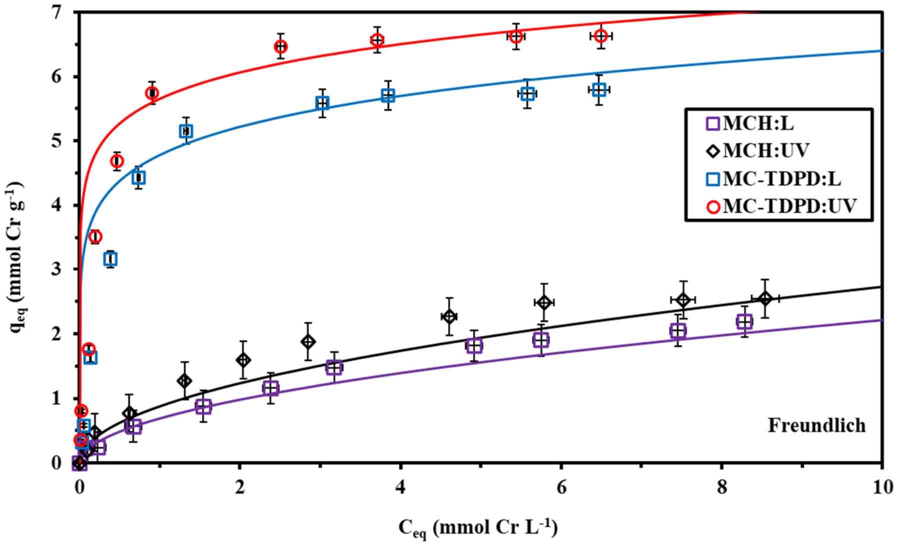

Figure S6. Cr(VI) sorption isotherms using MCH, MC-TDPD in light and UV condition- with the Freundlich equations. .

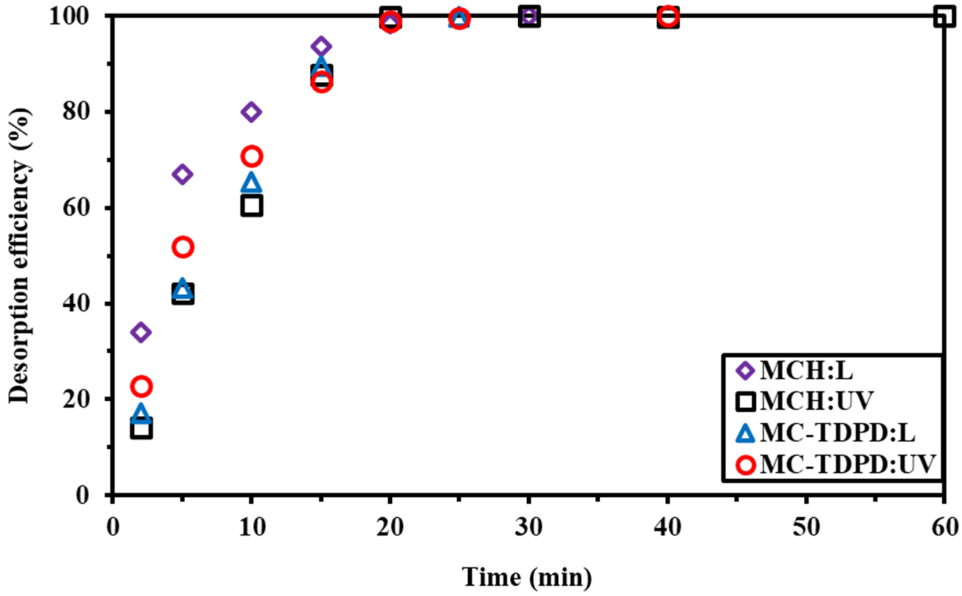

Figure S7. Desorption kinetics of MCH:L, MCH:UV, MC-TDPD:L and MC-TDPD:UV sorbents.

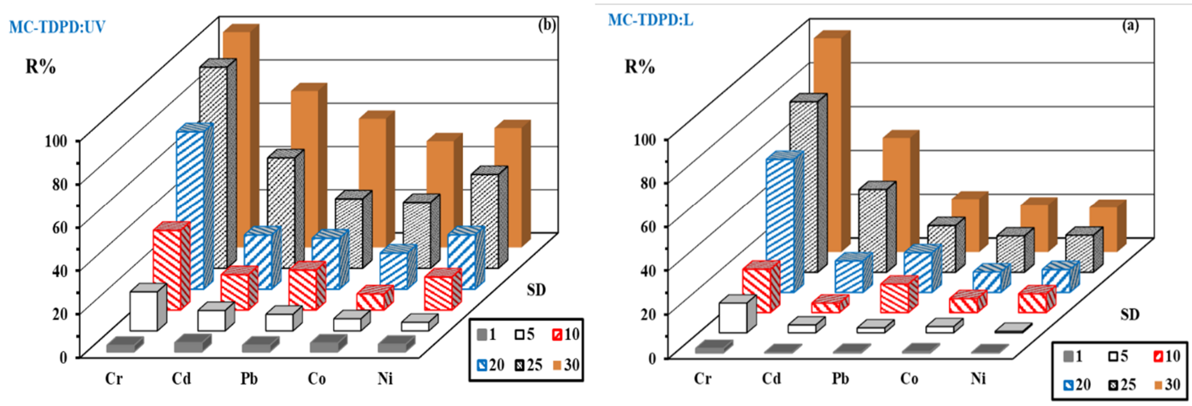

Figure S8. Recovery efficient of MC-TDPD at visible light (a) and Ultraviolet (b).

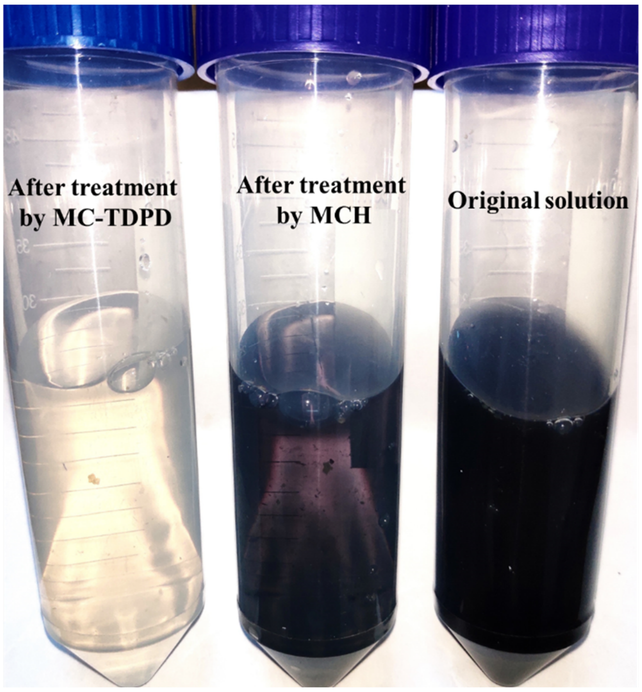

Figure S9. Removal efficient of Cr(VI) using MCH and MC-TDPD

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