Chapter VII

Comparison of Sorption Ability and Preferential Order of Adsorption

An insightful comparison amongst the identified biomaterials to trap the divalent metal ions viz., Pb(II), Cd(II) and Ni(II), along with the preferential order of chosen metal ions to get chelated are exemplified in this chapter.

Sorbent characteristics viz., surface area, mean pore diameter and constants viz., q_e (amount adsorbed), q_m (monolayer adsorption capacity) and $\Delta S°$ (change in entropy) for the nine systems are listed in table 7.1.

Table 7.1 Comparison of Parameters and Constants Values

Parameters	**TPJB**			**TTIH**			**TGH**		
Surface Area (m^2/ g)	3.261			0.325			**3.633**		
Mean Pore Diameter (nm)	56.60			52.33			**64.93**		
Constants	**Pb (II)**	**Cd (II)**	**Ni (II)**	**Pb (II)**	**Cd (II)**	**Ni (II)**	**Pb (II)**	**Cd (II)**	**Ni (II)**
q_e (mg/g)	14.22	13.68	12.52	13.40	12.82	12.41	**56.89**	22.22	20.93
q_m (mg/g)	14.78	13.92	13.63	14.10	12.87	12.34	**56.02**	21.34	18.82
$\Delta S°$ (kJ/ mol K)	41.30	21.88	8.95	19.44	11.29	5.40	**46.05**	22.78	20.59

The highlighted values for Pb(II)- TGH system reveal the better sorption capacity and high order of randomness in preference to other sorbents/ sorbates. This suggests that TGH is best amongst the identified materials and Pb(II) is preferentially adsorbed over other divalent ions. This is supported by the retention capacity of TGH (5 cycles of adsorption/ desorption) against 3 cycles in case of TPJB and TTIH. Thence, the orders are: TGH > TPJB > TTIH; Pb(II) > Cd(II) > Ni(II) ions.

Pb(II) ion, being the better sorbed, is substantiated by the higher hydration enthalpy ($\Delta H_h°$)[169] and diffusion coefficient[170] values (Table 7.2). Similar observations were reported by Muhammed H Al-Malack[62] *et al.*

Table 7.2 Hydration Enthalpy and Diffusion Coefficient Values

Metal Ions	**Hydration Enthalpy $\Delta H_h°$ (KJ/ mol)**	**Diffusion Coefficients ($x\ 10^{-10}\ m^2\ s^{-1}$)**
Pb(II)	**-1481**	**9.45**
Cd(II)	-1807	7.20
Ni(II)	-2105	7.14