Chapter IX

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The competence of preferred materials in segregating anions (PO_4^{3-}, NO_3^-, SO_4^{2-}) is compared on the basis of variable aspects viz., isothermal constants and surface area of the utilized material (BET analyses).

The data in Table 9.1 proclaims the maximal anion holding ability (q_e) of TETS invariably for all the anions than other three materials. The reason being that, the seed possess hard woody shell layer with large amounts of lipids and essential bioactive components which chelates the anionic species preferably. This made observations is reflected in the calculated q_m value too (Langmuir constant).

Table 9.1 Sorption Efficiency Comparison- Parametric Evidences

Sorbates/ Sorbents		PO_4^{3-}	NO_3^-	SO_4^{2-}
TCSS (SA - 36.31)	Dose	200	200	250
	q_e	57.26	48.92	52.95
	q_m	54.70	44.16	49.74
TETS (SA - **58.63**)	**Dose**	**100**	**100**	**150**
	q_e	**60.81**	**55.93**	**57.89**
	q_m	**63.69**	**59.17**	**60.97**
TVFH (SA - 31.42)	Dose	200	200	250
	q_e	56.54	46.07	48.34
	q_m	52.2	45.19	46.53
TGGDB (SA - 30.24)	Dose	200	200	250
	q_e	56.08	45.15	47.67
	q_m	52.62	40.86	43.67

*SA – Surface Area (m^2/g), Dose (mg), q_e/q_m (mg/g)

The possible rephrase of TETS with minimal need of desorption and slight depletion in percentage removal of anions confirms it to be the foremost amongst the four employed materials. Thence the order of sorbents is TETS > TCSS > TVFH > TGGDB.

The rate of anions getting sorbed onto the surface of the chosen sorbents are examined using the properties such as electronegativity, diffusion coefficient, Gibb's hydration energy, oxidation states.

Electronegativity is a measure of how strongly atoms attract bonding electrons to themselves. Thence, low electronegative elements register higher adsorption capacity, thereby, Phosphorous element with lower electronegativity value (2.19) against sulphur (2.58) and nitrate (3.04) show extended sorbed property. Diffusivity is a proportionality constant between the molar flux due to molecular diffusion and concentration gradient of the species. Anion with diffusion coefficient value exhibits better sorptive nature, as evident from the coefficient values listed below, PO_4^{3-} (10 -13 $\times 10^{-4}$ cm^2 S^{-1}) > SO_4^{2-} (1.6416 $\times 10^{-4}$ cm^2 S-1) > NO_3^- (0.56 $\times 10^{-5}$ cm^2 S^{-1}). Gibb's hydration energy ($\Delta G_h°$) values of PO_4^{3-} , NO_3^-, SO_4^{2-} are stated as -238 kJ/mol, -270 kJ/mol, -258 kJ/mol respectively, greater negative hydration energy implies least sorbing nature of the anion. This makes sense of phosphate ion being sorbed at a greater extent while comparing with the other two anions. The trivalent charge on phosphate ion promotes its tendency to get adsorbed on the surface of the sorbent in an extended manner, than the divalent (SO_4^{2-}) and monovalent (NO_3^-) ions. Also, a comparison of oxidation states of the target anions implies that phosphate has it has more whereas sulphate being a divalent anion it shows moderate sorption than monovalent nitrate ion which shows minimal sorption.

From the above discussions, it is observed that the order of anion species getting sorbed is as PO_4^{3-} > SO_4^{2-} > NO_3^-.