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Best Modeling Parameters Applicable To Rare Earth Metals Extraction From Aqueous Waters.

Monika Nagrani, Dharamveer Singh
Research scholar, Professor
Department of Physics, Department of Physics
Agra College Agra(India), Agra College Agra(India)

Abstract: Modern World is "Electronic World" where in there is strong urge for electronic equipments, rare earth elements are considered to be the "Nutrients" of the modern world. High demand and limited resources subjected mankind for secondary sources of rare earth metals to fulfill the un -forbidden gap. In order to understand the adsorption and extraction mechanism from secondary sources we need to understand and find applicability of Langmuir model in this case.

Keywords: Langmuir model, Adsorption, Rare earth elements

Introduction: Rare earth elements (REEs) have received increased consideration in recent decades and due to their distribution properties and distress application in modern technologies particularly in the nuclear field control metallurgy and ceramic industry (1, 2).Significant amount of cerium and cerium oxide concentrates are used in glass polishing applications and many compounds have found important uses in biomedical applications. While Neodinum being first triad of the lanthanide illustrations and used in steel moth selection compound(3).But due to wide application of REEs across the world there is limited production of them.

Data collection and sources of data: Out of that India accounts of 1% of whole world supply as data presented and configured by Indian Rare earth limited.

So along with limited primary there is urgent need to locate secondary sources of extraction of Rare earth metal.

Theoretical Framework: It has been reported after the first measurements of dissolved rare earth elements in the head water of the Yamuna river draining through southern slopes of Himalayas(4).To understand the process in order to purify the river water and extraction of rare earth elements through nano adsorption, we can outline few modeling parameter as well. Adsorption is a adhesion of atoms/Ions/molecules from a gas, liquid or dissolved solid onto a surface. It create film on to the surface of adsorbent of nano membrane. The migration of pollutants in aquatic media and subsequent development of containment measures have resulted in the use of adsorption as best among their other techniques as well[5-6] .A proper understanding and interpretation of adsorption is other way to critical for the overall improvement of adsorption mechanic pathway and effective design of adsorption systems in exemplified form[7]. Adsorption Equilibrium is at most important for understanding adsorption process. In recent times linear regression analysis has Been one of the most applied tools for defining the best fitted adsorption models as it quantifies the distribution of adsorbents and analyzes the adsorption on to the system. It overall verifies the consistency of theoretical assumption of adsorption in other models as well[8].Langmuir Adsorption which was primarily designed to describe gas solid phase adsorption and is also used to quantify and contrast of various adsorbents.[9].It is accounted for the balancing adsorption and desorption equilibrium. Adsorption is proportional to fraction of adsorbent surface that is covered[10].

Equations: The Langmuir equation in linear form states

Cc/qe, = 1/qmKe +Ce/qm(1)

Ce = Conc. of adsorbate at equilibrium (mg/g)

K_L= Langmuir Constant

concentration(mg/g) which are corrected with variation of the suitable area and porosity of adsorbent and implies the large surface area and pore volume will result in higher adsorption capacity. The Essential

Characteristic of Langmuir model can be expressed by dimensionless constant which is called separation factor[11]

$R_L = 1/1+K_L\ C_O$ [2]

Co = Initial concentration of adsorb ate [mg/g]

R_L indicates whether the absorption is favorable or else unfavorable

RL>1; unfavorable

RL = 1; linear

$0<R_L<1$; irreversible and favorable

Results: Rengarajan et.al. calculated the range and concentration of REE in Yamuna river which has been table(1).

Applying the Langmuir isotherm it can be seen from table (2) that

$0<R_L<1$,that defines the reaction on to homogeneous surface for the extraction of sludge while best for purification of Yamuna waters is **favorable and irreversible.**

Research Methodology: It is more of deductive and analytical approach of research.

Conclusion:- Langmuir isotherm model proposed well for modeling of rare earth from Yamuna river .But more modeling parameters for heterogonous adsorption can be encapsulated for the further development in this field. More research and development is required for the area specific terrain of Yamuna river in Agra and its nearby region.

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TABLE 1:Range and mean concentrations (mg/L) of dissolved REE and Europium,Cerium and Gadolinium anomalies in the Yamuna river and its tributaries

REE	MIN	MAX	GE	AVERAGE	
La	15.0	267	54.5	77.1	
Ce	13.8	558	98.2	156	
Pr	2.3	64.9	12.9	18.9	
Nd	18.3	253	56.2	77.8	
Sm	4.1	60.6	13.6	18.9	
Eu	2.0	11.9	4.2	5.0	
Gd	4.7	61.0	14.7	20.1	
Tb	0.69	8.6	2.2	3.0	
Dy	3.0	50.5	12.8	17.3	
Ho	0.50	9.2	2.4	3.3	
Er	1.3	27.9	6.9	9.2	
Tm	0.30	4.2	0.92	1.3	
Yb	1.4	21.3	5.4	7.3	
Lu	0.50	3.0	1.1	1.4	
∑REE	87.0	1374	289	414	
∑LREE[1]	66.3	1201	239	349	
∑HREE[1]	11.9	186	46.4	62.4	
La_N/Yb_N	3.2	14.7	6.7	7.1	
La_N/Sm_N	1.7	7.2	2.5	2.7	
Gd_N/Yb_N	1.5	3.3	2.2	2.2	
Eu/Eu*[(2)]	0.49	0.73	0.62	0.63	

(2)The Eu,Ce and Gd anomalies are calculated as follows:

$Eu/Eu^* = Eu_{CN}/(Sm_{CN} * Gd_{CN})^{0.5}$

$C_e/C_e^* = 3Ce_{CN}/(2\ La_{CN} + Nd_{CN})$

$Gd/Gd^* = Gd_{SN}/(0.33Sm_{SN} + 0.67Tb_{SN}$

TABLE 2:Calculation of Langmuir Isotherm Dimensionless Constant(R_L)

REE	AVERAGE	$Q_e=K_{HE}C_e$	R_L
La	77.1	$175.0178*10^{-5}$	0.032
Ce	156	$1354.12*10^{-5}$	0.05
Pr	189	$42.903*10^{-5}$	0.045
Nd	77.8	$176.606*10^{-5}$	0.096
Sm	18.9	$42.903*10^{-5}$	0.304
Eu	5.0	$11.35*10^{-5}$	0.62
Gd	20.1	$45.67*10^{-5}$	0.291
Tb	3.0	$6.81*10^{-5}$	0.733
Dy	17.3	$39.271*10^{-5}$	0.32
Ho	3.3	$7.491*10^{-5}$	0.719
10^{-}Er	9.2	$20.884*10^{-5}$	0.473
Tm	1.3	$2.951*10^{-5}$	0.864
Yb	7.3	$16.571*10^{-5}$	0.531
Lu	1.4	$3.178*10^{-5}$	0.855
∑REE	414	$939.78*10^{-5}$	0.0196
∑LREE[1]	349	$792*10^{-5}$	0.023
∑HREE[1]	62.4	$141.6*10^{-5}$	0.116
La_N/Yb_N	7.1	$16.117*10^{-5}$	0.54
La_N/Sm_N	2.7	$6.129*10^{-5}$	0.75
Gd_N/Yb_N	2.2	$4.994*10^{-5}$	0.789
Eu/Eu*[(2)]	0.63	$1.4301*10^{-5}$	0.93