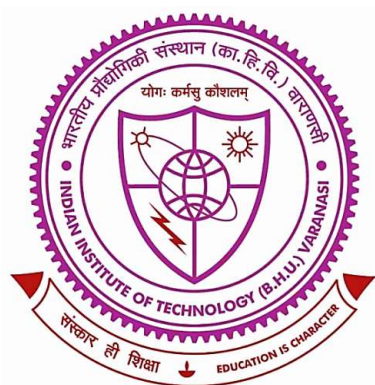


# Production of environmentally benign Biochar composites for removal of Fluoride and Nitrate from Drinking Water



Thesis submitted in partial fulfillment for the  
Award of Degree of  
**Doctor of Philosophy**

by

*Vartika Verma*

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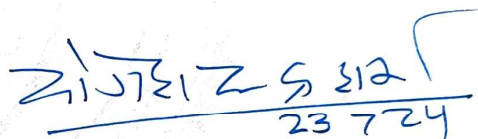
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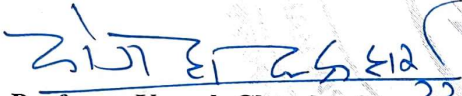
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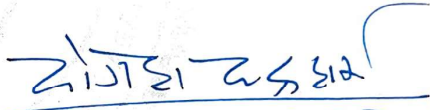
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**Date:** 24.07.2024

**Vartika Verma**

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## List of abbreviations

### Symbol/Abbreviation Description

|                          |  |
|--------------------------|--|
| b                        | Langmuir constant related to the affinity of binding sites (L/mg)  |
| BET                      | Brauner-Emmett-Teller  |
| $C_e$                    | Equilibrium concentration of the adsorbate (mg/L)  |
| $C_t$                    | Residual concentration of the adsorbate remaining after adsorption has taken place over a time period of t (mg/L), in batch mode |
| $C_0$                    | Initial adsorbate concentration (mg/L)   |
| E                        | Mean free energy of the adsorption (kJ/mol)  |
| EDAX                     | Energy Dispersive X-ray Analysis   |
| FTIR                     | Fourier-transform infrared spectra   |
| h                        | Hour   |
| $\Delta G$               | Gibbs free energy change (kcal/mol)  |
| h (kinetics)             | Initial sorption rate of pseudo second order kinetics of adsorption (mg/g/min)   |
| $\Delta H$               | Enthalpy change (kcal/mol)   |
| K                        | Constant obtained by multiplying the $Q^\circ$ and b (Langmuir's constant)   |
| $K^F$                    | Freundlich constant which indicate relative adsorption capacity ( $\text{mg}^{1-1/n}/\text{gL}^{1/n}$ )                          |
| $K_s$                    | Equilibrium rate constant of pseudo-first-order kinetics adsorption ( $\text{min}^{-1}$ )  |
| $K_2'$                   | Equilibrium rate constant of the pseudo-second-order kinetics of adsorption  |
| m                        | Mass of the adsorbent per unit of volume (g/L)   |
| n                        | Freundlich constant indicative of the nature and strength of the adsorption process and the distribution of the adsorption sites |
| $\text{pH}_{\text{pzc}}$ | point of zero charge   |
| $Q^\circ$                | Langmuir constant represents the monolayer adsorption capacity (mg/g)  |
| q                        | Uptake capacity of the nanoadsorbent (mg/g)  |
| $q_e$                    | Amount of adsorbate adsorbed at equilibrium (mg/g)   |

|            |   |
|------------|---|
| $q_t$      | Adsorption capacity of the adsorbent at time $t$ (mg/g) |
| $R$        | Universal gas constant [8.314 J/mol/K]                  |
| rpm        | Rotation per minute                                     |
| $R^2$      | Correlation coefficient                                 |
| SEM        | Scanning Electron Microscopy                            |
| $\Delta S$ | Entropy change  |
| $T$        | Temperature   |
| $t$        | Time  |
| Temp.      | Temperature ( $^{\circ}\text{C}$ )                      |
| TGA        | Thermogravimetric analysis                              |
| $V$        | Volume of the solution (L)                              |
| WHO        | World Health Organization                               |
| XRD        | X-Ray Diffraction                                       |
| XPS        | X-ray photoelectron spectroscopy                        |