

## Supplementary Information

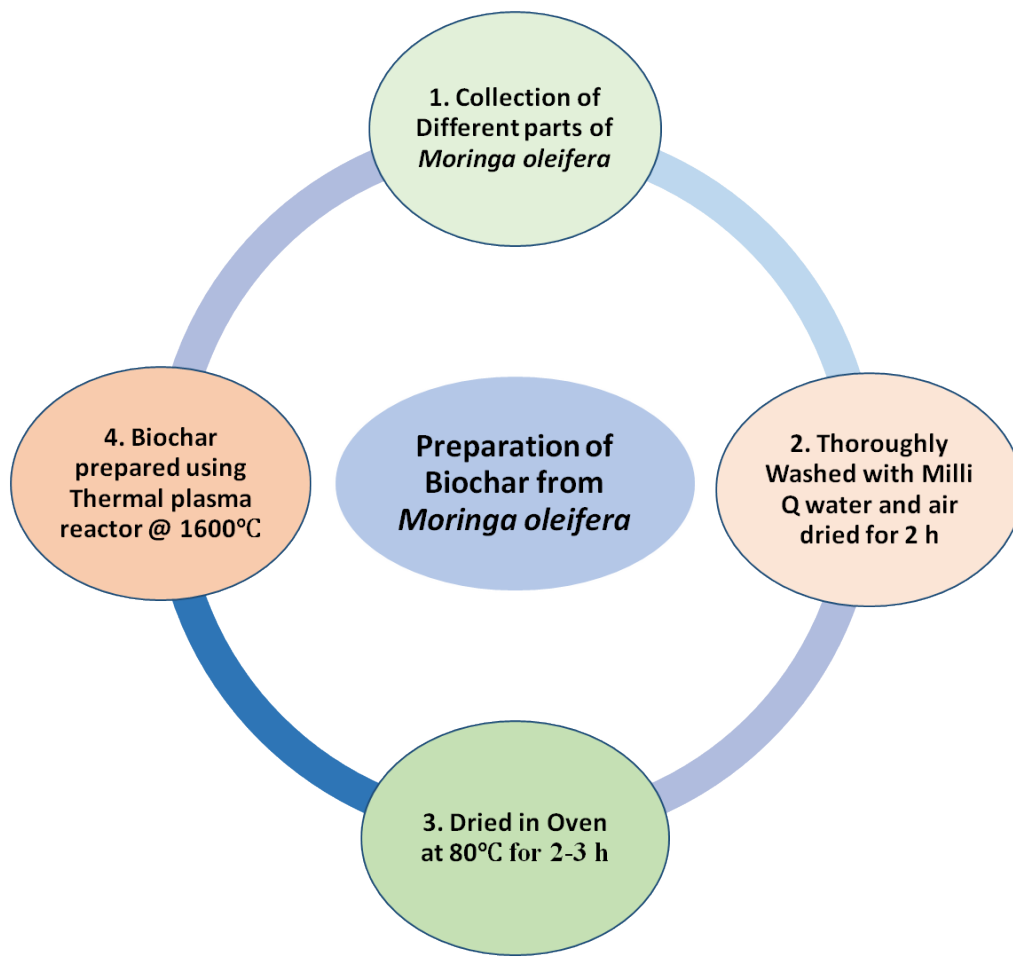
### Preparation of *Moringa oleifera* biochar by thermal plasma processing: Adsorbents for fluoride removal from water

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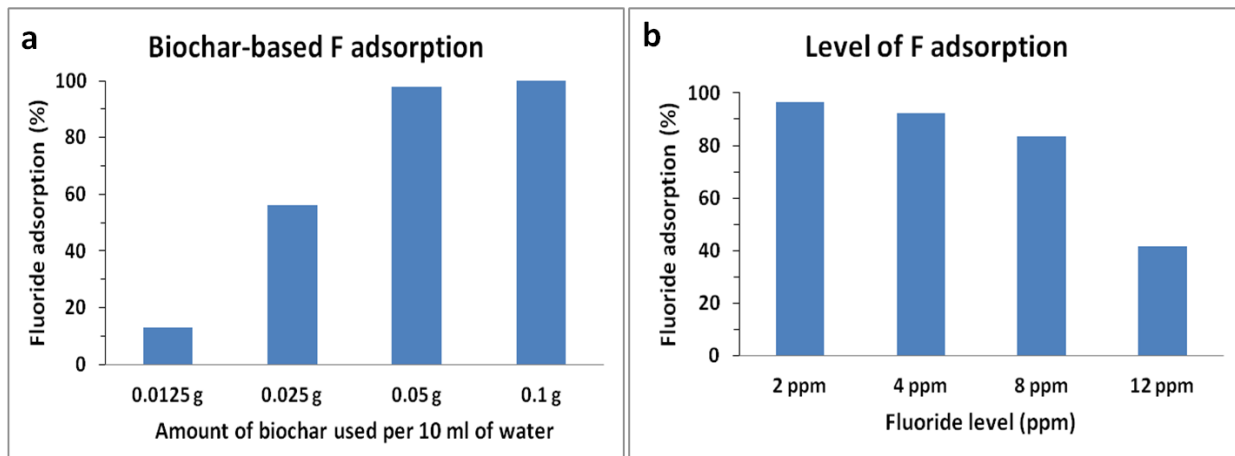
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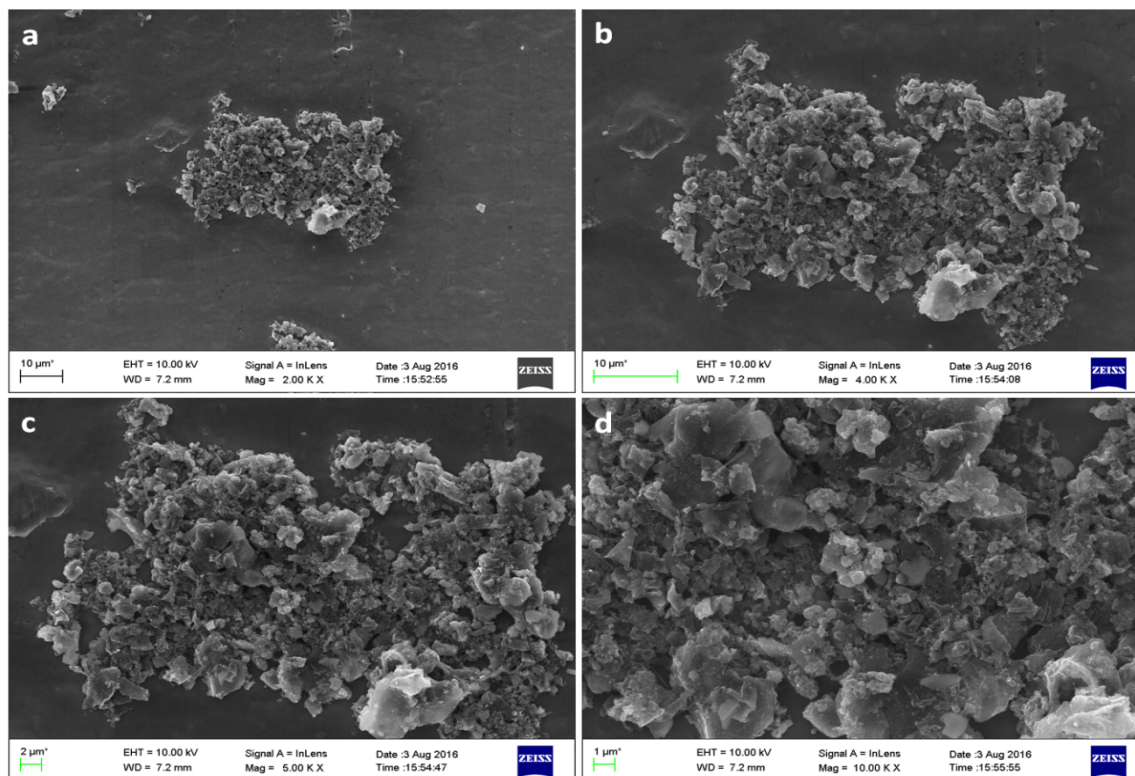
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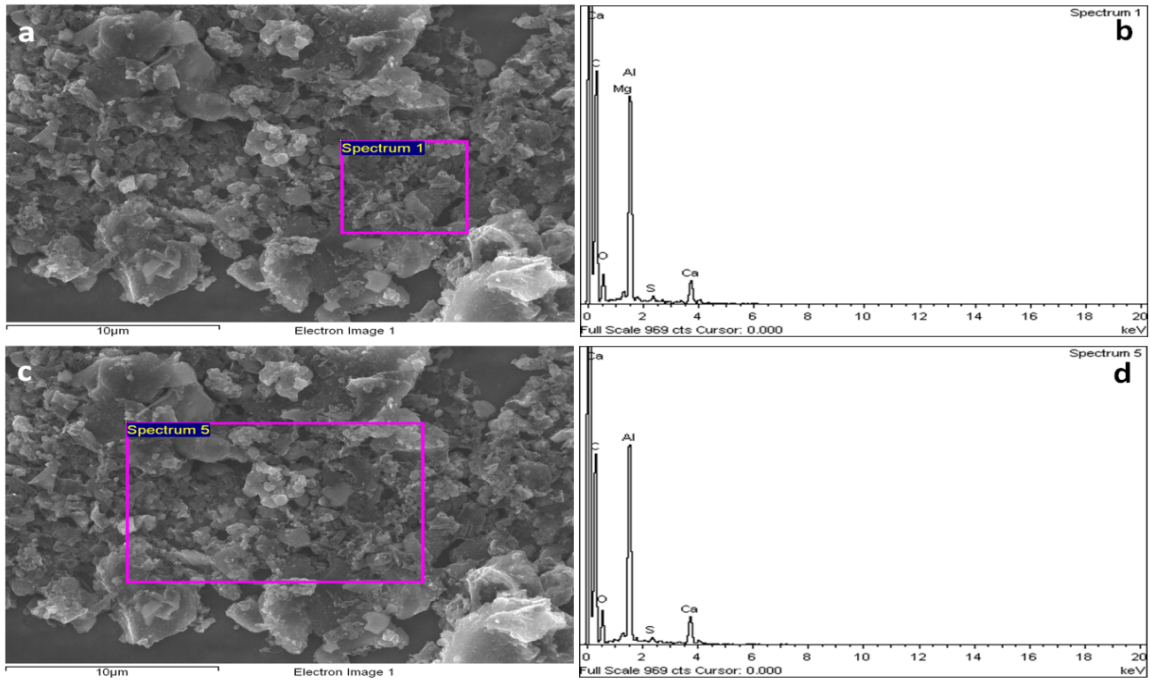
Flow-sheet of preparation of *Moringa oleifera* biochar



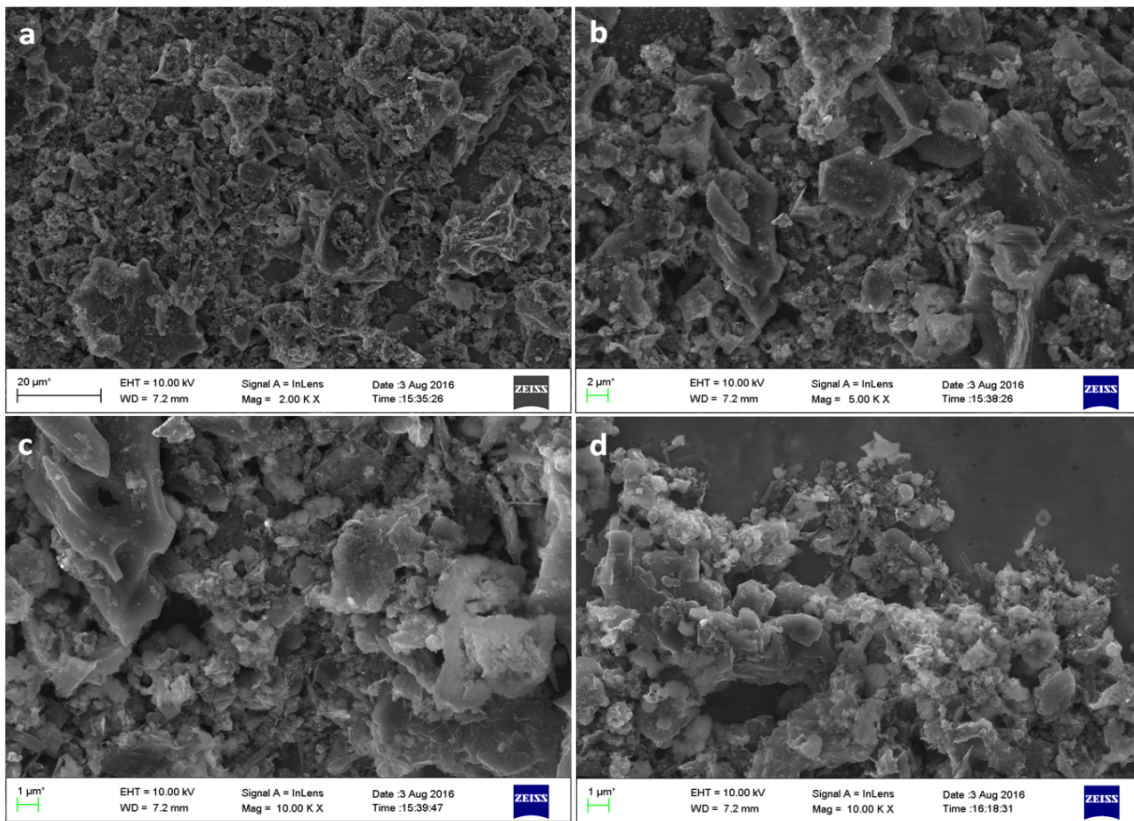
**Fig. S1** The absorption efficiency was examined with different amount of *Moringa* seed biochar while the fluoride concentration is 2 ppm. The absorption efficiency is maximum (100%) in case of 0.1g of seed biochar for 2 ppm fluoride in 1h (a). *Moringa* seed biochars able to remove 96%, 92%, 84% and 42 % of fluoride from 2 ppm, 4 ppm, 8 ppm and 12 ppm fluoride solution, respectively (b).



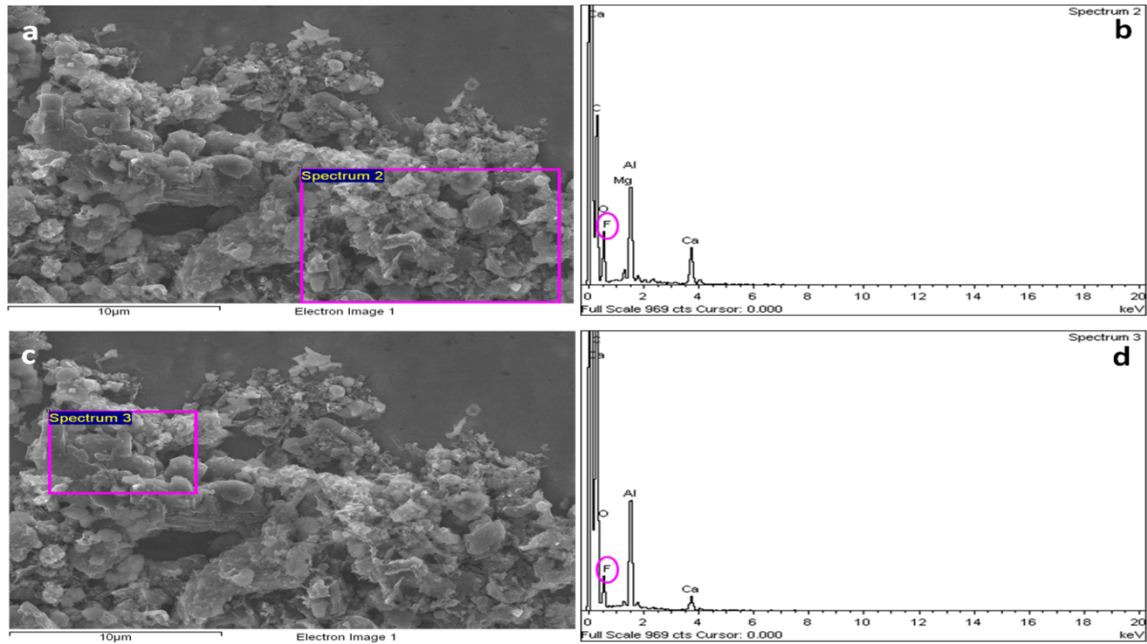
**Fig. S2** FESEM images of *Moringa* leaf biochar before fluoride adsorption. All images shows higher surface area and porosity.



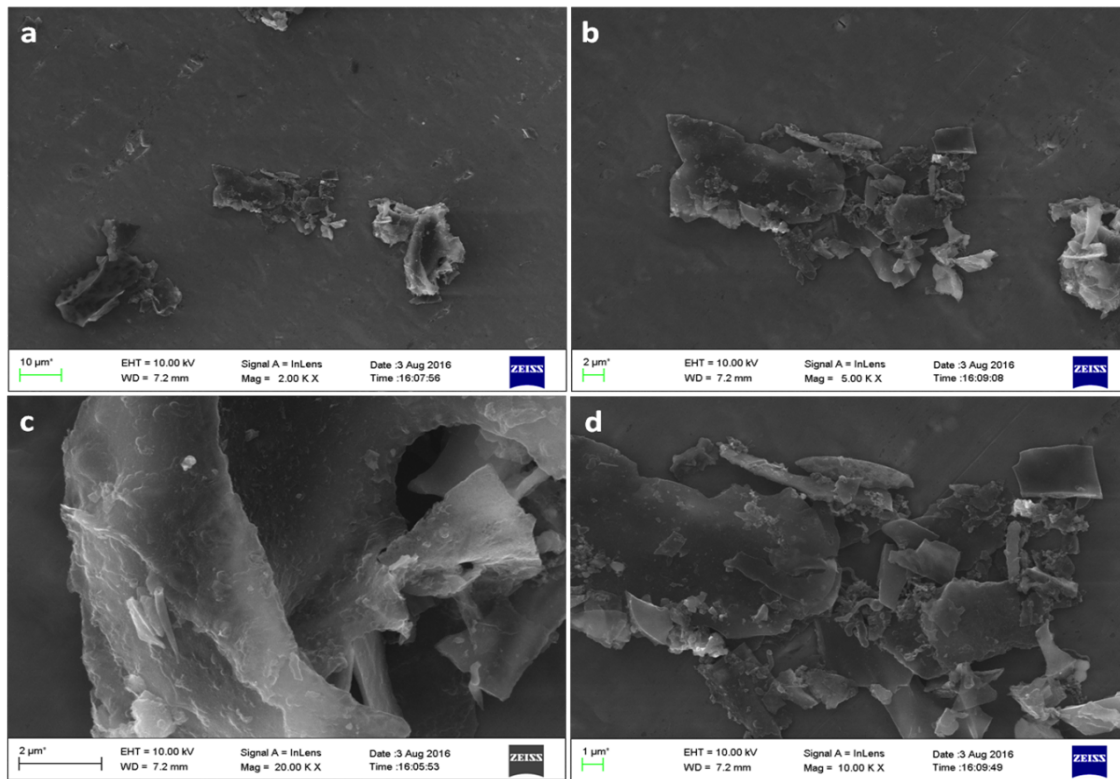
**Fig. S3** EDX spectra of *Moringa* leaf biochar showing the presence of Ca, C, O, Al, Mg, and S.



**Fig. S4** FESEM images of *Moringa* leaf biochar after fluoride adsorption.

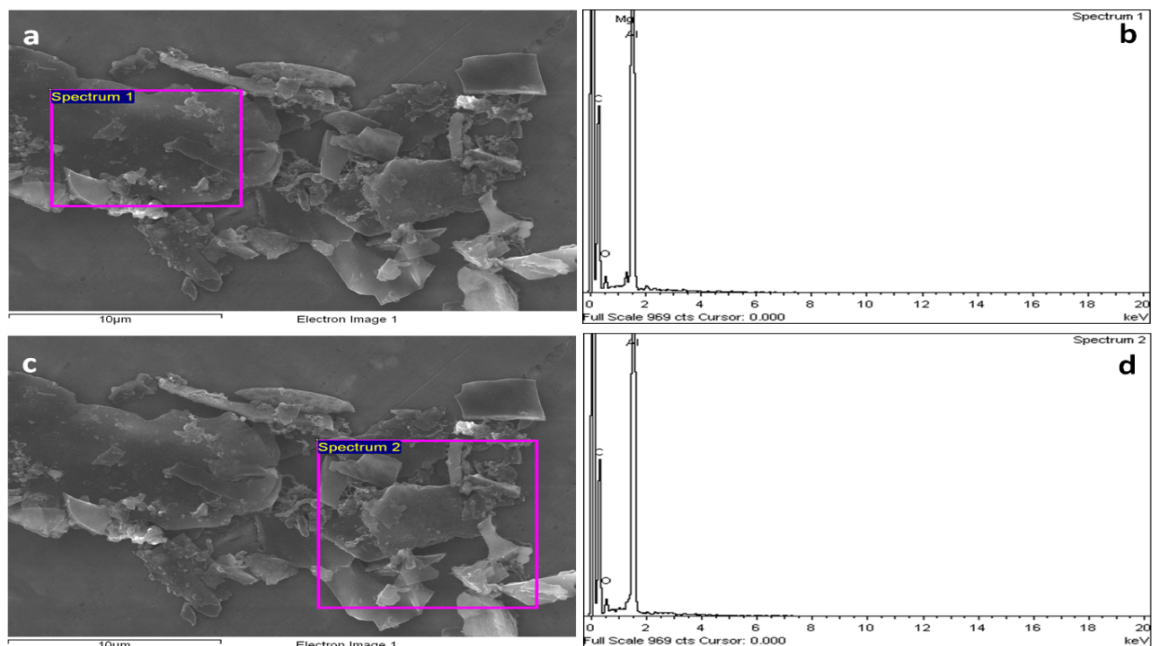


**Fig. S5** EDX spectra of *Moringa* leaf biochar showing the presence of Ca, C, O, F, Al, and Mg. Aggregation appeared in highly porous leaf biochar surfaces due to adsorption.

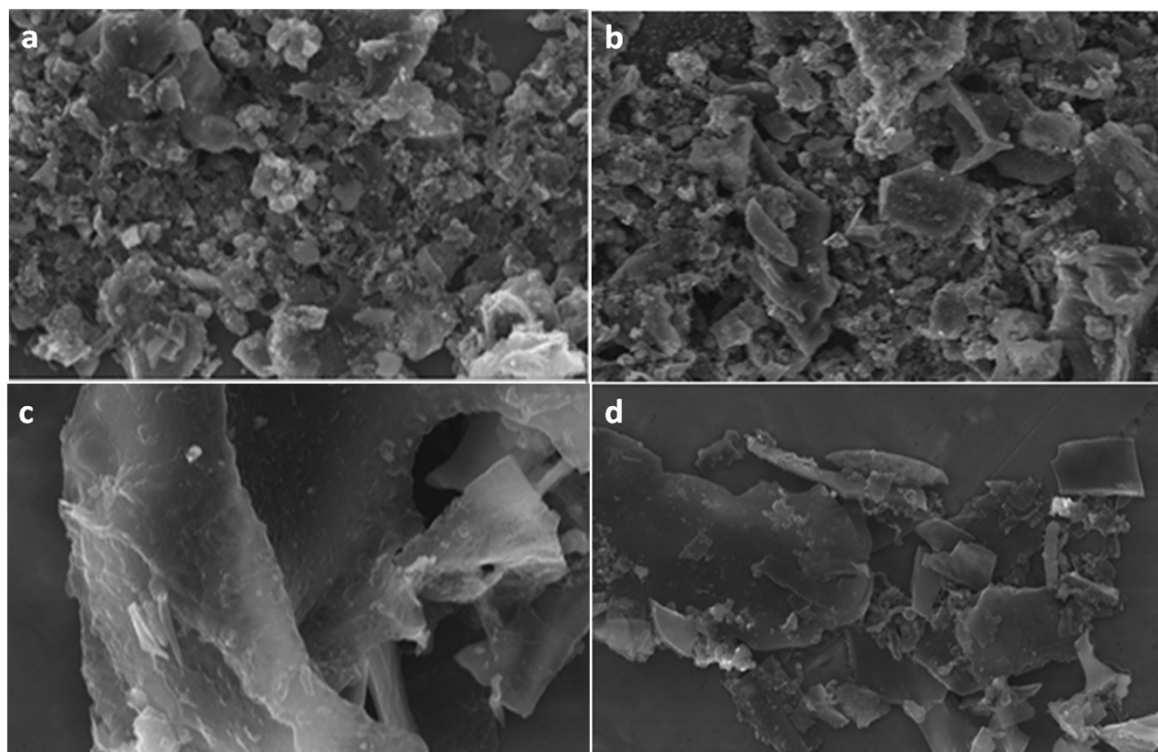


**Fig. S6** FESEM images of *Moringa* seed biochar after fluoride adsorption showing low surface area and low porosity.





**Fig. S7** EDX spectra of *Moringa* seed biochar showing the presence of C, O, Al, Mg.



**Fig. S8** Comparison of the SEM images before and after fluoride adsorption in leaf and seed biochar. Porous surface of leaf biochar before (a) and after (b) the fluoride removal, while sheet like surface of the seed biochar before (c) and after (d) the adsorption of fluoride.

**Table S1** Collection of fluoride contaminated water from different villages of the Nuapada district in the state of Odisha such as Kotamal-Makardampada (20°24'46"N 82°37'19"E), Pandrapathar (20°34'41"N 82°39'25"E), Karlakot-Kadobhata (20°22'52"N 82°37'24"E), Kotamal-Jhakarpada (20°24'35"N 82°37'20"E), and Dohelpada (20°33'50"N 82°38'57"E) and characterization of fluoride content.

Sample	Block	Gram Panchyat	Village	Habitation	pH	Fluoride (ppm)
1	Boden	Karlakot	Kotamal	Makardampada	7.8	0.932
2	Komna	Buddhikomna	Pandrapathar	Pandrapathar	7.26	4.028
3	Boden	Karlakot	Karlakot	Kadobhata	7.45	3.31
4	Boden	Karlakot	Kotamal	Jhakarpada	7.7	3.97
5	Komna	Kureswar	Dohelpada	Sri Sathya Sai Water Project	7.6	6.12

**Table S2:** Elemental composition of leaf and seed biochar of *Moringa oleifera*

Element	% in Leaf biochar	% in Seed biochar
C	79.43	72.13
O	10.18	2.74
Al	6.44	24.95
S	0.43	0.0
Ca	3.38	0.0
Mg	0.47	0.55