

Granulated clay-type sorbent materials for chromium containing wastewater treatment



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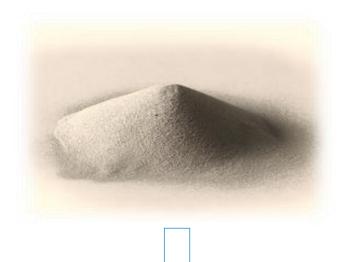
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INTRODUCTION

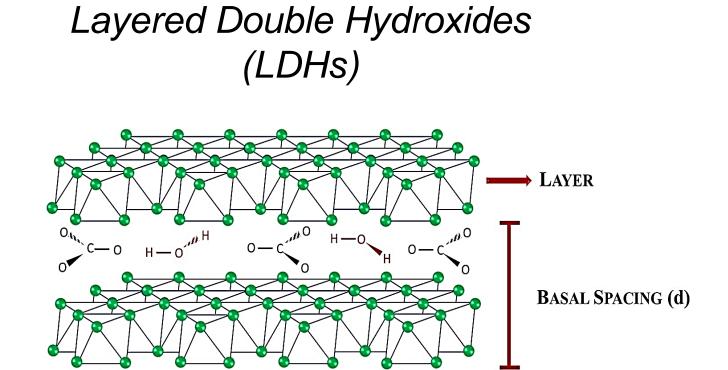
The present study focuses on the application of the granulated clay-based adsorbents for heavy metal uptake (such as Cr) from the Jajmau municipal wastewater treatment plant (STP) as part of the H2020 EU-India PAVITRA GANGA project which focuses on improving existing wastewater treatment systems. Within the project, the composition of the structured clay-based sorbents is adapted to the specific conditions of the Indian test-case, taking into account the chromium speciation (Cr3+ and/or Cr6+) relevant concentrations and the competitive ions. The final goal is to ensure that wastewater loaded with Cr can be reused for irrigation after the treatment.

Structured sorbents of Composites with specific structure:



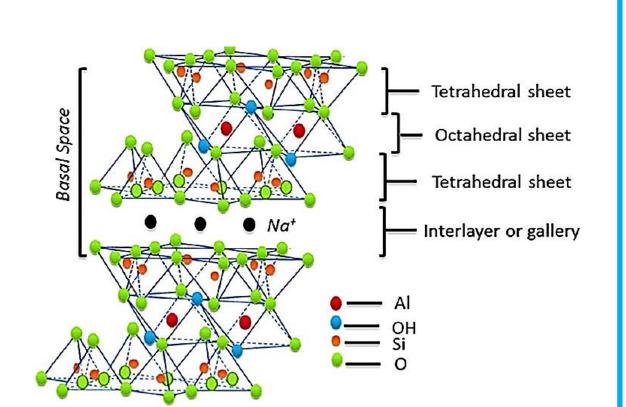


 \checkmark Cr⁶⁺ \rightarrow LDH type clay ✓ Cr^{3+} → Phyllosilicate type clay



Eco-friendly, highly available, cheap, ... Anionic clay, positive layer charge

Layered Phyllosilicates (Bentonite - B)

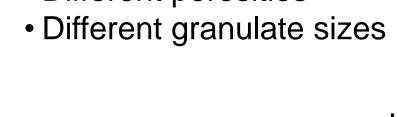


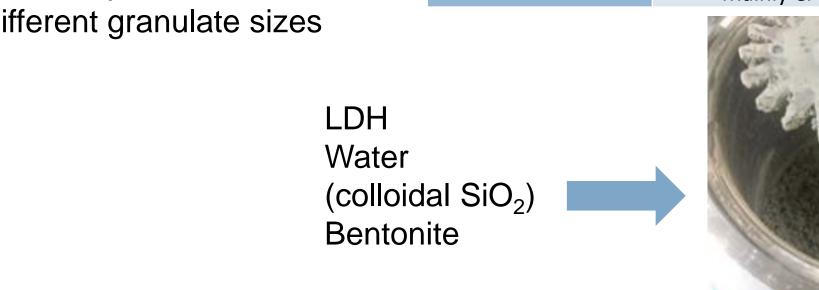
Cationic clay, negative layer charge

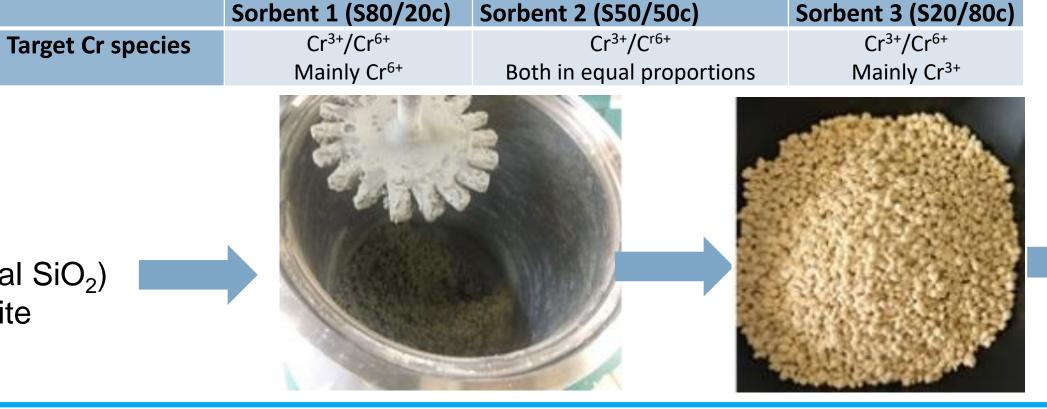
METHODS

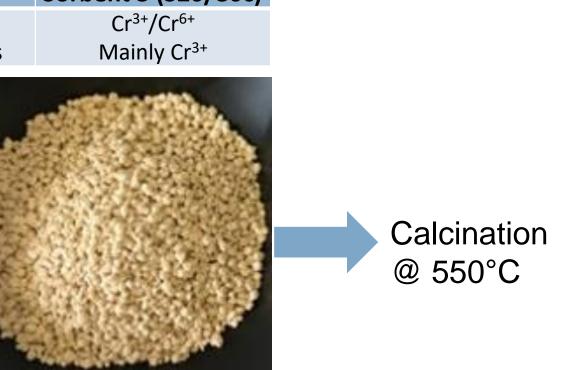
Granulated composites prepared by intensive mixing technique:

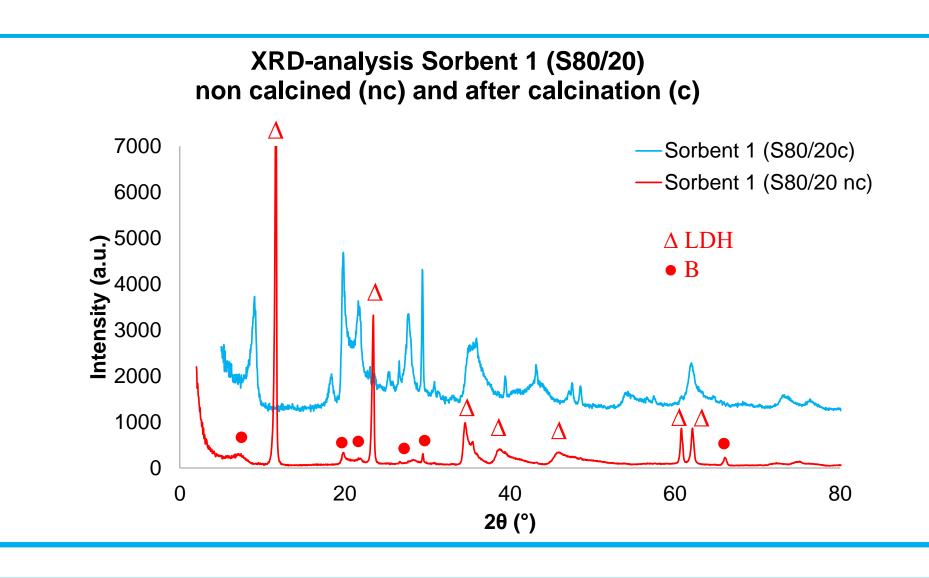
- Different ratios (LDH/B)
- Different porosities



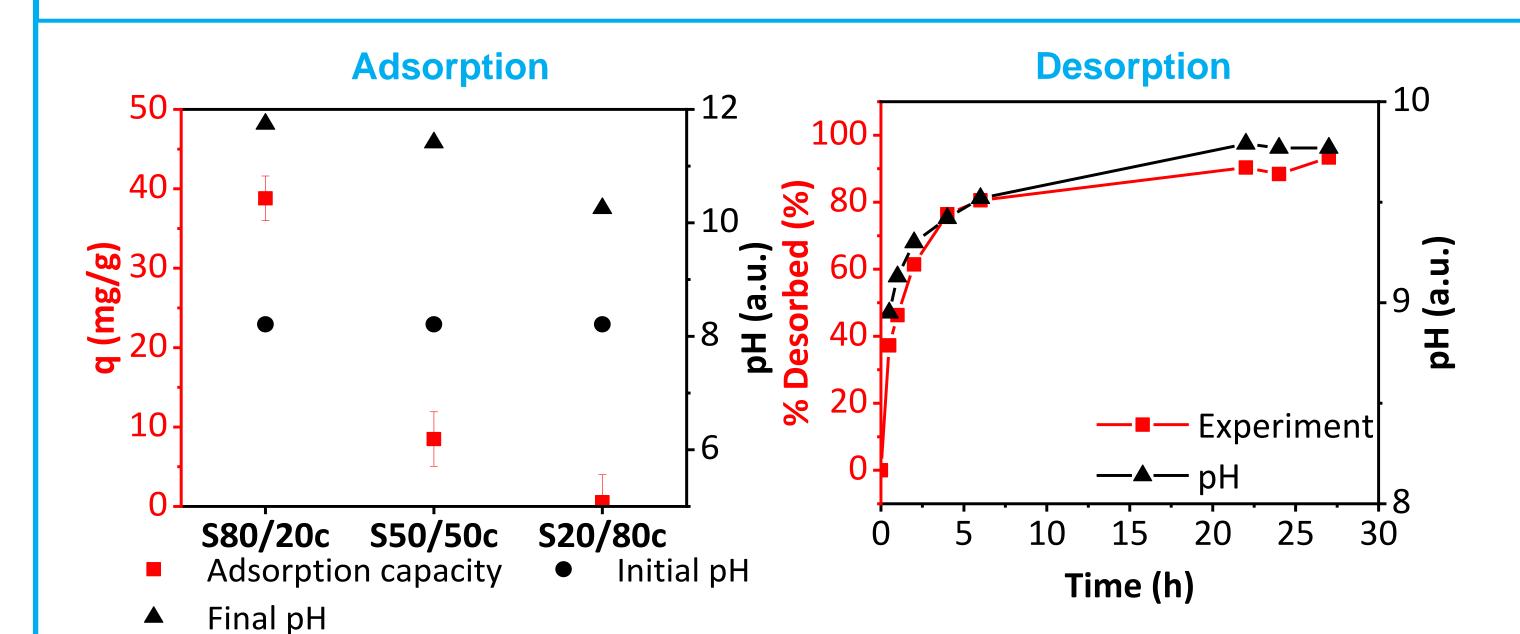




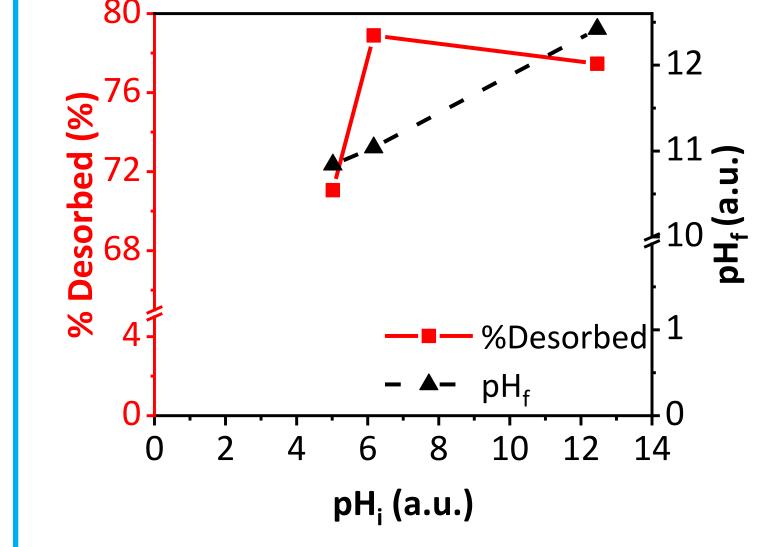


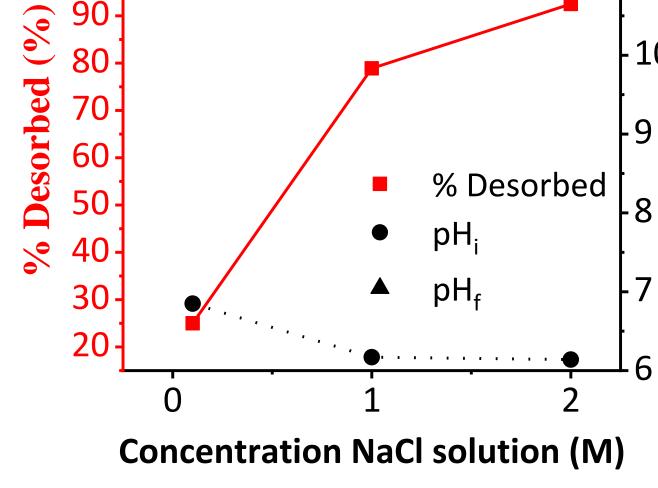


RESULTS and DISCUSSIONS









Adsorption

Best adsorbent: S80/20c

Desorption

ADS 1

DES 1

ADS 2

DES 2

ADS 3

DES 3

ADS 4

DES 4

ADS 5

DES 5

- Granulates of 1-2 mm, dried prior to test
- pH => better desorption due to competition
- Cl⁻ concentration => better desorption due to competition
- Kinetic model: pseudo-second order model

Adsorption – desorption cycles

Percentage (%) 80 100 120

Adsorption – desorption cycles

- Cycles of 24 h
- Granulates of 1-2 mm
 - Excellent stability

CONCLUSIONS

- Within the project, the composition of the structured clay-based composite sorbents was adapted to the specific conditions of the Indian test-case, considering the chromium speciation (Cr³⁺ and/or Cr⁶⁺).
- Sorption performance with regard of capacity, kinetics, selectivity and desorption procedure were optimized.

Outlook

- Testing environmental samples
- Column-mode experiments

ACKNOWLEDGEMENTS

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References:

Robson, Dakiky, M.; Khamis, M.; Manassra, A.; Mer'eb, M. Selective adsorption of chromium(VI) in industrial wastewater using low-cost abundantly available adsorbents. Adv. Environ. Res. 2002, 6, 533-544.

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