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TEXAS A&M

Uptake of Fluoride from Solution by Layered Double Hydroxides (LDHs)

The FLOWERED project (de-FLuoridation technologies for imprOving quality of WatEr and ard agRo-animal products along the East African Rift Valley in the context of aDaptation to climate change) aims to contribute to the development of a sustainable water management system in areas affected by fluoride (F) contamination in water, soils and food in the African Rift Valley countries (Ethiopia, Kenya, Tanzania), and improve the standards of living of its population, especially in rural areas.

1 Introduction

The usual consumption of drinking water with fluoride concentration over the limit of 1.5 mg/L, set by the World Health Organization (WHO 2011), causes dental and skeletal fluorosis and seriously affects the rural areas of the East African Rift Valley.

One of the main goals of the Horizon2020 FLOWERED project is to develop a low-cost method for the fluoride removal from natural waters of the East African Rift Valley addressed for drinking use.

Among the technologies for water purification, adsorption is a simple and effective method. Layered Double Hydroxides (LDHs) are minerals that can be potentially used for low cost water treatment by sorption processes.



4 Summary

The calcined LDHs remove effectively the fluoride from solution (up to IV cycles maintaining the 80% of removal capacity; however, the coexistence of other anions in solution, especially the carbonate, at the high pH value reached during the rehydration of LDHs can significantly decrease the LDHs fluoride removal capacity from natural waters.

ACKNOWLEDGMENTS

This research is part of the Flowered project (a Horizon 2020 European funded project: Grant Agreement - N. 690378) (www.floweredproject.org)

The International Conference on Water, Environment, Energy and Society ICWEES'2018 08-11th May 2018, Djerba Island, Tunisia

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The FLOWERED Project







LDHs have general stoichiometry: $M^{2+}_{1-x}M^{3+}_{x}(OH)_{2}(A^{n-})_{x/n} \cdot mH_{2}O$

water (Cavani et al. 1991).

KEY REFERENCES

WHO (2011). Guidelines for drinking-water quality, fourth edition. Geneva, Swiss, World Health Organization, 531 pp. Cavani et al. (1991). Hydrotalcite-type anionic clays: preparation, properties and applications. Catalysis Today 11(2), 173-301.

The LDHs structure consists of octahedral brucite-like layers, positively charged due to the partial substitution of bivalent metals ($M^{2+} = Mg^{2+}$, Zn^{2+} , etc...) with trivalent ones ($M^{3+} = Al^{3+}$, Fe^{3+} , etc...), alternating with negative interlayers containing anions ($A^{n-} = CO_3^{2-}$, F^- , CI^-) and variable quantity of