COMPARISON OF EROSION BEHAVIOUR OF DIFFERENT CLAYS

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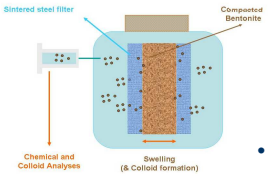
INTRODUCTION

- More than 15 different natural clays, mainly bentonites from different sources, were studied to analyse their erosion behaviour.
- Complete geochemical and mineralogical characterisation was carried out [1], to assess the relevance of the inherent physico-chemical, structural properties and charge distribution of clay minerals on their erosion behaviour.

METHODOLOGY



- Closed and confined system.
- Clay compacted at 1.65 g/cm³ and deionised water (DW): most favourable conditions for erosion.
- Particle release through 2 filters (100 µm pore size).
- The electrolyte was analysed, as a function of time, to measure the concentration of eroded particles mobilized to the liquid phase. The system is closed and initial water (200 mL) evolves until equilibrium.

MATERIALS [1]

Smectite group clays

Na- smectites

- Wyoming MX-80 (USA).
- MSU (Khakassia, Russia).
- B75 Na-activated (Czech R.).
- Sabenil S65 (Czech R.).
- YC-D40 Doel (Belgium).
- YC-K38 Kallo (Belgium).

Ca-Mg smectite

- FEBEX bentonite (Spain).
- IBECO from Mylos (Greece).

Ca- smectite

- SAz-1 (CMS, USA).

Nontronite-Fe

- Nau-1 (South Australia).

Beidellite

- SBId-1 (USA).

Saponites

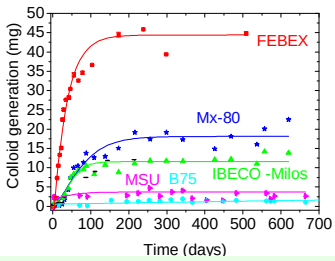
- MCA (Spain).
- B64 (Germany).

Clay

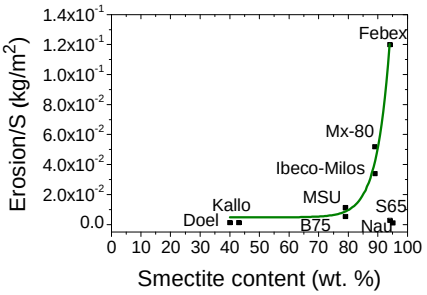
- **Illite** du Puy (France).
- **Kaolinite** KGa-1-b (USA).

EROSION RESULTS & CONCLUSIONS

Eroded mass as function of time. (Only clays showing appreciable erosion were included)



Eroded masses vs. smectite content.



EROSION

- All clays showing appreciable erosion are within smectite group, and Na or Ca-Mg montmorillonites.
- Erosion behaviour is not only related to the main exchangeable cation.
- Erosion mainly related to the clay smectite content (higher in FEBEX case), rather than only to the exchangeable Na (higher in MX-80, MSU, B75 or S65 clays).

EXCEPTION

S65: Na- clay with high smectite content but **no erosion:** **Charge mainly tetrahedral sheet.**

LIMITED EROSION

- Ca and Fe smectites: no erosion.
- Beidellite, Fe-nontronite and saponites have high smectite content, but did not showed appreciable erosion
- The presence of certain minerals and oxides affects colloid stability [2] and erosion.
- Equilibrium chemical conditions affect erosion.
- Clays with surface charge mainly located in the tetrahedral sheet (>50%) are not easily eroded.
- Illite & kaolinite showed no erosion

Maximum eroded masses, mobilized to the liquid phase, from clay minerals at 1.65 g/cm³, Initial water D.W

Clay	Type	Colloid/S (Kg/m²)	Mean particle Size (nm)	Final pH	Final Cond (µS/cm)
FEBEX	Ca-Mg montmorillionite	$(1.2 \pm 0.5)\cdot10^{-1}$	340 ± 24	7.9	190
Mx-80	Na- montmorillionite	$(5.2 \pm 0.5)\cdot10^{-2}$	290 ± 30	8.9	370
Ibeco	Ca-Mg montmorillionite	$(3.4 \pm 0.5)\cdot10^{-2}$	370 ± 50	9.3	290
MSU	Na- montmorillionite	$(1.13 \pm 0.2)\cdot10^{-2}$	330 ± 140	9.9	685
B75	Na- montmorillionite	$(5.4 \pm 0.5)\cdot10^{-3}$	> 1 µm	9.3	395
Sabenil S65	Na-montmorillionite	$(2.9 \pm 0.5)\cdot10^{-3}$	≅ 1 µm	9.6	270
Kallo-38	Na- montmorillionite	$(1.5\pm 0.5)\cdot10^{-3}$	600 ± 200	7.6	250
Doel-40	Na- montmorillionite	$(1.4 \pm 0.5)\cdot10^{-3}$	400 ± 50	8.8	260
Nau-1	Fe- nontronite	$(1.13 \pm 0.5)\cdot10^{-3}$	> 1 µm	6.4	200
Saz-1	Ca-montmorillionite	$< 8\ 10^{-4}$	n/a	7.6	250
SB-Id	Beidellite	$< 8\ 10^{-4}$	n/a	7.3	125
MCA	Saponite	$< 8\ 10^{-4}$	n/a	7.8	80
B64	Saponite	$< 8\ 10^{-4}$	n/a	7.6	90
Illi Du Puy	Illite	$< 8\ 10^{-4}$	n/a	8.8	70
KGa-1b	Kaolinite	$< 8\ 10^{-4}$	n/a	6.7	85

[1] Fernández, A.M., Alonso, U, and Missana, T. *This poster session.*
[2] Mayordomo, N., Alonso, U., Missana, T., Benedicto, A. Mat. Res. Symp. Proc., pp. 131-138 (2014).

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