A case study of lime`s behavior during slaking with different set of natural water: implications for industrial water treatment technologies for light brackish waters

G. Leontakianakos[a], I. Baziotis[b,c], V.N. Stathopoulos[d], S. Tsimas[a]

[a] *School of Chemical Engineering, Laboratory of Inorganic and Analytical Chemistry, National Technical University of Athens, Heroon Polytechniou 9 Street, 15773, Zografou, Athens, Greece*

[b] *Department of Mineralogy, Petrology and Economic Geology, Aristotle University of Thessaloniki, 54124, Thessaloniki, Greece*

[c] *Department of Earth Sciences, University of Perugia, 06100, Perugia, Italy*

[d] *School of Technological Applications, Technological Educational Institute of Sterea Ellada, 34400, Psahna, Greece*

Two samples were collected from different quarries from Greece; one sample is characterized as calcitic limestone and the other as dolomitic limestone. The samples were calcined at 1050 ^{0}C. We investigated the effective role of the water anions on the reactivity and slaking rate on the basis of laboratory-produced quicklime. The ultimate scope of the present work is to place constraints on the brackish-water treatment processes as potential guidelines, marking the cost-benefits of pointless investments.

In our slaking products [1], we used 4 different types of water. Composition was tuned using mixtures of well water (natural water) and distilled water;

1) W1 (conductivity 572 μS/cm) a mixture of distilled and well water with Cl^-=55 mg/l, HCO_3^-=203 mg/l, SO_4^{2-}=12 mg/l and NO_3^-=10 mg/l,

2) W2 (conductivity 31 μS/cm) distilled water with Cl^-=7.5 mg/l, HCO_3^-=5 mg/l, SO_4^{2-}=<1 mg/l and NO_3^-=<5 mg/l,

3) W3 (conductivity 792 μS/cm) well water with Cl^-=62.5 mg/l, HCO_3^-=409 mg/l, SO_4^{2-}=20 mg/l and NO_3^-=30 mg/land

4) W4 (conductivity 274 μS/cm) mixture of distilled and well water with Cl^-=25.7 mg/l, HCO_3^-=102 mg/l, SO_4^{2-}=8 mg/l and NO_3^-=5 mg/l.

The anions, at low concentrations remain relative constant with changes of reactivity values without affecting the quicklime slaking. At higher anion contents a chromatographic effect is observed for both chlorides and sulfates. The chlorides react with the slaking water producing very soluble ($CaCl_2$) products relative to the $Ca(OH)_2$, thus facilitating the transformation of quicklime (CaO) to slaked lime [$Ca(OH)_2$]. We observe no kind of statistical trend for sulfates for the compositional spectra of our natural waters, suggesting their meaningless effect during the hydration of the quicklime. Consequently, for the used range of natural waters and their mixtures, only the chloride concentrations influence positively the quicklime hydration. We conclude that for natural, light-brackish water compositions, the application of any water treatment method is not necessary for the improvement of the quality of lime-industry products.

References

[1] G. Leontakianakos, I. Baziotis, A. Papandreou, D. Kanellopoulou, V.N. Stathopoulos, S. Tsimas, Materials and Structures, 48 (2014) 3735-3753