Preparation of Al/Fe-PILC clay catalyst from concentrated precursors: process intensification towards scaling-up

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Introduction

The Catalytic Wet Peroxide Oxidation (CWPO) is one of the Advanced oxidation processes (AOPs) useful to deplete low concentrated, hazardous compounds in water effluents. CWPO is based on the continuous generation of hydroxyl radicals (HO•) carried out by immobilized cations of transition metals like Fe in presence of peroxyde. Structural modification of bentonites by pillaring with Al/Fe mixed oxides at nanometric scale leads to highly porous materials with the corresponding higher exposure of the catalytic active sites; although it has provided excellent catalytic response in the CWPO degradation of organic pollutants in wastewaters, it might also display interesting potential polishing surface waters for production of drinking water. However, in order to make it possible at a real scale, the scaling-up of the catalyst’s preparation from both (i) high-concentrated dissolved metals and (ii) clay precursors, is mandatory. Thus, this research was devoted at first to compare the preparation of highly concentrated Al/Fe solutions by two methodologies against the very widely reported diluted one. The best performing concentrated solution was then used to study in a second step, three procedures for the mineral swelling yielding the pillared clays at 50 g scale. Whereas, the effect of previous refining (C2-R) of the natural clay mineral (C2-N) was determined. Every prepared material was characterized by standard physicochemical methodologies and assessed for their catalytic properties in the CWPO reaction of phenol (PhO) degradation.

Experimental Materials & Methods

Preparation of highly-concentrated Al/Fe interlayering solution

Methods of clay-interlayering

Catalytic properties in the CWPO degradation of phenol

Results

Table 1. Physicochemical properties of highly-concentrated Al/Fe interlayering solutions

Table 2. Physicochemical characteristics of pillared clays from either C2-N or C2-R obtained by three methods of clay-interlayering (a) wt, (b) wt, (c) instead of concentrated solution.

Conclusions

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References

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