

# DEGRADATION OF AMOXICILLIN THROUGH THE FENTON AND PHOTO-FENTON PROCESSES USING Fe-PCH OBTAINED FROM A RAW CLAY

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## INTRODUCTION

**Amoxicillin**, a semisynthetic antibiotic widely used, is often excreted from the body without being completely metabolized so it can be found in waterbodies. This can lead to imbalances in the aquatic ecosystem and contribute to bacterial resistance. Wastewater treatment plants are not capable of removing micropollutants such as amoxicillin. However, **heterogeneous Fenton and photo-Fenton processes** constitute a promising **alternative for the degradation of amoxicillin**. **Porous clay heterostructures (PCHs)** are solids with **high specific surface area and combined microporous and mesoporous structure**. These materials are obtained by the **modification of a cationic layered silicate with a surfactant and a silica precursor**, followed by heat treatment to remove the surfactant. The aim of this work was to **prepare iron-modified PCH (Fe-PCH) from a raw Uruguayan montmorillonite (Mt)** and evaluate its catalytic activity in the degradation of amoxicillin by Fenton and photo-Fenton processes.

## EXPERIMENTAL

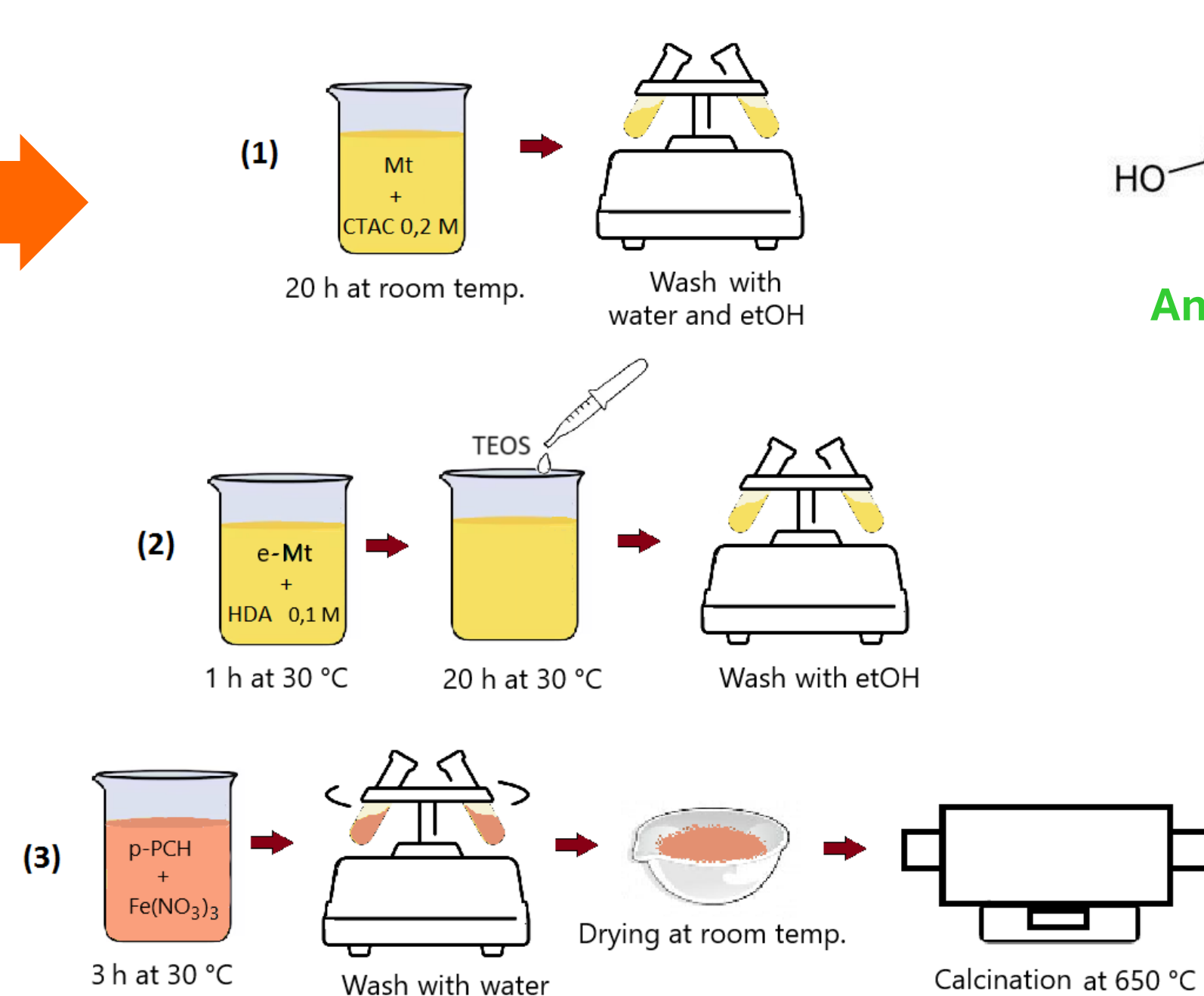
### Clay (Raw montmorillonite)



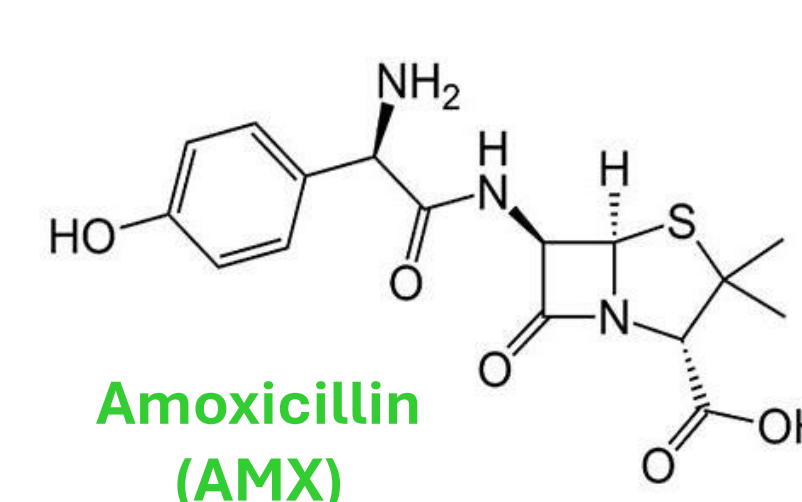
### Pretreated clay



### Fe-PCH SYNTHESIS



### CATALYTIC TEST

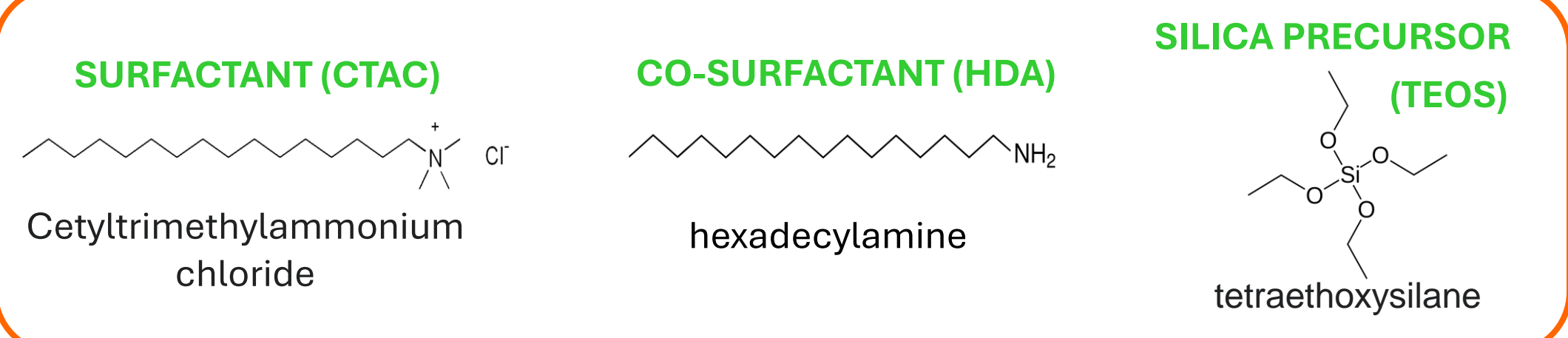


### Photoreactor

Batch cylindrical photo-reactor made of borosilicate glass and surrounded by visible LEDs (6500 K, 72 W) was used.

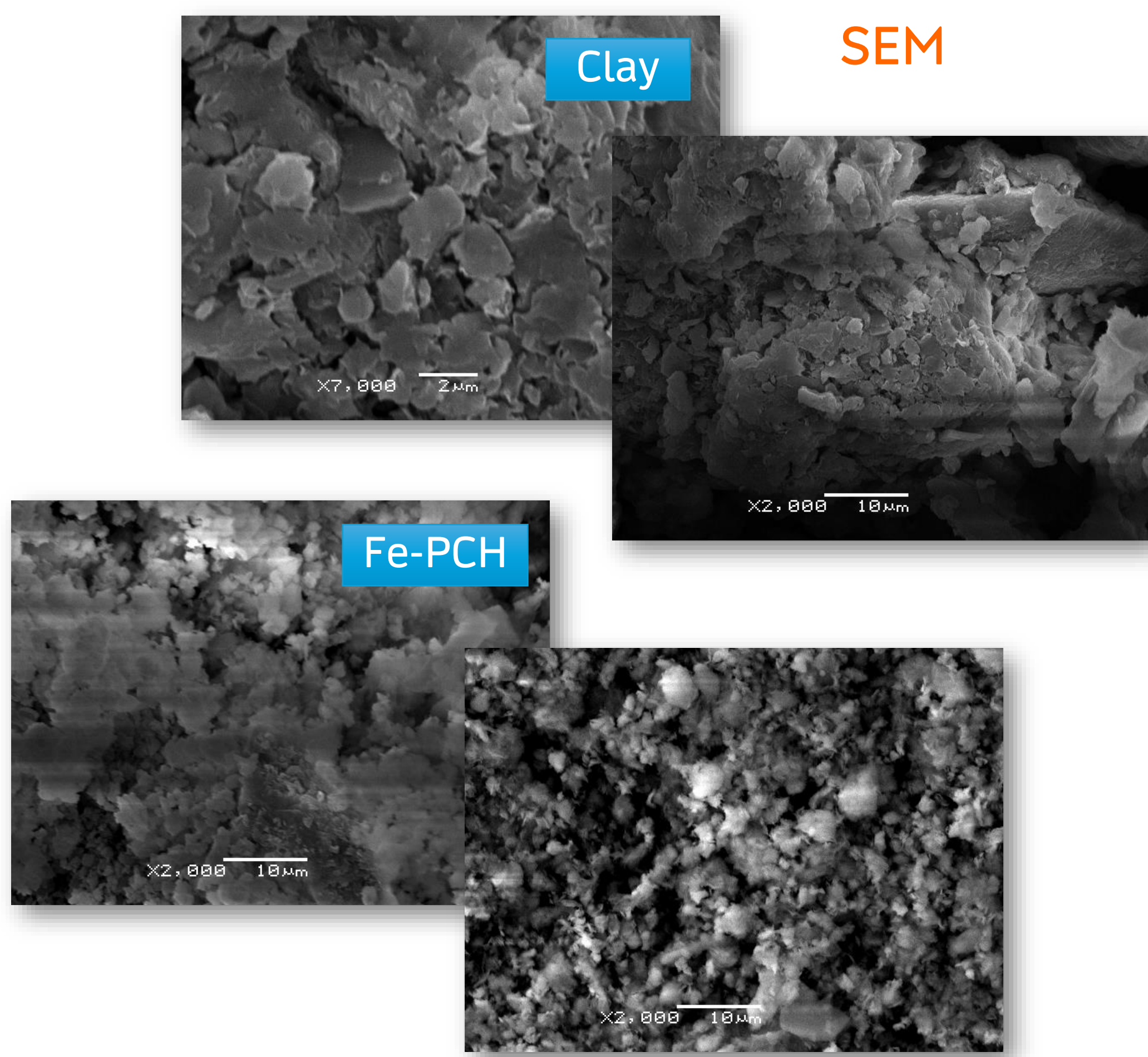
### Experimental conditions

Test	[AMX] (mg/L)	Catalyst (g/L)	[H <sub>2</sub> O <sub>2</sub> ] (mM)	LEDs
Fenton	50	1	10	-
Photo-Fenton	50	1	10	✓
Photolysis	50	-	-	✓
Adsorption	50	1	-	-

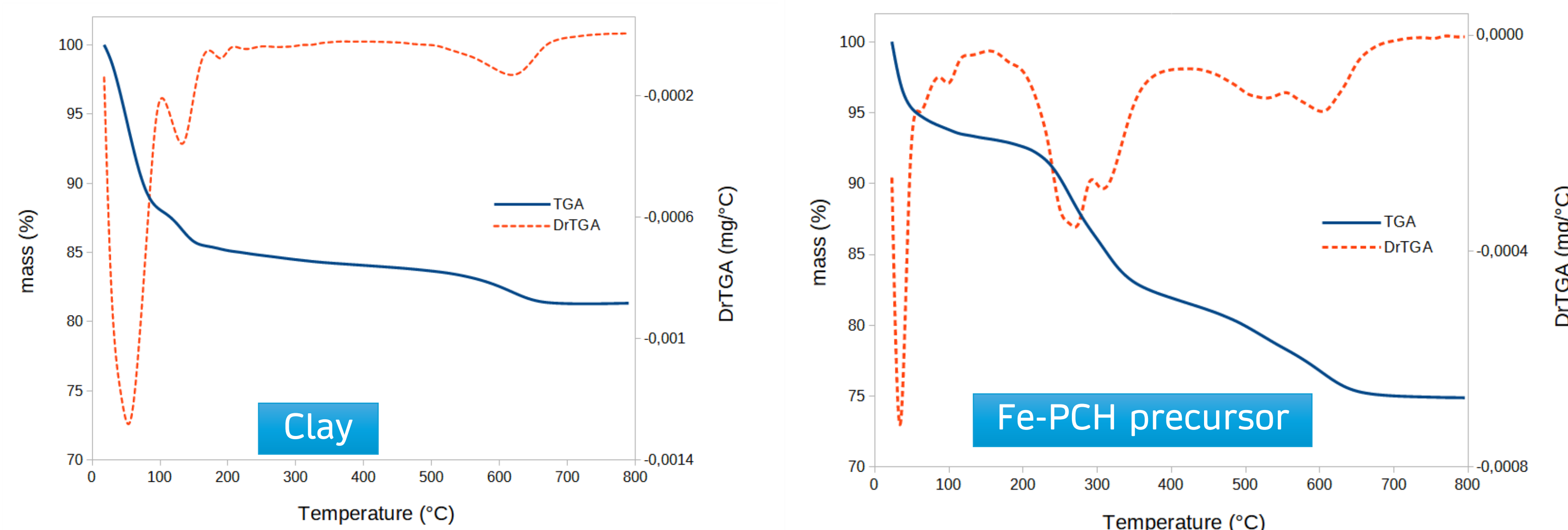


## RESULTS

### SEM



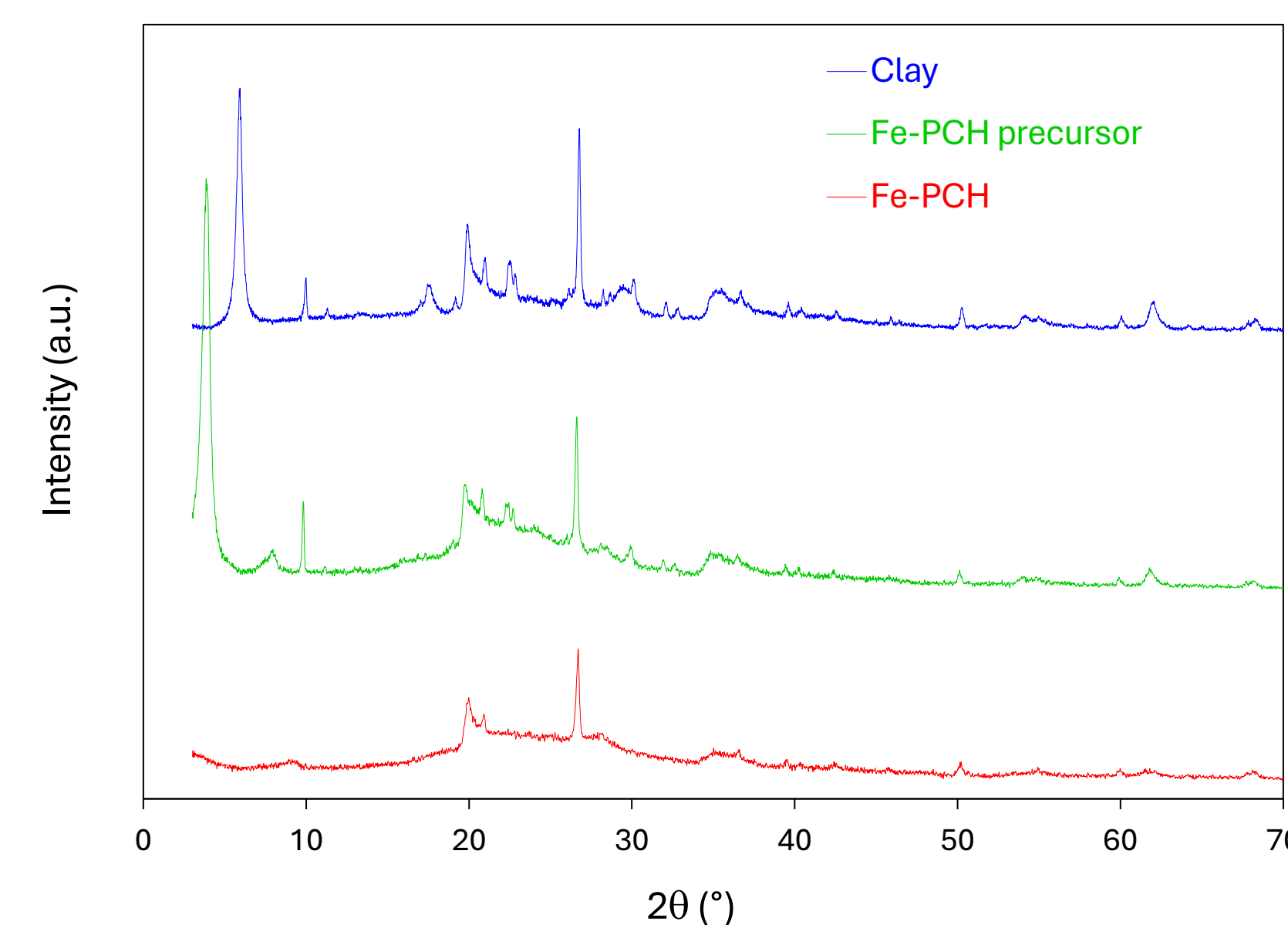
### Termogravimetric Analysis



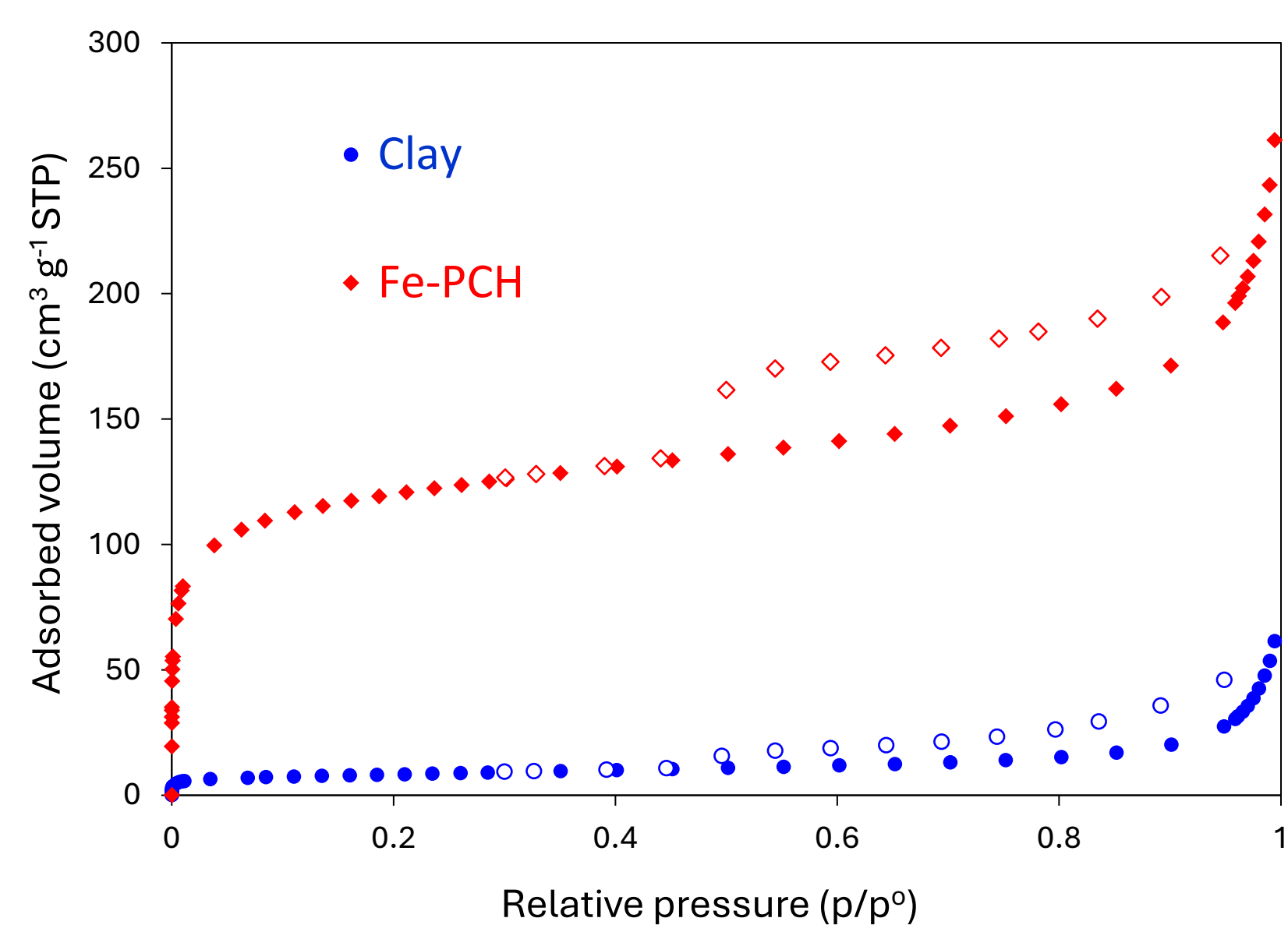
### FRX

ELEMENT	SOLID	
	Clay	Fe-PCH
Al	8.34	5.19
Si	28.5	36.2
Ca	1.69	0.19
Fe	1.06	1.55
Si/Al	3.42	6.97

### DRX

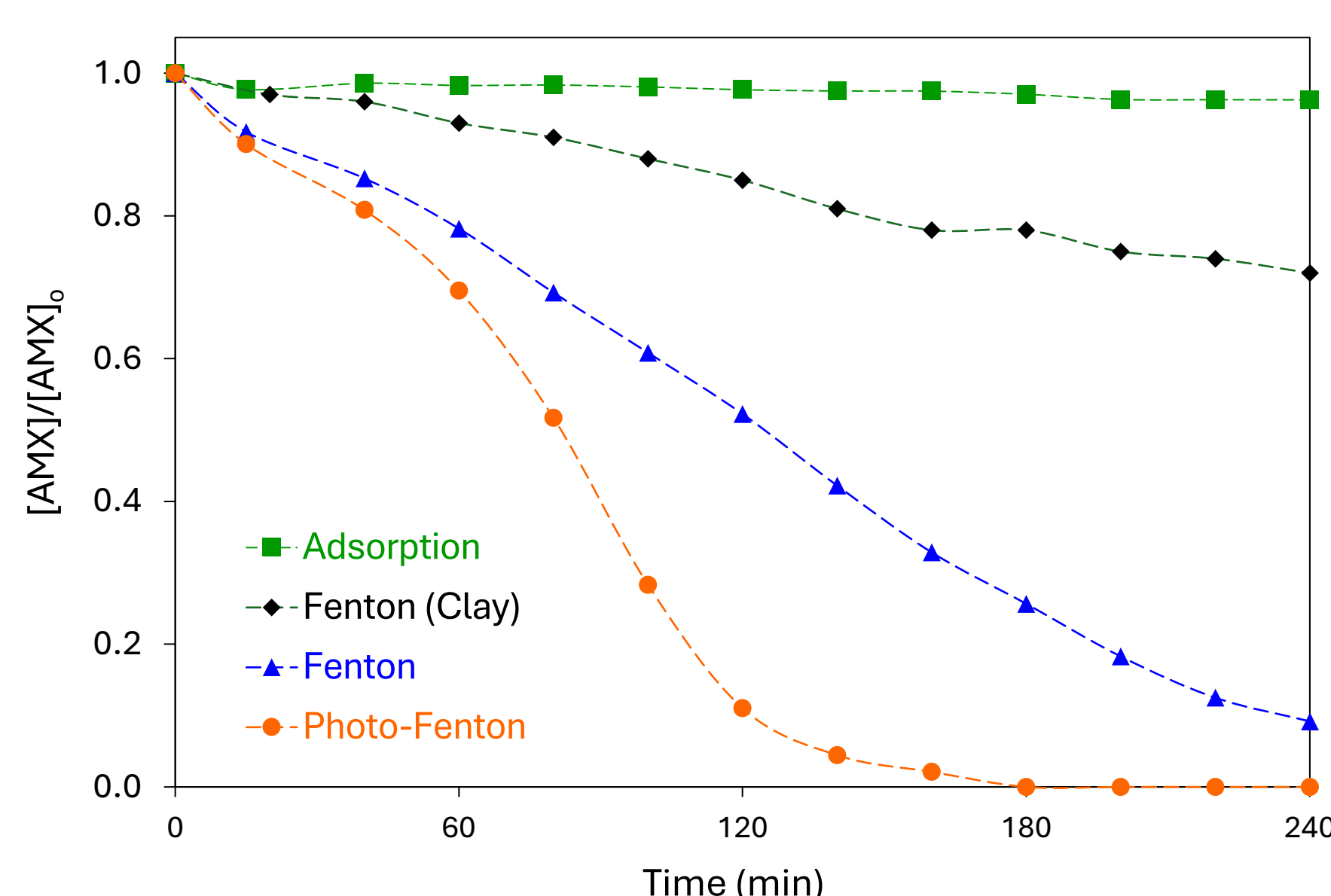


### N<sub>2</sub> adsorption-desorption isotherms



SOLID	S <sub>BET</sub> (m <sup>2</sup> /g)	V <sub>p</sub> (cm <sup>3</sup> /g)	V <sub>μp</sub> (cm <sup>3</sup> /g)	V <sub>mp</sub> (cm <sup>3</sup> /g)
Clay	28	0.043	0.012	0.031
Fe-PCH	386	0.294	0.176	0.118

### Catalytic test



Fe-PCH shows catalytic activity under Fenton conditions, achieving a removal of 91% at the end of the test.

In the photo-Fenton test the degradation of AMX is higher, achieving its total removal in 180 min. The removal of TOC is lower (33%).

The stability of the catalyst could be verified, since at the end of the Fenton and photo-Fenton tests the concentration of iron in solution was less than 1 mg/L.

## CONCLUSIONS

The modification of the raw clay allowed to obtain a nanoporous material (Fe-PCH) with a high specific surface area and pores volume, in whose structure it was possible to incorporate iron. Fe-PCH probe to be active as catalyst in the degradation of amoxicillin using the Fenton and photo-Fenton process, thus constituting a very promising material.

## ACKNOWLEDGMENTS