

COAL FLY ASHES FOR WASTEWATER TREATMENT

Ana Cláudia Santos^{1*}, Iwona Kuźniarska-Biernacka², Alexandra Guedes¹, Andreia F. Peixoto², Bruno Valentim¹

¹ Instituto de Ciências da Terra (ICT) – Pólo Porto, Departamento de Geociências, Ambiente e Ordenamento do Território, FCUP, Universidade do Porto rua do Campo Alegre s/n, 4169– 007 Porto, Portugal

² REQUIMTE/LAQV, Departamento de Química e Bioquímica, FCUP, Universidade do Porto, Rua do Campo Alegre s/n, 4169-007 Porto, Portugal

*anasantos@fc.up.pt

INTRODUCTION

COAL FLY ASH (CFA)

750 Million tons produced per year

Approx. 75% is landfilled

High potential to be used as heterogenous catalysts

Due to thermal stability and metallic oxide contents (e.g., Fe₂O₃)

Main goal:

Characterization of the material and further application.

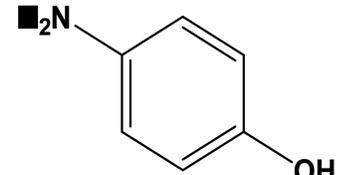
1. 4-NPh is a toxic compound commonly found in wastewaters

4-Nitrophenol (4NPh)

2. Promising method for its removal/conversion:

CATALYTIC REDUCTION

4-Aminophenol is the only product of the reaction and has several applications (e.g., pharmaceuticals)



METHODOLOGY

BENEFICIATION PROCESS



FLY ASH
PEGO thermoelectric power plant (Portugal)



SIEVING
Cut-off at 75µm

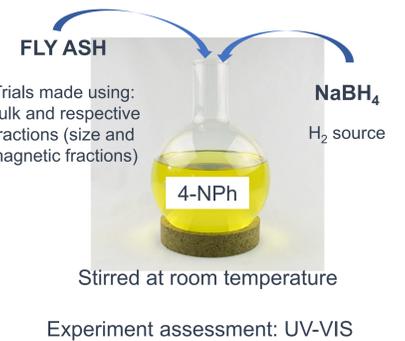


MAGNETIC SEPARATION
Ferrite magnet

CHARACTERIZATION

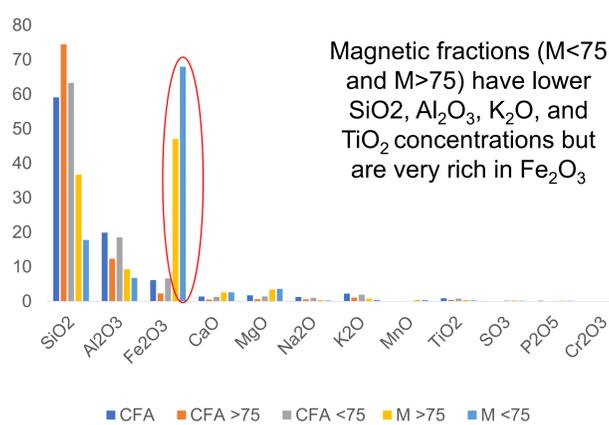
- X-ray fluorescence (major and minor oxides);
- Elemental analysis (total carbon and sulphur);
- Scanning Electron Microscopy with Energy Dispersive Spectroscopy (SEM/EDS, imaging and semiquantitative chemical analysis);
- Raman microspectroscopy (Fe-bearing phases identification);

4-NPH REDUCTION REACTION



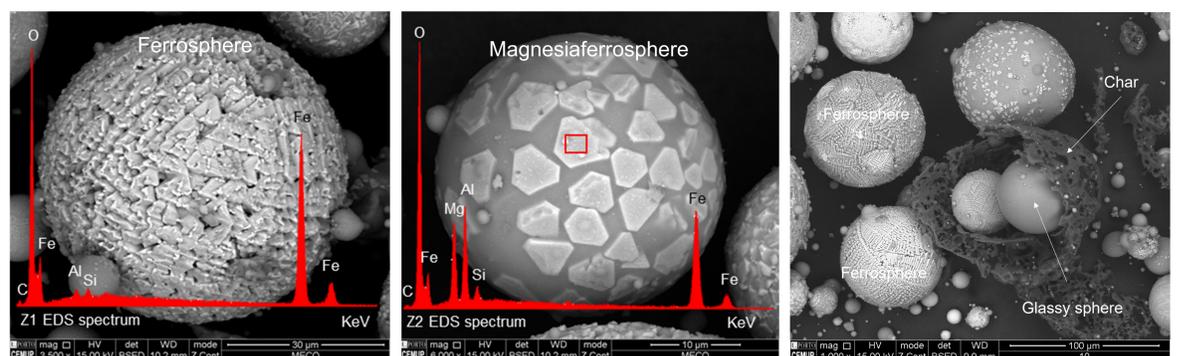
RESULTS

MAJOR AND MINOR OXIDES



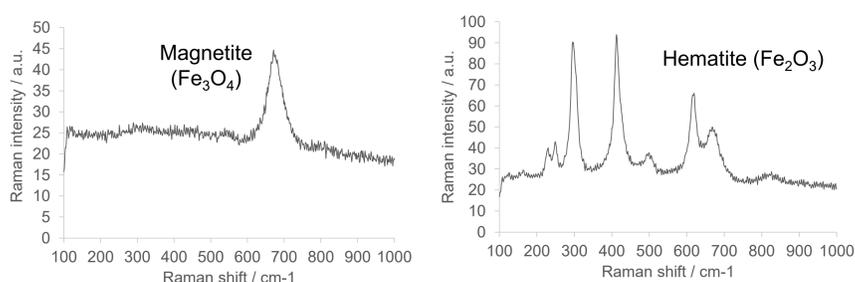
SEM/EDS

Magnetic fractions are distinguishable from bulk CFA and size-fractions by the abundance on Fe-bearing morphotypes such as ferrospheres and magnesiaferrospheres. Nevertheless, those fractions are far from being pure and some aluminosilicate glass and char (carbonaceous solid residue) are still observed.

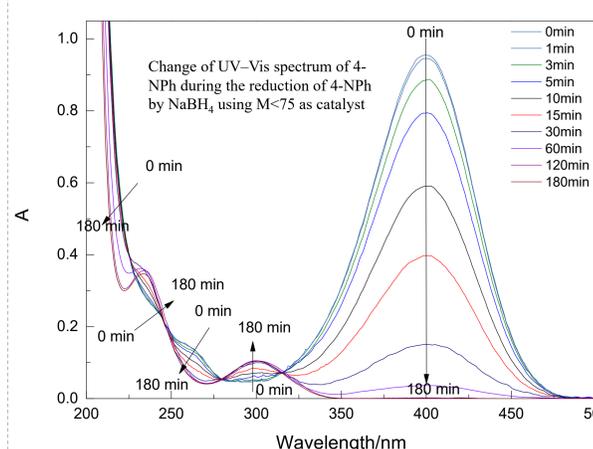


RAMAN

The obtained Raman spectra confirmed the presence of magnetite and hematite. This last occur as an alteration from magnetite (martite).



APPLICATION ON REDUCTION REACTION OF 4-NPH



All materials can effectively catalyzed reduction of 4-NPh reduction reaction in the presence on NaBH₄ and could be reused up to 5 cycles without activity lost. MF are more active than bulk CFA and the respective fractions indicating that Fe-bearing phases should be acting as active sites.