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NON-FOSSIL FUELS IN ENERGY GENERATION

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EXTENDED ABSTRACT

The co-combustion of coal with high calorific waste materials, rubber from discarded tyres, has been carried out to take advantage of both rubber calorific value and a waste material elimination.
Rubber, major component of tyre, has a high calorific value and lower heteroatom and ash contents than coal, very good qualities for a fuel. However, around one third of rubber from tyre is carbon black and approximately 3 % is ZnO added to rubber to control the vulcanization process.
Because of this, a previous study in order to know firstly the Zn distribution between volatile and ash and secondly the impact due the particulate matter (PM) should be performed in order to assess its environmental impact.
Coal applied in this research comes from a mine located in Puertollano (Ciudad Real, Spain). This subbituminous coal has been previously investigated by the authors. Besides its main trace elements and their distribution in the combustion products has been studied. In some coals the presence of metals could cause a serious environmental problem, in emissions by the atmospheric pollution of trace elements and in the ashes, because when they are deposited leaching process of some elements could be produced, originating water and soil pollution.
Coal and rubber from tyre blends have been co-burned in a fluidised bed laboratory scale pilot plant and the combustion of this blend has been optimised in order to decrease the gas emissions that cause the greenhouse effect.
Particulate matter and several trace elements besides Zn behaviour have been followed by analysing their presence in emissions, as trace elements, and/or in the generated ash.
Trace elements characterization has been carried out by atomic absorption (AA), the mineral phases with X-Ray Diffraction (XDR) and the carbon residues by Fourier Transformed Infrared Spectroscopy (FTIR). The Zn content of smaller particulate matter (PM) trapped on filters has been analysed by inductive coupled plasma (ICP).
The Zn is enriched in fly ashes in comparison to bottom ashes and it could be recovered appropriately by leaching with 10 % w/w H_2SO_4. The leaching temperature is the parameter with highest influence in Zn extraction.
The best results in Zn recovery have been obtained when the proportion of tyre in the blend coal-tyre is higher because therefore the Zn content in the combustion products is higher. The relative presence of other metals as Fe, Ca, Mg, and K in the leached is lower when the proportion of tyre is higher.
Practically, all the Zn is emitted and recovered on the higher sized particulate matter.

Key words: Coal, tyre, combustion products, fluidezed bed combustion, leaching, Zn recovery.