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Quality of Ashes Produced in the Co-Combustion of Coal and MBM in a Fluidized Bed Reactor

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Abstract. Since the 90's decade there are severe restrictions to the use of MBM, due to BSE. The co-combustion of Meat and Bone Meal (MBM) and coal is a possible energetic valorization route for MBM. However, the chemical and ecotoxicological properties of the ashes produced in this co-combustion process need to be more characterized. In order to evaluate the chemical and ecotoxicological properties of this type of ashes, three combustion tests were performed in a fluidized bed reactor (FBR): 1) combustion of coal; 2) co-combustion of coal and MBM; 3) combustion of MBM. The characterization of the ashes was focused on the following aspects: (1) the bulk content of metals; and (2) the chemical and ecotoxicological characterization of eluates. The ashes were classified according to their ecotoxicity levels based on the French regulation CEMWE. According to Council Decision (CD) 2003/33/EC, all fly ashes need stabilization prior to landfilling, except the 1st cyclone ash produced in the co-combustion test that could be landfilled in a hazardous waste landfill. The bottom ashes were classified as non-hazardous residues. The novelty of this paper is related with two aspects: 1) the use of MBM as co-fuel; and 2) both chemical and ecotoxicological characterization of the ashes produced during the combustion of coal and MBM.

Key words

Combustion, coal, meat and bone meal, ecotoxicity

1. Introduction

The replacement of fossil fuels by renewable sources of energy can contribute to improve the environmental performance of the power production and to move forward in the sustainability way [1]. The experience has shown that the availability of alternative fuels can be a serious obstacle for its extensive use for energy production. The use of non-hazardous wastes may be an alternative to biomass, if they are economically unattractive for recycling or if they have a high cost for land filling [2]. Co-firing non-hazardous wastes with coal is, therefore, a subject of great interest for the sustainability of energy production and the reduction of the emissions of fossil greenhouse gases [3]. The use of these wastes for energy is promising if they combine well with other fuels during the conversion process for energy and don't have negative effect on the combustion system, on the ash quality and on the gaseous emissions [4]. The utilization of MBM as animal feedstock was forbidden in 1994, by the European Union, since it was in the origin of the spreading of Bovine Spongiform Encephalopathy (BSE) which can promote the equivalent human disease (Creutzfeldt-Jakob disease). One possible way for the valorization of MBM is its incineration ([5], [6]).

2. Materials and Methods

2.1. FBC, fuels and combustion conditions

The combustion and co-combustion tests were performed in a bubbling FBR of LNEG/UEZ. Further details of this FBR are shown in Gulyurtlu and Monteiro (1991) [7] and Lapa et al. [8]. Three combustion tests were performed: 1) combustion of coal; 2) co-combustion of coal and MBM (85% Coal+15% MBM); 3) combustion of MBM. Each combustion test produced three types of ashes: bottom ashes and two cyclone ashes (1st cyclone and 2nd cyclone ashes). The bottom ashes were collected at the bottom of the FBR and the fly ashes were collected by two containers located at the bottom of each cyclone. The bed material used was cleaned river sand. The fossil fuel used was a bituminous coal from the Colombian mine of El Cerrejón. MBM was produced in slaughter houses of Germany.

2.2. Bulk characterization of fuels and ashes