INVESTIGATION OF POTENTIALLY TOXIC TRACE ELEMENTS IN COALS AND THEIR BEHAVIOUR DURING COAL COMBUSTION

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The increasing interest to mineral matter and trace elements in coal arises mainly from modern operating processes (production of electric power and conversion to other fuels) and from the concern about environmental quality. The pressing need to produce more electric power by fossil-fuelled power plants implies a bigger coal comsumption and consequently increased mobilization of potentially toxic trace element (PTTE) with contamination that is hazardous for man and the environment. Considerable amounts of PTTE are transferred to the surrounding if we take into account that a 1000 MW power station has a normal consumption of 12000 tons of subbituminous coal per day.

The coals under investigation are from the Teruel Mining District (NE Spain). These coal deposits are currently worked to produce electric power by means of three coal fired power stations (1050 *MW*, 175 *MW* and 143 *MW* with mean annual consumptions of $5 \cdot 10^6$, $0.9 \cdot 10^6$ and $0.8 \cdot 10^6$ tons of coal).

The aim of the present work is to study the occurrence and distribution of the PTTE (As, B, Ba, Be, Cd, Co, Cr, Cu, Ge, Hg, Li, Mn, Mo, Ni, Pb, Se, Sr, Th, U, V and Zr) and their behaviour during combustion. The partial objectives of the project proposed are:

1. Determination of the PTTE contents and affinities in coal.

2. Determination of volatilization temperatures of the PTTE during coal combustion by the mobilization tests in laboratory boilers (conventional and fluidized bed boilers).

3. Elaboration of a model of PTTE mass balance during coal combustion (the emission volume and pathways of PTTE emissions to atmosphere).

4. Determination of PTTE mobilities in the combustion wastes.

The most powerfull tools for this investigation are instrumental neutron activation analysis (INNA) and X-ray fluorescent analysis (XRFA) both permitting to analyse element contents in any materials (coal, ash, liquid fuels etc.).

At the beginning analytical part of the investigation the optimal parameters for the INAA technique (sample detector weight, irradiation and cooling times, number of measurements and detector type) have been experimentally chosen.

The first run of the INAA has shown the good sensitivities for the elements under investigation (see table).

Table

Sensitivities (in ppm or percent if written) of INAA to some different elements for the samples of coals from Teruel Mining District

Na	K	Ca	Sc	Cr	Fe	Co	Zn	As	Se	Br	Rb	Sr
80	400	2000	0.3	2	600	0.5	20	2	1	0.2	5	100

Mo	Ag	Cd	Sb	Cs	Ba	La	Ce	Nd	Sm	Eu	Gd	Tb
2	2	1	0.005	0.2	20	0.5	2	3	0.2	0.5	10	0.1

Dy	Ho	Yb	Lu	Hf	Ta	W	Re	Ir	Au	Th	U
0.2	0.1	0.01	0.05	0.1	0.1	0.3	0.03	0.005	0.02	2	0.2