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CHEMISTRY AND MORPHOLOGY OF FLY ASH SAMPLES FROM THE MAIN LIGNITE POWER STATIONS OF NORTHERN GREECE

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EXTENDED ABSTRACT

More than 73% of the electrical power requirements of Greece are generated in coal-fired power plants that consume approximately 65 million tons of lignite per year and produce near 13 million tons of fly ash. Most of these fly ashes are landfilled in the mine sites or disposed in specific mounds. The main coal mining area in Northern Greece is the Lignite Center of Western Macedonia. The lignites exploited in opencast mines are used to generate electricity in the Power Stations of Liptol (43 MW), Amynteo-Filotas (600 MW), Ptolemais (620 MW), Kardia (1200 MW) and Agios Dimitrios (1585 MW), while a new Power Station (330 MW) is under construction near the city of Florina. The exploitation and the combustion of low quality fossil fuel (lignite) in these Power Stations is a source of environmental pollution in North-western Greece. The kilometric scale coal opencast mines introduce severe changes in the regional landscape, drainage system, and infrastructures due to the mobilisation of large volumes of materials. Besides, the large coal consumption in the Thermal Power Stations generates large volumes of solid wastes (fly ash mainly, but also bottom ash and slags) and air emissions. These wastes can introduce severe changes in the water, soil and air quality. The Power Stations are equipped with particulate control systems such as electrostatic precipitators (ESP's), designed to confront the fly ash emissions. ESP's are huge devices that can electrically charge the solid particles of the fly ash and remove them from the flue gas stream. The ability of the particles to be charged depends on the physical characteristics of the fly ash (particle size and temperature) and its chemical composition (moisture, sulfur and calcium contents etc). The second group (chemical characteristics) is more flexible in interventions for the improvement of the ESP's efficiency and, of course, has a very pronounced environmental importance. In the present study fly ash samples from Agios Dimitrios, Kardia, Ptolemais and Amynteo-Filotas Power Stations are studied for their chemical and morphological features. The concentrations of 47 trace elements (Ag, As, B, Ba, Be, Bi, Cd, Ce, Co, Cr, Cs, Cu, Dy, Er, Eu, Ga, Gd, Ge, Hf, Hg, Ho, La, Li, Mo, Nb, Nd, Ni, Pb, Pr, Rb, Sb, Sc, Se, Sm, Sn, Sr, Ta, Tb, Th, Tl, U, V, W, Y, Yb, Zn and Zr) were determined by ICP-MS in composite fly ash samples. The enrichment factors, which are the ratio of an element concentration to that of the Earth's crust, are determined for all analyzed samples. A trace element analysis was also performed on a fly ash sample (SCSF), presenting the self-combustion phenomenon, collected in the ash dumps of the Southern Field Mine, Lignite Center of Western Macedonia. Selenium presents very important enrichment factors when comparing to the Earth's crust element concentrations, while an enrichment is also presented by the elements Ag, As, B, Cd, Ge, Hg, Mo, Ni, Sb, and U. Scanning electron microscopy revealed that the fly ash samples consist of spherical, oval or irregularly shaped particles of varying size.

Key words: Environment, fly-ash, trace elements, Power Stations, Greece