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# Contents

# Recovering of metals and metal oxides through thermal decomposition process of coal bottom ash: a comprehensive kinetic analysis

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In this work, the thermal decomposition process of coal bottom ash (collected after lignite combustion in coal-fired power plant "Kostolac B" (TEKO-B), Serbia) was investigated, using simultaneous TG (thermogravimetry) – DTG (derivative thermogravimetry) techniques in an inert (Ar) atmosphere, at various heating rates (10.3, 20.9 and 32.1 K/min). In addition to thermal characterization of the sample, the chemical composition and naturally occurred radionuclides were also determined. Using the model-free (isoconversional) (by Friedman (FR), Kissinger-Akahira-Sunose (KAS), Ozawa-Flynn-Wall (OFW) and Vyazovkin (VY) methods) analysis, the complex kinetic nature of the process was successfully resolved. The conducted numerical optimization of the process (using non-linear least square optimization) had confirmed accuracy and reliability of estimated kinetic parameters. Model-based (model-fitting) kinetic analysis showed the existence of a complex reaction scheme, over two consecutive reactions steps and one single-stage reaction step, *via* mechanism order A*n*, F2, F*n*, R3, C*nm* (through *n*-dimensional nucleation/growth, chemical reactions, and *n*-th order and *m*-power with autocatalysis mechanisms). Through physicochemical interpretation of mechanism scheme, an assessment of recovery of valuable metals and metal oxides was performed, by analysing the concentration of reaction species in a function of temperature of individual steps. Likewise, the influence of certain precursor involved in decomposition process as catalyst (in order to increase the yield of targeted product) was also inspected. Finally, the simulation of actual process using the results obtained from applied methods/models was performed, through application of modulated dynamic (MD) prediction.

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