Serbian Ceramic Society Conference
ADVANCED CERAMICS AND APPLICATION X
New Frontiers in Multifunctional Material Science and Processing

Serbian Ceramic Society
Institute of Technical Sciences of SASA
Institute for Testing of Materials
Institute of Chemistry Technology and Metallurgy
Institute for Technology of Nuclear and Other Raw Mineral Materials

PROGRAM AND THE BOOK OF ABSTRACTS

Serbian Academy of Sciences and Arts, Knez Mihailova 35
Serbia, Belgrade, 26-27. September 2022.

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P6
Thermodynamic and kinetic study of nicotine adsorption on acid-modified smectite

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Kinetic and thermodynamic parameters of nicotine adsorption onto acid-activated standard Wyoming clay were investigated to obtain the optimum conditions for adsorption. The nicotine adsorptions were performed in a batch system, using 0.75 mM solution of nicotine, the mass of adsorbent of 25 mg at native pH=9.26, in temperature range from 25°C – 60 °C. The pseudo-first (PFO) and pseudo-second kinetics (PSO) models in both linear and non-linear forms were apied for experimental data in the temperature range 25 °C – 60 °C. Error analysis parameters such as correlation coefficient (R^2) and χ^2 (chi-square) have been used to determine the best kinetics interpretations of adsorption data. The analyzed parameters suggested that nicotine adsorption can be best described by tested models in the following order: non-linear PSO = linear PSO >non-linear PFO>linear PFO. The Weber-Morris intra-particle diffusion model was applied in order to predict the rate-limiting step. The calculated values for C_{id} were in the range 0.452 mmol g^{-1} to 0.484 mmol g^{-1}, indicating effective role of the boundary layer on the adsorption rate. Thermodynamic study revealed that nicotine adsorption is spontaneous ($\Delta G°$=-18.93 kJ mol^{-1}) physisorpton process with calculated value of enthalpy change of 4.99 kJ mol^{-1} and activation energy of 21.95 kJ mol^{-1}.
Acknowledgement This work was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia (Contract 451-03-68/2022-14/200026)

P7
Cobalt impregnated mixed Al, Fe-pillared montmorillonite as a catalyst for decolorization of tartrazine in the reaction with Oxone®

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Mixed Al, Fe pillared clay (AlFePILC) was synthesized from Na-exchanged Wyoming clay (Na-Wy) rich in montmorillonite. In the pillaring process Na-Wy was modified with a mixed intercalating (Al, Fe) solution with molar ratio of $Fe^{3+}/(Al^{3+}+Fe^{3+})$ = 10%. The obtained AlFePILC was impregnated with cobalt using the incipient wetness impregnation method, dried at 110 ºC and calcined at 450 ºC (Co-AlFePILC). Co-AlFePILC was tested as a catalyst in catalytic oxidation of tartrazine in the presence of Oxone®. Decolorization was monitored at wavelength λ=426 nm, while degradation of aryl groups was followed at λ=257 nm using UV-Vis spectroscopy. The influence of the mass of the catalyst on degradation process was

followed in the mass range from 10 mg to 50 mg at 30 °C. It was found that mass increase was beneficial for the decolorization rate. The effect of temperature was investigated from 30 ºC to 60 ºC. The decolorization was over 90% after only 10 minutes for the temperature of 60 ºC, while with the temperature decrease, the decolorization rate decreased. Co-AlFePILC was found to be an efficient catalyst in degradation of tartrazine in the presence of Oxone®.
Acknowledgement: This work was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia (Contract 451-03-68/2022-14/200026)

P8
Chemical analysis of historical mortars from the Roman period in Serbia

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This work is part of the MoDeCo2000 project research concerning the historical mortars from the Roman period in today's Serbia. It is focused on the chemical analysis of mortar samples selected from archaeological sites along the Danube River. The main compositional and technological features of the mortars were determined by chemical analyses with energy-dispersive x-ray fluorescence (EDXRF) and inductively coupled plasma optical emission spectrometry (ICP-OES) with an HF resistant introductory system. The aim of this study is to present the analytical chemistry strategy used for the rapid and reliable characterisation of the relevant features of historical mortars.
It is concluded that the EDXRF technique can be directly applied to solid samples, but ICP-OES still requires sample decomposition and dissolution to make full use of its analytical capabilities. However, in many cases, ICP-OES includes a quartz introductory system, and hydrofluoric acid removal by treatment with borates must be applied before measurement. Replacing the quartz introductory system with an HF resistant introductory system is achieved to eliminate the neutralisation step with borates, and still get very accurate boron and silicon results.
After detailed research, standard reference certified materials of selected rocks, clays, and limestone (CRM NIST 688 (basalt rock), NCS DC CRM 60102 (clay), NCS DC CRM 60104 (clay), NCS DC CRM 60105 (clay), NCS DC CRM 60106 (clay), BCS-CRM 512 (dolomite), BCS-CRM 513 (limestone)) were analyzed with the same chemical techniques, sighting the identification of potential types of raw materials employed for the production of mortars. Data analysis as a tool of statistics was applied to evaluate the characteristics of mortars, mutually differentiating mortars from different sites, as well as typify updated samples.
The analytical results showed that the EDXRF technique can be used together with other well-established techniques (ICP-OES) and presents a good potential as a reliable, cheap, and fast chemistry strategy to carry out the study of historical building materials. Elaboration of cheap and quick analytical methodology is an important aspect in the development of advanced steps in the research of historical mortars' production technology.
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