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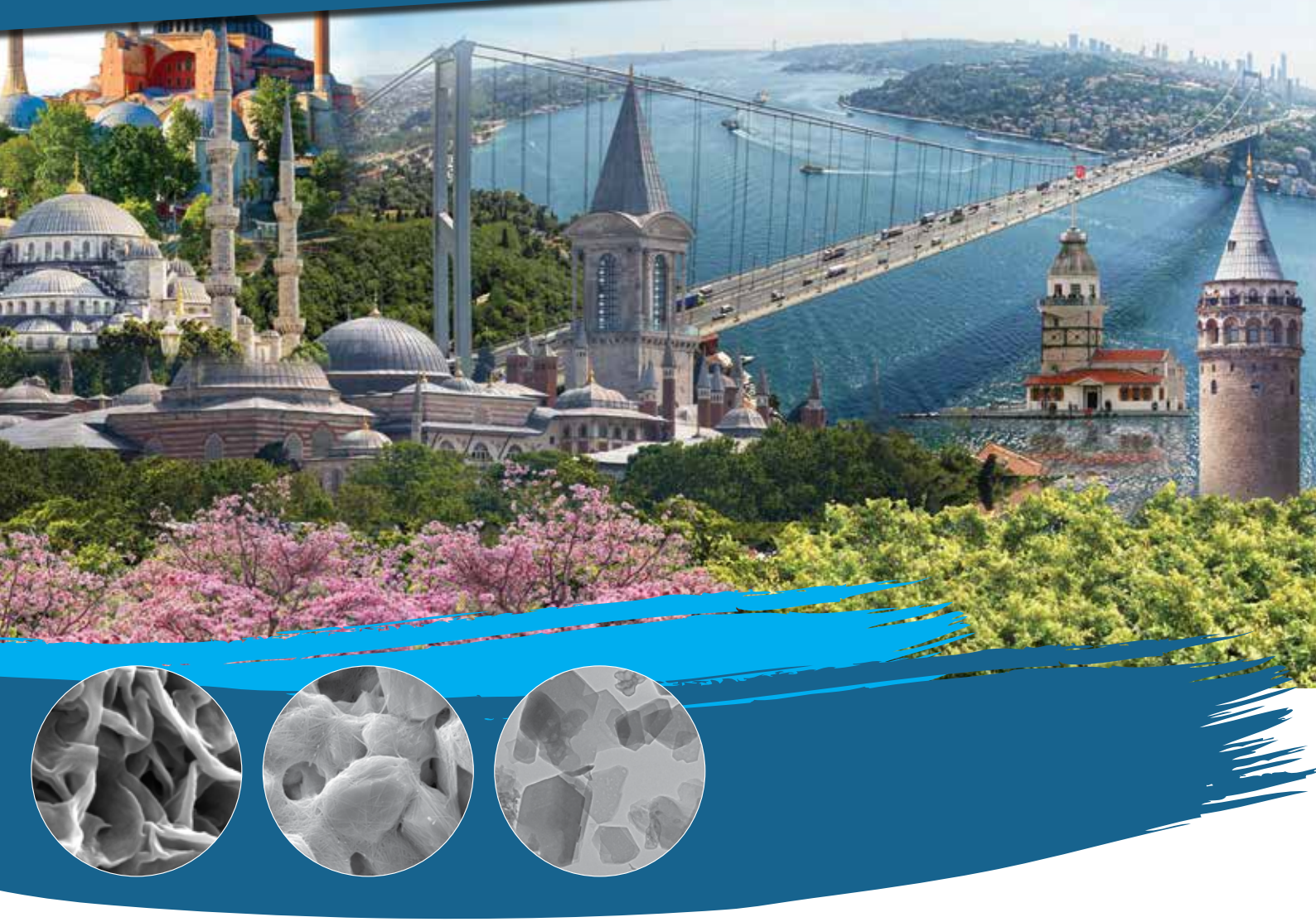
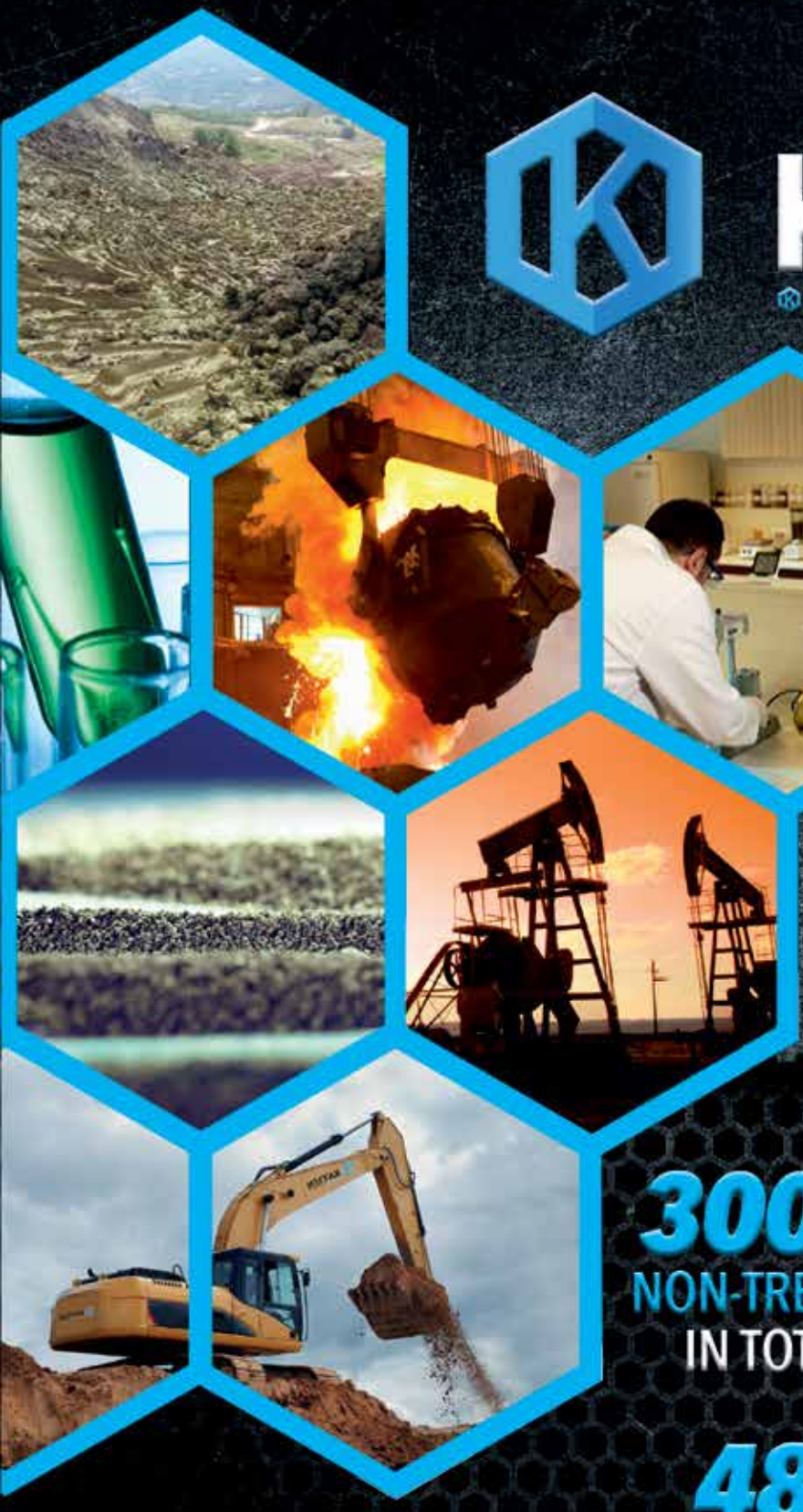
New Interfaces Bridging Continents and Cultures with Clays



SCIENTIFIC RESEARCH

ABSTRACTS



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Hydrotalcite-zeoliteheterocoagulatedmaterials:towardsmaterials with dual adsorption properties

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With the rapid development of modern industry, an increasing amount of wastewaters is produced.Thesecontainawidevarietyofcationicandanionicpollutants,frequentlyclassified as carcinogenic or toxic. Leather manufacturing, especially tanning, is recognized as an enormous source of heavy metals and hazardous dyes. Due to the complexity of their simultaneous removal, the synthesis of materials with dual adsorption properties is essential.

In the present study, a one-pot hydrothermal method for combined layered double hydroxide (LDH) and zeolite synthesis was investigated. In total 4 various samples (HM) were obtained containing zeolite synthesized from calcined kaolinite or halloysite and Mg/Al-Cl or Mg/Al- NO_3LDH, respectively. Prior to synthesis all substrates (metakaolinite or metahalloysite with MgandAlsalts)weresubjectedtoagingin3MNaOHatroomtemperature.Thesynthesiswas carried out within 24 h in a closed system at 100°C and ~1 bar pressure. For comparison 2 materials(CM)werepreparedbyco-precipitationofMg/Al-NO_3LDHinsuspensioncontaining earlier synthesized zeolite from metakaolinite or metahalloysite. All synthesized adsorbents were tested for As(V) and cationic safranin O dye (SO) removal.

The XRD patterns of all samples confirmed the presence of hydrotalcite with the basal reflection in the 7.2–8.2 Å range and sodalite with (110) reflection in the 6.3-6.4 Å range.TheFTIRspectrarevealedbandsinthe3650-3440cm^{-1}regionduetoOHstretchingvibrations of ads or bedwater.Inturnthebandsinthe1420-1370cm^{-1}regionconfirmedpresenceofLDH intercalated with nitrates and/or carbonates. The SEM images of HM samples showed homogenous mixture of LDH and zeolite particles. Whereas clear separation of these phases was observed for the comparative CM samples. This resulted in significant differences of externalcationexchangecapacity(ECEC).Itwasintherangeof19.25-6.18meq/100gforthe HM samples and 0.10-1.33 meq/100 g for the CM materials. This was probably the effect of blocking the surface active sites of zeolite by precipitated hydrotalcite phases. The different synthesis approaches in particular affected the removal efficiency of SO. Regardless of the studied system i.e. single system (SO or As(V)) or dual system (SO and As(V)) the removal efficiencies showed same trends. The HM materials adsorbed ~64.6-94.4% of SO (initial concentration: 100 mg/L) while their analogs (CM) removed only ~7.2-11.4%. The anion exchangecapacity(AEC)determinedbyAs(V)adsorptionprovidedvaluesinabroadrangeof ~56.5-120.4meq/100g.DespitethattheefficiencyofAs(V)removalforbothHMandCMwas equal to 20.5-33.9% (initial concentration: 1000 mg/L). Allanalyses indicated superior adsorption properties of HM composites in systems containing both As(V) and SO.

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