Supplementary Materials

Biomass-derived adsorbent for dispersive solid-phase extraction of Cr(III), Fe(III), Co(II) and Ni(II) from food samples prior to ICP-MS detection

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- **Infrared spectroscopy (IR):**

  The infrared analysis was applied for the prepared samples. Each sample was grinded with a suitable amount of potassium bromide (KBr) and then pressed to form the disc-shape. The device that was used for analysis is of type THERMO Nicolet 6700 FT-IRwith an average of 32 scans at 4 cm^{-1} resolution in King Saud University - Department of Chemistry. Frequency space area Change from 400 cm^{-1} to 4000 cm^{-1}. The system was operated by OMINIC 8 software.
- **Ray Diffraction (XRD):**

  X-ray diffraction (XRD) measurements were carried out employing an Ultima IV,X-ray Rigaku difractometer using Cu-Kα radiation (30 kV, 10 mA) using Cu anode (k = 0.15406 nm) at 250 C in King Saud University - Department of Chemistry. The powderedsample was placed in a sample holder and exposed to X-ray radiation at room temperature,The patterns were collected in the 2 [theta] range of 4-700 with step size of 0.020 and scanrate of 1 s.
- **pH meter:**

  The samples pH values were measured using Thermo Scientific Orion 5 Star pH meter (Orion Star A Series, Thermo Fisher Scientific, Mississauga, Canada).
- **Analytical Balance:**

  For weighing samples, Precisa corporation, Dietikon, Zürich, Switzerland
- **HEATER (digital oven):**

  Digital oven was used for sample preparation Binder Inc., Fullerton, CA, U.S.A.

- **SHAKER (Shaking Water Baths):**

  Shaking samples at different temperatures was achieved by using Shaking Water Bath,JULABO GmbH, (Seelbach, Germany)

- **Milli-Q water:**
  Water used in all experimental parts was purified through a Milli-Q water purificationsystem (Millipore, Bedford, MA, USA).

- **Inductively Coupled Plasma Spectrometry (ICP):**

  Elemental analyses were carried out under an inductively coupled plasma spectrometry (ICP-MS) measurements using a Perkin Elmer Nexion 300D Spectrometer was used for the determination of Hg(II), Pb(II), Zn(II) and As(II) analytes in samples using water as a solvent. The optimum ICP-MS operating conditions are given in Table S1.

Table S1: ICP-MS operating conditions

S #	Operations	Conditions
1	RF Power	1175 W
2	Nebulizer type, Gas Flow	Meinhard, 0.80 L/min
3	Argon Gas Pressure	60 psi
4	Lens Voltage	7.25 V
5	Analog Stage Voltage	-2078.13 V
6	Pulse Stage Voltage	1300.00 V
7	Discriminator Threshold	300.00
8	AC Rod Offset	-9.50
9	Detector Mode	Dual
10	Number of replicates	3
11	Reading / Replicates	1
12	Sweeps / Readings	30
13	Rinse Delay Time	34 sec
14	Flush Delay Time	34 sec
15	Read Delay Time	14 sec

- **Scanning Electron Microscopy (SEM):**

  The morphology analysis showing the surface texture, elemental composition, pore structure and arrangements of the pores of prepared samples. In the present work the samples prepared at optimum conditions were analyzed by scanning electron microscopy (SEM) followed by Energy Dispersive Spectrometer (EDS) using JEOL (JSM–6380 LA). The elemental analysis was done by using EDS at same operating conditions of SEM. Thenumber and energy of the X-rays emitted from the samples were

measured by an energy- dispersive spectrometer. As the energy of the X-rays are characteristic of the difference in energy between the two shells, and of the atomic structure of the element from which they were emitted, this allows the elemental composition of the specimen to be measured.