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Development of an integrated strategy for reducing the carbon footprint in the food industry sector

National Technical University of Athens

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Agenda

Poster session (duration 3 days)

57. W. Tao, A.T. Ukwuani
Design considerations to scale up vacuum thermal stripping for ammonia recovery from anaerobic digestate

58. M. Kaszubska, M. Wzorek
Development of measurement techniques for siloxanes in landfill gas

59. RES-URBIS consortium, Resources from Urban Biowaste:
The RES URBIS Project

60. K. Philippou, I. Pashalidis
Uranium monitoring in ground and wastewaters

61. D. Díez, A. Urueña, R. Gil, F. Corona
Steam reforming of model tar compounds over nickel catalysts prepared from hydrotalcite precursors

62. G.M. Kirkelund, L.Díez, C. Scheutz, R. Eisted
Evaluating potentials for waste sorting in the Arctic: waste separation studies from Greenland

63. N. Yilmaz, M. Elhag
Cost - Benefit Analysis of Water Management Projects of Nestos River, Greece

64. M. Harmankaya, T. T. Onay, A. Erdinçler
Impact of sewage sludge co-disposal on waste degradation in anaerobic reactors

65. T.M. Massara, E. Katsou, A. Guisasola, A. Rodriguez-Caballero, M. Pijuan, J.A. Baeza
Can modelling of GHGs be used to improve the process performance in WWTPs?

66. V. Panaretou, S. Vakalis, A. Ntolka, A. Sotiropoulos, K. Moustakas, D. Malamis, M. Loizidou
Study of carbon balances from organic waste in a decentralised composting facility in Tinos island

67. N. Durmuş, İ. Yılmaz, İ. E. Mülazımoğlu, A. Demir Mülazımoğlu
Development of a novel highly sensitive voltammetric sensor electrode a TKAN modified based carbonaceous materials for dopamine measurement

68. S. Sağır, A. Demir Mülazımoğlu, İ. E. Mülazımoğlu
A novel synthesis and investigation of electrochemical behaviors of HPNPC/GC sensor electrode: Using simultaneously determination of dopamine, ascorbic acid and uric acid

69. A. Demir Mülazımoğlu, N. Durmuş, S. Sağır, İ. E. Mülazımoğlu
Electrochemical behaviours of Aclonifen on GC electrode in non-aqueous media: Investigation of Aclonifen determination

70. P.F. Rupani, A. Embrandiri, M. H. Ibrahim, A.K.M. Omar, C.T. Lee
Kinetic evaluating of carbon to nitrogen ratio in relation to different POME-PPF mixture during vermicomposting process

71. F. Safari, V. Saadattalab
Hydrogen production via hydrothermal gasification of algal biomass using hydrochar catalyst as a solid waste of the process

72. K. Lasaridi, C. Chroni, K. Abeliotis, K. Boikou, M. Villares, A. Jandric, J. Hobohm, K. Kuchta, E. Terzis
Waste electrical and electronic equipment (WEEE) collection for recovery of rare earth elements and other critical metals

73. N. Durmuş, A. Demir Mülazımoğlu, İ. E. Mülazımoğlu
A novel highly sensitive carbon based HMPD/GC sensor electrode: Cu (II) ions analysis in flour and drinking water samples

74. G. Z. Kyzas, A. C. Mitropoulos
Banana waste residues for environmental applications

75. A. Aguado, M. Calvo
Chemical recycling of polyurethane foams from shoe soles for use them in the footwear sector

76. T. Kritikou, K. Abeliotis, K. Lasaridi
Consumers' awareness and behaviour on food waste prevention

Banana waste residues for environmental applications

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In the present study, activated carbons (ACs) were hydrothermally prepared with an environmental friendly preparation route after pyrolysis from biomass (specifically from banana peels). The prepared biochars were activated with potassium hydroxide (chemical activities). Biochars were impregnated with aqueous solutions of potassium hydroxide following a variant of the incipient wetness method. Activation was carried out under nitrogen flow by heating to 873 K. Biochars were also activated with aqueous solutions of potassium hydroxide at room temperature for reasons of comparison. The porous texture of the obtained ACs was characterized by physical adsorptions of N_2 at 77 K. The preparation route had a strong impact on the pore structure of ACs. In addition, surface chemistry was also affected by the preparation and activation process. The adsorbent materials were also characterized by Scanning Electron Microscopy (SEM) and Fourier Transform Infrared (FTIR) spectroscopy. The prepared activated carbons were used as adsorbents for the removal of the cadmium. Batch experiments were performed to investigate the effect of physico-chemical parameters, such as pHpzc, ionic strength, adsorbent dose, contact time, initial metal concentration and temperature. The kinetics of adsorption were studied by applying the pseudo-first order, pseudo-second order and intraparticle diffusion models. Equilibrium data were analyzed using Langmuir and Freundlich isotherm models. The thermodynamic parameters such as the change of enthalpy (ΔH^0), entropy (ΔS^0) and Gibb's free energy (ΔG^0) of adsorption systems were also determined and evaluated..

Below is the step-by-step preparation method:

The dried mixtures were then transferred into capped crucibles and kept inside the muffle furnace for pyrolysis at 600 °C for 2 hours under self-burn atmosphere. The crucibles were then cooled at room temperature, and the content inside was ground into a uniform particle size (particle size <180 μm). The hydrochars were denoted as (char).

1. Preparation of hydrothermal carbons

The hydrocarbonization process (HTC) of the precursors was carried out in a 0.120 L stainless steel autoclave (Berghof, Germany) using a volume of 0.1 L of deionized water and 5 g of biomass. The mixture was sealed into a Teflon vessel and then inserted in the autoclave, which was subjected to 150 or/and 200 °C for 2 h. The autoclave was cooled down to room temperature and then the hydrochar was collected and washed with distilled water. The hydrochar was then dried in an oven (100 °C) and the solid yield determined by weight. The hydrochars were denoted as Ban-Hyd (150 °C)

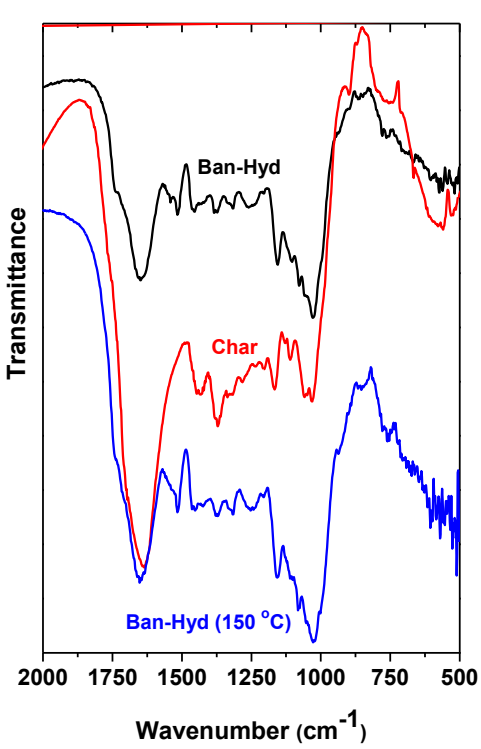
2. Activation at room temperature

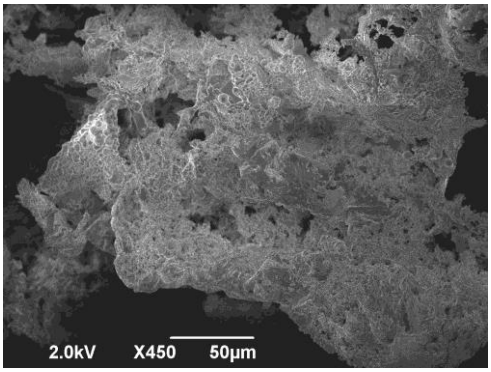
A known weight of the sample was dipped into the solution of activating agent, KOH, keeping the impregnation mass ratio equal to 1, under stirring at room temperature for 2 hours. Uniform particles of activated carbon were washed with excess demineralized water to remove the excess activating agents, and by-products that may have form during activation on the surface of activated carbon. The samples were then dried in the oven at 105 °C for 12 hours for complete removal of the absorbed water. The activated carbon were labeled here as Ban-Hyd (KOH 25 °C).

3. Activation by pyrolysis

A known weight of the sample was dipped into the solution of activating agent, KOH, keeping the impregnation mass ratio equal to 1, under stirring at room temperature for 2 hours. The samples were then filtered and put for pyrolysis. Pyrolysis treatments (activations) were carried out in a vertical tubular reactor made of quartz in furnace CarboliteTM, using in all cases 25 g of impregnated and dried material. All treatments were done at a constant heating rate of 10K/min and with a nitrogen (99%) flow of 30 STP cm3/min, which was kept during heating and cooling. An activation temperature of 823K and a soaking time of 2 h were used. After cooling, the solid pyrolysis residue to room temperature it was washed with distilled water. The resulting ACs was dried at 383K for 24 h in a vacuum furnace. The activated carbon were labeled here as Ban-Hyd (KOH 600 °C).

Below are some preliminary characterization results (FTIR and SEM images)¨.





(a) (b)

Fig. 1. (a) FTIR spectra and (b) SEM of the banana adsorbent.