STUDY OF ACTIVATED CARBONS OBTAINED FROM FOOD INDUSTRY BY-PRODUCTS APPLYING THERMOANALYTICAL, BET AND ELECTRON MICROSCOPY METHODS

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Introduction

It is known that activated carbons (AC) have a wide utilization in different fields of human activity. Here we report the results of a study of activated carbons obtained from different local fruit stones: plum and peach stones, nut peels. Important quantitaties of raw materials are annually collected in the Republic of Moldova, which can be utilized for obtaining activated carbons. The obtained adsorbent materials have rather high adsorbent properties and can be utilized both in problems of environment (purification of liquid and gaseouse solutions) and in medicine as entero and hemosorbents.

Experimental

The activated carbons have been obtained as it is shown in (1). Activated carbons were obtained from nut peels (CA-16), from peach stones (CA-23) and from plum stones (CA-36) which are initial samples of AC. We also studied AC oxidated with nitric (V) acid (CA-36 ox) and (CA-36 ox+Fe) which was prepared by a wet impregnation method using $FeCl_3$. $6H_2O$. Gemini 2370 equipment was used for measuring the specific surface area. Thermoanalytrical method TG, DTG, DTA and Q-TG were used for the study of the desorption processes of benzen from surface of activated carbons. Conical crucibles were used for the attainment of a self - generated atmosphere (isothermal conditions). For DSC measurements NETZSCH DSC 204 equipment was used. The activated. carbons pictures were studied using a scanning electron microscope Cambridge S 500. For the study of the regeneration process CA-16 and CA-23, they were saturated with o-, p-nitrofenol, o-, p-nitroanilin and through TA method the temperature interval, in which the adsorbtion took place was established.

Results and Discussion

The BET surface area of activated carbons(AC) are reported in Table 1. The BET surface areas range from 756-1155 m^2 /g. Figure 1 shows the TG, DTG, DTA curves for the desorption processes of the benzen from surface of the sample (CA-23). The approach we used allowed us to establish the peaks and steps responsible for the thermodesorption of benzen from micro-, meso- and macropors of activated carbons. By way of example temperature range of thermodesorption processes for (CA-23) is given: I step 35-85 ^{0}C, Δm= 6,8 %; II step 85-115 ^{0}C, Δm_2=4,0 %; III step 115-370 ^{0}C, Δm_3=14,4 %. On the basis of data TG, DTG, DTA and Q-TG the adsorption parameters were calculated: V_S=0,38 cm^3/g (by TA method); Vs=0,45 cm^3/g (adsorption isotherm method V_1=0,10cm^3/g (I step); V_2=0,06 cm^3/g (II step); V_3=0,22 cm^3/g (III step); W_{01} = 0,36 cm^3/g; W_{02} = 0,07 cm^3/g Wme = 0,08 cm^3/g.

Figure 2 shows DSC curves for four samples of activated carbons for the initial ones which were subjected to oxidation and impregnation processes. The change of the shape DSC curves indicated the modification of the surface of activated carbons after their treatment with nitric acid and solution iron salt. It was established that the oxidation and impregnation processes modified the CA surface.

The morphology of surface of activated carbon (CA 36 ox Fe) is ilustred in Fig. 3

A typical nitrogen adsorptyion isoterm for the sample (CA-36 ox) is shown in Fig. 4. The interval of the regeneration temperature was 300-360 ^{O}C for CA-16, CA-23 satured with o-, and p-nitroanilin and 300-370 ^{O}C for CA-16, CA-23 satured with o-, and p-nitrofenol.

Conclusions

Activated carbons obtained from food industry by-products have rather high adsorbent properties and can be recommended for utilization in different fields. The thermoanalytical methods may be used for characterization and for the determination of the temperature condition for the regeneration of satured activated carbons.

References

1. Lupascu T, Monahova L. and Gonchar V. Adsorption properties of active carbons obtained from food industry by-products. Revue Roumaine de Chimie 1994; 39(8): 1279-1294.

Table 1. Surface area and raw materials for obtaining AC.

Sample No.	Raw materials	BET Surface Area, m^2/g
CA-16-in	nut peels	978
CA-16-ox	nut peels	919
CA-23-in	peach stones	881
CA-23-ox	peach stones	756
CA-36-in	plum stones	1130
CA-36-ox	plum stones	1155
CA-36-ox+Fe	plum stones	1070

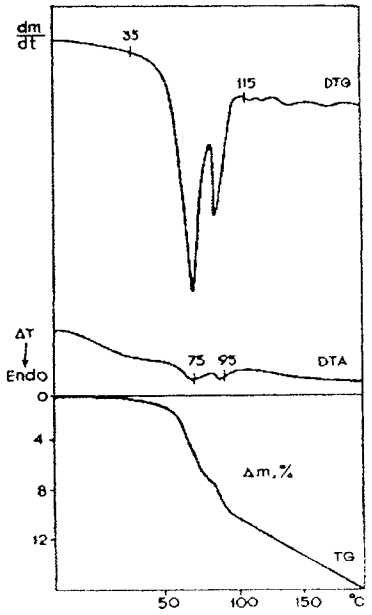

Figure 1. TG, DTG, DTA curves desorption of benzen from surface of CA-23-in

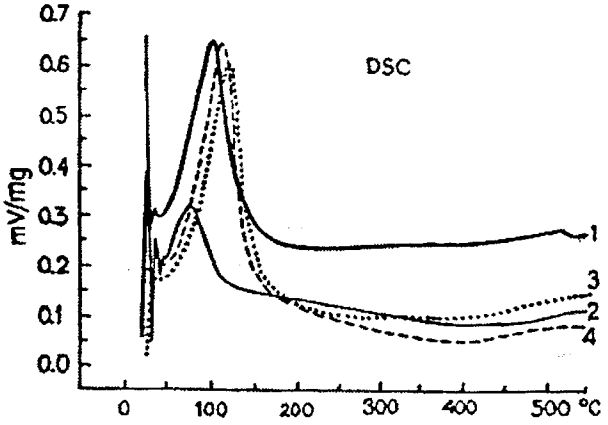

Figure 2. DSC curves: 1-CA-36; 2-CA-36ox: 3-CA-36(1); 4-CA-36(2); 36ox+Fe

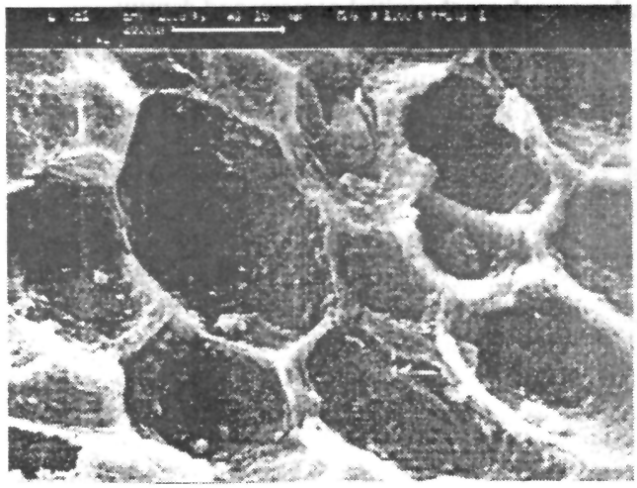

Figure 3. Transmission electron micrograpf for sample CA-36ox+Fe (20 μm)

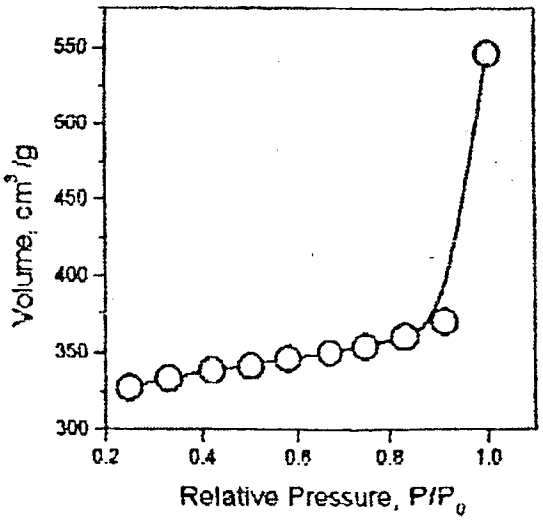

Figure 4. Typical nitrogen adsorbtion isoterm for simple CA-36ox