Production of activated carbon from different biomass and wastes

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Abstract

This aim of this study is the preparation of activated carbons from different biomass and other wastes by chemical activation. Lignite (Tunçbilek, Elbistan, Gölbaşı), and polymers (PET waste etc.), apricot stone etc were used to obtain activated carbon. Activated carbons have been prepared by impregnation using with KOH, NaOH, K_2CO_3, $ZnCl_2$, H_3BO_3, H_3PO_4.

Introduction

Qualities of activated carbons depend on the physical and chemical properties of the raw materials and the activation methods. Experimental conditions such as type of activating agents, impregnation ratio, activation temperature and time are related with different physical and chemical characteristic of the products. Literature survey shows that chemical activation is the most effective method to produce activated carbons with a high surface area and narrow pore size distribution [1-3].

Raw Material	İmpreg.	Surface area ($m^2.g^{-1}$)
Apricot Stone	KOH	1693
	K_2CO_3	1080
	$ZnCl_2$	1267
	H_3PO_4	1285
Waste Apricot	H_3BO_3	491
	$ZnCl_2$	1060
Chickpea Peel	$ZnCl_2$	1271
Elbistan Lignite	$ZnCl_2$	1300
Active Mud	KOH	218
	$ZnCl_2$	284
	K_2CO_3	262
	NaOH	174
Waste PET	KOH(1/4)	2392
	$ZnCl_2$	1866
Orange Peel	$ZnCl_2$	1215
	K_2CO_3 (950°C)	1352
	H_3BO_3 (600°C)	577
Carbonized Apricot Stone	KOH	2107
Chestnut shell	KOH	1542
	$ZnCl_2$	1701
	K_2CO_3	1072
Gölbaşı Lignite	$ZnCl_2$	748
	NaOH	530
	K_2CO_3	576
	KOH	1047
Tunçbilek Lignite	KOH(1/3)	1016
Taş Kömürü	KOH(1/4)	1069
Walnut shell	KOH	1693
Peanut shell	KOH	813
	$ZnCl_2$	1417
	K_2CO_3	438
Sugar Beet	$ZnCl_2$	1697

KOH, K_2CO_3, NaOH: 800°C $ZnCl_2$, H_3BO_3, H_3PO_4:500°C

Experimental

Activation temperature for $ZnCl_2$, KOH, NaOH, K_2CO_3, H_3BO_3 and H_3PO_4 was selected as 500, 800, and 500°C, respectively. The impregnated sample was heated to reach the activation temperature under N_2 (100 mL. min^{-1}) atmosphere with heating rate of 10 °C. min^{-1} and they were hold at the temperature for 1 h. Surface properties were determined with TriStar3000 (Micromeritics).

Results and Dıscussion

Surface areas of activated carbons were given next to Table. The values of BET surface area were determined in the range of 174–2392 $m^2.g^{-1}$. It was clearly seen that activated carbons produced using KOH have got the highest surface area. Especially, high surface area was calculated activated carbons which were produced from waste PET and apricot stone. Increase in the ratio can attribute to the increase in porosity by increasing the release of volatile matter.

References

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