ACTIVATED CARBON (CHARCOAL) OBTAINING . APPLICATION

Lecturer PhD.Eng. Florin CIOFU,
University "Constantin Brâncuşi" of Târgu-Jiu, florin.ciofu@utgjiu.ro

Abstract: *The activated carbon is a microporous sorbent with a very large adsorption area that can reach in some cases even 1500sqm / gram. Activated carbon is produced from any organic material with high carbon content: coal, wood, peat or moor coal, coconut shells. The granular activated charcoal is most commonly produced by grinding the raw material, adding a suitable binder to provide the desired hardness and shape.*
Enabling coal is a complete process through which the raw material is fully exposed to temperatures between 600-900 degrees C, in the absence of oxygen, usually in a domestic atmosphere as gases such as nitrogen or argon; as material that results from this process is exposed in an atmosphere of oxygen and steam at a temperature in the interval from 600 - 1200 degrees C.

Keywords: carbon, retort, granulosity.

1. INTRODUCTION

The activated carbon (charcoal) is the resulting solid in the process of incomplete combustion of wood, with a dosed intake of air at temperatures of 260 ° C, in specific installations.

The quality of charcoal depends on the method of obtaining (in mounds or flasks) and wood species used. The mound charcoal can be obtained by any wood species, but the best results from beech, hornbeam, oak, birch, maple and form soft hardwood and softwood results the charcoal of an inferior quality. For getting charcoal it is used beech wood charcoal as ster meters, hard champs to be chopped, branches tops and hardwood timber, mining residues. The wood for charcoal can have any defects except mildew fungus. The charcoal from pile mound has black, gloss freshly exposed metallic sound and presents porosity.

If wood conversion to charcoal occurs in pile mounds, it is obtained only the charcoal, the other products (tars, pyrogenic water, gas) getting lost by their spread in the air and soil, with negative effects on the environment.

In case of wood dry distillation in retorts there are possibilities not only for the recovery and refinement of the charcoal together with the products used directly or processed (acetic acid, methanol, ethanol), but also thermal energy.

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Fig.1. The pile mound

Fig.2. Retort

*The pile mound charcoal o*btained at temperatures of 600-650 ° C is considered a very good fuel, because it has high porosity (p = 75-85%) has a high carbon content (83-88%), a very small percentage of ash (1-3%) and almost no sulphur content. The charcoal obtained this way is mechanically weak and has a high price because it is less used as fuel for blast furnaces being used only for the development of high quality cast iron *Retort charcoal* has an increased purity and quality being used for the production of special steels. As the form of active carbon, it is used to fading, deodorizing, gas absorption and the pharmaceutical industry.

2. CHARCOAL PROPERTIES

2.1. Charcoal mass.

Ifn case of determining the mass of charcoal there are distinguished two kinds of masses: the specific mass and hectoliter mass of charcoal.

The specific mass or weight is the amount of ground charcoal powder which has a mass of 1.4 kg so 1 dm³ charcoal weighs 1.4 kg . For both qualities of charcoal, specific mass pile must be 210-250kg / m³. Its specific mass / weight varies by species, with the process of obtaining charcoal in pile mounds , with granulosity and moisture. Based on experiments it has been demonstrated that the specific mass of charcoal produced at 150 ° C is 1.3; at 270 ° Cit is 1.5; at 340 ° C it is 1.5 and above 1000 ° C it is 2.0.
Data related to charcoal production are presented in Table 1.

Table 1.

Species and species groups.	Hectoliter mass kg/hl	The average yield on charcoal obtaining in pile mounds		Specific consumption stere / ton..
		Hl/ster	Kg/ster	
Fir-tree	12-15	5	75-80	13-17
Spruce, Pine-Spruce, Pine	14-18	5	70-90	11-14
Beech, Oak, Hornbeam	20-25	4.8-5.4	110-140	7.0-8.8
Ash, Maple	20-22	5.1-6.5	105-140	7.7-8.8
Soft Hardwood	14-20	5	70-100	7.0-11

The specific mass or weight in the pile of the charcoal produced from beech in vertical mound piles is between the limits 215-263 kg / m³ on average 240 kg / m³, at a humidity of 8-10%. The charcoal hectoliter mass is the weight in kg of a hectolitre of charcoal pieces that varies with:
-TheCharcoal moisture content;
-The dimensions of the pieces of charcoal; for iron and steel, the charcoal gaps should be 44%.
-The carbonization time duration ; if the process of charcoial obtaining has been slow , the charcoal has a high weight
-The species or group of species (Table 1)
The retort charcoal has a hectoliter mass of 16-170 kg / hl.

2.2. Charcoal Hygroscopicity

Charcoal hygroscopicity or wettability is its ability to absorb water vapor in air or liquids. The charcoal can absorb in a few hours 4-16% moisture depending on the species of origin. Wettability depends on the temperature at which charcoal was obtained, so if the temperature was high, the charcoal is different from the state and the chemical composition of the wood from which it originates, and its absorption strength decreases.
Hygroscopicity of the charcoal in the first 24 hours depending on species (table 2).

Table 2

Species	Water absorption %	Species	Water absorption %
Fir	16.3	Oak	4.3
Spruce	4.5	Poplar	8.8
Pine	5.1	Elm	6.6
Hornbeam	5.8	Whirpool	4.8
Birch	4.4	Hazelnut	7.7
Beech	5.3	Ash	4.0

Since charcoal absorbs liquid gases, it is used as a disinfectant and bleaching of liquids of organic nature, not changing their chemical composition. The gas absorption is stronger for the fresh obrained charcoal and gases that are soluble fall in water. A cubic meter of charcoal can absorb in the conditions of a temperature of 0 ° C and 1.75 m³ at a normal pressure hydrogen, nitrogen 7,05m³, 9,42m³ carbon monoxide, 35 m³ CO2 H2SO4 65 m³, 85 m³ and 90 m³ HCl NH3.

2.3. Charcoal Humidity.

The charcoal taken out from the pile mound absorbs in the atmosphere 5-8% moisture. To this it can be added that charcoal is usually obtained in the forest, near a river, where the atmospheric humidity is high, and that after it was removed from the pile mound, it needs to be cooled for at least 24 hours, to increase the humidity 10-12%. The moisture absorption depends on the temperature at which the process of charcoal obtaining took place, so its calorific power increases with temperature and decreases with the absorption. While decreasing the amount of absorbed water, the charcoal density increases. Table 3 presents the variation related to the temperature absorption.

The total humidity of the pile mound charcoal results from the sum of the inhibition humidity with the hygroscopic humidity, according to the formula:
$W_t^i = W_i^i + W_h^i$, [%];

The total humidity is deifferent depending on the mound charcoal quality.
The mound charcoal physical and chemical properties are presented in table 4.

Table 3.

Temperature at charcoal obtaining (°C).	Water absorbed quantity (%)	Charcoal density related to water
150	20-21	1300
200	10-11	1420
250	7-8	1420
300	7-8	1420
350	5-6	1500
400	4-6	1700
1000	4-5	1840
1500	2-3	1870

Table 4.

Characteristics	Quality		
	I	II	III
Total humidity (W),%max	9	10	12
Pile density (ρ_g),kg/m^3	220-250	210-250	210-280
Ashes reported to the anhydic product (A),% min.	2	2.5	4
Coke (K), % min	82	77	65
Volatile materials (V), % max.	17	-	-
Superior caloric power (Q), kcal/kg, min.	7500	7500	6500
Crushing strength, % min.	70	65	-

The mound charcoal humidity varies depending on the season, weather, storage, transport. Under normal conditions of storage and transport the moisture limits can be maintained between 8-10%.

2.4.Temperatura of ignition.

The ignition temperature of mound charcoal depends on the temperature at which it was obtained and the wood species was produced. Both the ignition temperature and the carbonization temeperatuire of charcoal is shown in Table 5.

Table 5.

Carbonization temeprature	Charcoal ignition temperature
270	340-380
300	360-370
350	400
400	400
1100	600-800
125	600-800
1500	600-800
1500	1200

The charcoal obtained from soft wood and coniferous wood self-ignites at lower temperatures and burns quickly and completely.

In case in which in the charcoal mass heat is stored by slow oxidation that occurs from absorption of oxygen in the air, it can self-ignite.

2.5.Caloric power.

The calorific value is the amount of heat that is developed by complete combustion of one kilogram of charcoal and it is measured in calories (cal). The calorific value of charcoal depends on its composition or the amount of carbon, hydrogen and contained volatile substances and also of moisture and ash content in related to the temperature of carbonization. If it is developed by combustion the entire amount of heat, and therefore the evaporation of the water consumed by charcoal has a high calorific value, and if gases train water vapors, the amount of usable heat that gives the charcoal is lower as caloric power.The calorific value (lower value) of charcoal depending on humidity is shown in Table 6.

Table 6.

Humidity, (%)	Caloric power, kcal/kg	Humidity, (%)	Caloric power, kcal/kg
0 2. 5.0 7.5 10.0 12.5	7955 7735 7515 7295 7076 6856	15.0 17.5 20.0 22.5 25.0	6635 6415 6195 5976 5756

The charcoal calorific value decreases with increasing of humidity. Charcoal maximum calorific output is 8080 kcal / kg (in dry beech 4000 kcal / kg) and it can be obtained only when the burning was done completely, namley, if charcoal turned entirely into CO2, this being achieved with oxygen surplus . When combustion is well managed, the content of carbon monoxide gas is small, and the heat developed by the charcoal is high. For a more complete combustion of charcoal, it must meet certain dimensional characteristics that allow air circulation, otherwise the temperature drops producing solidifying of pig iron in the blast furnace..

3. APPLICATIONS OF THE ACTIVATED CARBON

Granular activated charcoal (Fig. 3) - specifically for use with water to remove contaminants, derivatives, or immersed in water disinfection agents (for example chlorine or ozone);

The formed activated charcoal - is generally used to clean air, for halogens, thinners, removing , for air contitionat appliances, gas masks, filter cigarette, in the case of storage level control C2O fruit and more;

The impregnated activated carbon **(**Fig. 4**) -** is used in particular for gas and air cleaning.

Activated charcoal powder - used especially in chemical and food industry, dioxin removal, raw metals and more other cleaning.

Activated charcoal block - is used as granular activated carbon, particularly for water filtration and removal of contaminants it can filter and sediment Additionally pretty fine, generally somewhere in the 5 micron but depends on the product.

Fig.3. Granular charcoal

Fig.4. . Filter used in the automotive field

Medicine activated charcoal - the activated charcoal has become the treatment of preference in medicine for treating poisoning or overdose after oral ingestion, even at the expense of older methods such as washing or pumping the stomach.
Activated charcoal in water treatment - has the capacity to hold over 90% of existing chemicals or foreign particles in drinking water networks.

4. CONCLUSIONS

Activated carbon is the most absorbent material currently known. 1 gram has a surface of between 650 and 1300 square meters. It is routinely obtained from any organic material containing carbon such as coconut shell, coal, wood, etc. By "activating" it is loaded with positive electric charge and she is increased filtration capacity. It is used for filtering chlorine and organic substances, removal of taste and smell.

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