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# CARBONIZATION OF WOOD BY DEHYDRATING AGENT

Part II\*

On the Preparation and the Decolorizing Power of the  
Hydrated Active Charcoal (H-A Charcoal) from  
"shirakaba" (Betula Tauschii) Wood

By

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脱水剤による木材炭化 (第II報)

シシカバ材より水和活性炭の製造およびその脱色力について

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In the previous report we have described studies on the preparation and adsorptive power of hydrated active charcoal (H-A charcoal) made from some species of wood which are most common in Hokkaido by dehydration and carbonization with sulphuric acid at low temperature. Now we have experimented with "shirakaba" (Birch, Betula Tauschii) sawdust as a raw material, and have investigated the proceeding state of the carbonization process of wood by dehydration with various concentrations of sulphuric acid, temperatures and times of heating.

## Preparation of H-A charcoal from "shirakaba" wood under various conditions.

H-A charcoals were prepared from sawdust of "shirakaba" wood with each 98, 70, 40, 15, 5, and 1 per cent sulphuric acid, and heated at 120° for 8, 14, and 24 hours, and at 150° for 4 and 8 hours. The other conditions were the same as those reported in the previous experiments<sup>1)</sup>. Two grams of oven-dried sample and 10 g of sulphuric acid

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were placed in a beaker, stirred in an 80°C water bath for an hour, and heated at each temperature for each period, and then washed with boiling distilled water.

The yields of the charcoal are given in Table 1.

Table 1. Yields of H-A charcoal from "shirakaba" sawdust under various conditions (oven-dry basis) (%)

Temp. (°C)	Time of heating (hr)	Concentration of sulphuric acid					
		98%	70%	40%	15%	5%	1%
120	8	62.68	57.63	54.45	57.80	61.43	81.10
	14	61.28	57.93	55.70	57.43	56.50	80.13
	24	59.88	58.33	56.58	55.68	58.08	80.28
150	4	56.28	57.68	52.13	52.13	55.93	73.30
	8	52.93	53.88	48.20	48.20	54.55	71.40

In the case of low concentration as 1 per cent  $H_2SO_4$ , the carbonization is not so sufficient that the yields of H-A charcoal treated at 120° and 150° are as high as nearly 80 and 72 per cent respectively, while the products prepared with the other concentrations of the acid can be obtained approximately from 52 to 62 per cent. It is interesting to show that the yields of the products treated with the concentration of 40 and 15 per cent  $H_2SO_4$  are lower than those with the other. These facts appear probable that the acid concentration has considerable influences upon the mechanism of carbonization by dehydration.

The losses of water and volatile matter during the carbonization with dehydration were calculated from the following formula.

$$\text{Losses during carbonization (\%)} = \frac{\text{Wt. after carbonization}}{\text{Wt. of sawdust} + \text{Wt. of } H_2SO_4} \times 100$$

"The weight after carbonization" was determined by weighing car-

Table 2. Losses by evaporation in the preparation of H-A charcoal under various conditions (oven-dry basis) (%)

Temp. (°C)	Time of heating (hr)	Concentration of sulphuric acid					
		98%	70%	40%	15%	5%	1%
120	8	1.75	12.58	47.00	68.50	83.67	85.05
	14	3.08	16.50	51.75	78.91	86.33	85.50
	24	5.25	19.17	53.58	78.91	86.33	85.67
150	4	21.75	27.50	64.58	84.92	89.00	86.92
	8	29.92	40.75	73.33	88.83	89.33	87.33

bonized product after cooling in a desiccator over calcium chloride.

The results are indicated in Table 2.

From the data in Table 2, the differences among the amounts of loss by evaporation with the temperature of heating were not so evident at low acid concentrations, however at high concentrations losses differed remarkably by temperatures between 120° and 150°.

#### Adsorptive power of H-A charcoal from "shirakaba" wood.

The adsorptive powers of these charcoal samples were tested by the caramel test that was previously described<sup>1)</sup>. The results are recorded in Table 3.

Table 3. Adsorptive powers (percentage of decolorization) by caramel test (%)

Temp. (°C)	Time of heating (hr)	Concentration of sulphuric acid					
		98%	70%	40%	15%	5%	1%
120	8	70.67	59.56	48.00	23.78	21.78	17.33
	14	70.67	63.11	58.89	38.67	21.56	13.56
	24	70.44	68.00	66.89	38.00	25.78	20.00
150	4	70.67	76.44	74.44	30.89	12.89	9.56
	8	70.89	82.67	60.22	31.56	23.11	16.00

In this experiment the adsorptive power of the charcoal which was prepared under the conditions of 70 per cent acid, 150°, and 8 hours was the highest. The next was 70%—H<sub>2</sub>SO<sub>4</sub>, 150°, 4 hrs, then 40%—H<sub>2</sub>SO<sub>4</sub>, 150°, 4 hrs., and then 98%—H<sub>2</sub>SO<sub>4</sub>, 8 hrs.. In case of 98 per cent sulphuric acid, it seemed that the temperature and time of heating had no effect on the adsorptive power. In the charcoals which were made with diluted sulphuric acid such as lower concentrations than 15 per cent, the adsorptive power was so weak that they could not be utilized as an active decolorizing charcoal.

#### Summary

The purpose of the present experiments was to investigate the proceeding state of the carbonization process of wood by dehydration with sulphuric acid. Hydrated active charcoals (H-A charcoals) were prepared using "shirakaba" (Birch, *Betula Tauschii*) sawdust as a raw material, with various concentrations of sulphuric acid and various temperature

and times of heating. The yields of the charcoal and the losses during carbonization were determined, and the decolorizing power of the charcoals was compared by caramel test.

H-A charcoal made from "shirakaba" sawdust treated with 70%  $\text{H}_2\text{SO}_4$ , heated at  $150^\circ\text{C}$ . for 8 hours, had the highest adsorptive power (about 83% decolorizing power with caramel test), and the yield was about 54%.

#### Literature referenced

- 1) HANZAWA, M., and SATONAKA, S.: The Research Bulletins of the College Experiment Forests, College of Agriculture, Hokkaido University, Vol. XVII, No. 2, 439 (1955).

#### 摘 要

硫酸による木材の脱水炭化の過程を追究するために、原料としてシラカバ材の鋸屑を用い、硫酸濃度、加熱温度および加熱時間を変えて水和活性炭を製造し、その収量、炭化中に失われる水分および揮発分を測定し、生成炭の脱色力をキャラメル試験によつて比較した。

その結果 70%-硫酸で  $150^\circ\text{C}$ 、8 時間処理で得られた水和活性炭の吸着力が最高でキャラメル脱色率 83% を示し、その収量はおよそ 54% であつた。