PORE CONTROL OF CARBON FROM WOODY MATERIALS AND ITS APPLICATIONS

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Introduction

Woody materials are important resources in Japan, especially in Kochi which has 84% forest area. We have been developing techniques for controlling pore sizes and numbers of carbon made from woody materials. Carbon with large size of pore, compared with traditional charcoal made from wood, can be used for a seedbed, a flowerbed of plants or a mycelia medium. Carbon with high density or fewer pores can be made from woody powder materials. This carbon can be used for a metallurgical reducer. Carbon with pore size change in the specific direction can also be made and this carbon can be used for functional carbons such as molecular sieve, sound proofing materials and so on.

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Experimental

Woody materials are usually pulverized by a grinder to under 1 μm, then put into a mold under pressure(10 to 1000mgf/cm^2). These samples are carbonized 600 to 1500℃ under nitrogen atmosphere. The distribution and sizes of pore in these carbons are measured by mercury porosimeter(Pascal 140 CE Instruments).

Results and Discussion

Photo.1 and 2 show the carbons made from woody materials in the electron microscope. From these photos pore of the carbon has two kinds, one is macro pore which is more than 1 μm, another is micro pore which is less 1 μm.

This macro pore depend on the the pressure in the mold before carbonization. On the contrary the micro pore depends on volatilization of the woody materials. Generally woody materials have 70 to 80 % volatilization during carbonization.

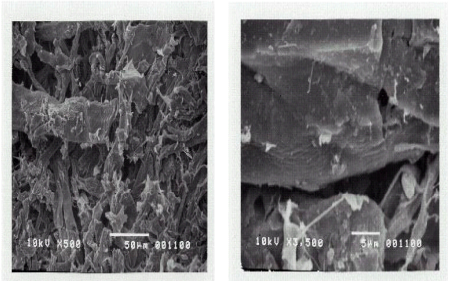

Photo 1 SEM IMAGE ×500 Photo 2 SEM IMAGE ×3500

SEM image of Carbon made from woody materials

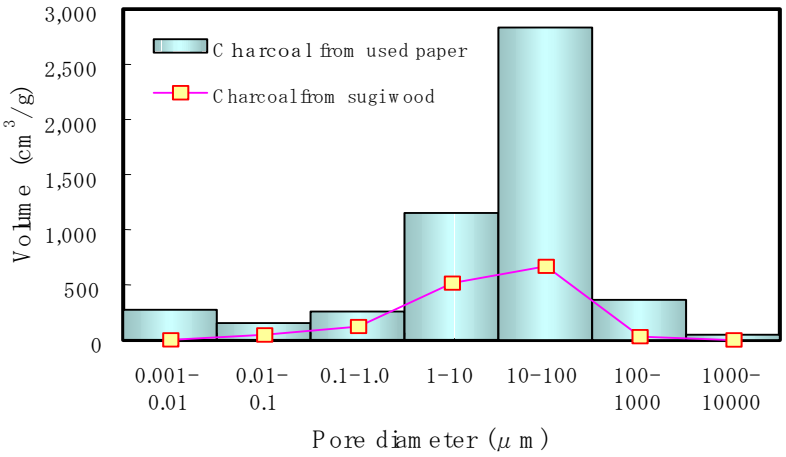

Fig.1 Pore distribution of carbon made from woody materials and traditional carbon

Fig.1 shows the distribution of pore in the carbon made from woody materials which is pressured in 20kgf/cm^2 and carbonizes at 800℃, compared with traditional charcoal made from wood. This carbon can be used for a seedbed, a flowerbed and a mycelia medium. Photo.3 shows pine tree gown up in this carbon made from woody materials without any soil.

Photo.3 Pine tree in this carbon

Carbon with high density or fewer pores made from woody materials can be also made. Woody materials are pulverized and pressed in the mold at about 180℃. The density of the carbon is about 1.10 g/ cm^3. This carbon is approximately equivalent to the traditional carbon with high density which is made from high density wood. This carbon is used for metallurgical reducing agents.

Carbon with pore size change in the specific direction can also be made. At first woody materials and phenol resin are co-carbonized. Phenol resin is about 50% volatilization, but woody materials are 75%. Also shrinkage temperature of resin and woody materials are different. When concentration of phenol resin is higher than woody materials, carbon made from this samples are large amount of pore volume after carbonization. Because stress strain makes pore produce. What is to make concentration distribution of phenol resin in the woody materials. Woody materials are purvalized, then put in a mold under pressure, make a cylindrical sample. This cylindrical sample is soaked partially in the liquid phenol resin. a capillary phenomena is used for making

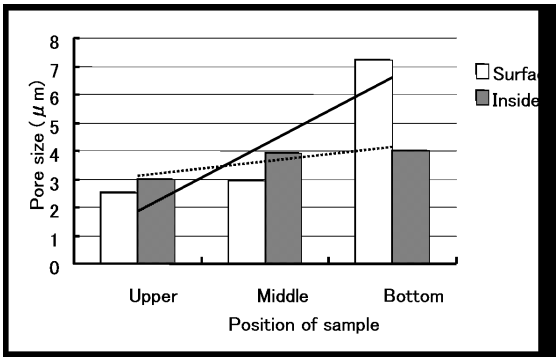

Fig.2 Pore change of this carbon

distribution of concentration of the resin. Fig. 2 shows pore of these carbons, upper side is less resin, under side is more resin, so upper side of carbon is less pore, compared with under part of carbon, because under part of carbon has more the resin. But surface and inside of carbon have different pore, inside of sample is less resin. Next woody materials are carbonized then resin is soaked, these samples are carbonized again. the result of pore of this carbon is shown in fig.3. Upper part of carbon has less pore than the under part of that. This carbon will be used for molecular sieve, sound proofing materials and so on.

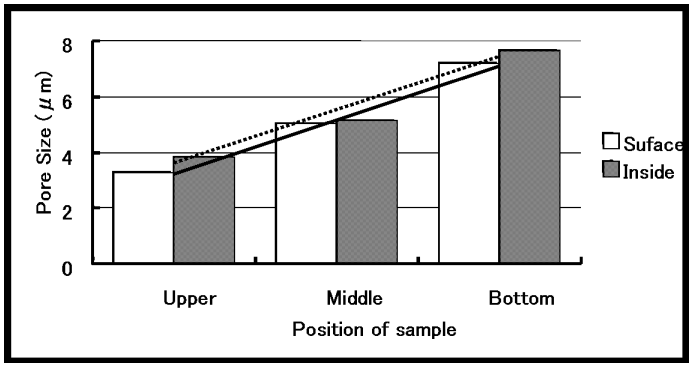

Fig.3 Pore change of this carbon

Conclusions

Pore of carbon from woody materials has two kinds. One is macro pore which is more than 1 μm, the other is micro pore. which is less 1 μm. This macro pore depend on the the pressure in the mold before carbonization。 Fig.3 Pore change

On the contrary the micro pore depends on volatilization of the woody materials. So the macro pore cab be controlled, but micro pore is depended on the raw materials. The application of these carbons made from woody materials is discussed.