"Science Stays True Here"
Biological and Chemical Research, Volume 2015, 161-164 | Science Signpost Publishing

Characterization of Activated Carbon From Kluwak Shell (*Pangium edule* Reinw)

Henny Rachdiati[1], Suryati[2,] Gustan Pari[3]

1. Faculty of Pharmacy and Health Science, Universiti Kuala Lumpur Royal College of Medicine Perak, No 3 Jalan Greentown 30450 Ipoh Perak Malaysia

2. Faculty of Pharmacy, Andalas University, Jl. Limau manis, Kecamatan Pauh, Sumatera Barat 25163, Indonesia.

3. Forestry Research and Development Agency,Jl. Gunung Batu No. 5, Bogor 16610, Indonesia

Received: February 01, 2014 / Accepted: February 26, 2015 / Published: April 25, 2015

Abstract: Characterization of activated carbon producing from kluwak shells have been conducted. Kluwak shell was activated by steaming at 60, 90, 120, 150 and 180 minutes. Furthermore, NaOH was added as activator at concentration 1% and 2%. Commercial activated carbon was used as a standard. The characteristic of activated carbon which were observed including ash content, adsorptive capacity towards benzene vapors, chloroform, carbon tetrachloride and formaldehyde and microscopic structure of activated carbon. The result showed that activated carbon without treatment with NaOH had an ash content less than 10%. Moreover, carbon content for all treated activated carbon and commercial activated carbon were 79.34 - 90.56%. The high absorptive capacity towards benzene and chloroform was shown by activated carbon which were steamed more than 120 minutes with value 14% and 21% respectively. Meanwhile, the high absorptive capacity towards formaldehyde was shown by activated carbon which were steamed more than 90 minutes with the value of 15%. All treated activated carbon showed to have higher absorptive capacity towards benzene vapors, chloroform, carbon tetrachloride and formaldehyde compared with commercial activated carbon. Scanning Electron Microscopy (SEM) showed that activated carbon had pores if they were carbonated in furnace at 500^0C.

Keywords: Activated Carbon, *Pangium edule* Reinw, kluwak shell, characterization

1. Introduction

Material which contains carbon and have porous structure can be used as raw material for activated carbon such as coconut shell and agricultural waste such as seed and hay (Sudrajat & Soleh, 1994). Keluwak shell is lignocelluloses which contains carbon with porous structure. Hardness of raw material could affect quality of the activated carbon. Hard material shows to have strong carbon bond and tight pores. They require longer time for activation in order to enlarge their pore structure. The pore size can be determined using Scanning Electron Microscope (SEM).

Some chemical agents such as NaOH, $ZnCl_2$, HCl and H_3PO_4 can be used to enlarge the pore size of the activated carbon. The selection of chemical agent and its concentration are dependent on the type of raw material

Corresponding author:

Henny Rachdiati, Faculty of Pharmacy and Health Science, Universiti Kuala Lumpur Royal College of Medicine Perak, No 3 Jalan Greentown 30450 Ipoh Perak Malaysia. E-mail: hennyrachdiati@unikl.edu.my / henny_rachdiati@yahoo.com.

used. The low concentration of chemicals used could be ineffective, while high concentration could damage in its pores structure (Pari, 2004).

The duration of activation time would also affect the percentage of yield. The longer of activation time will produce the small yield whereas short activation time would not maximize enlarge pores of activated carbon (Hudaya & Hartoyo, 1990). High quality of the activated carbon should fulfil some characteristic such as adsorptive capacity towards Iodine, benzene and methylene blue,and pore according required by Standard Nasional Indonesia (SNI).

2. Materials and Methods

Production of Activated Carbon

Method was adopted from Pari, (2004). Keluwak shell were washed and soaked in solution of NaOH 1% and 2% for 24 hours. It was then, dried under sunlight. After 24 hours, it was then carbonated in furnace at 5000 C for 5 hours, and followed by steaming for 60, 90, 120, 150 and 180 minutes at 8000 C and constant pressure (0.05 kg/cm2).

Ash Content (SNI 06-3730-1995)

Sample (2-3 g) was placed in tarred crucible dish, placed in furnace at 800-900ºC for two hours. Cooled and put in desiccators. Percent of Ash Content = A/B x 100% (A is weight of activated carbon, B is weight of raw material).

Adsorptive Capacity towards Benzene vapor, Chloroform, Carbon Tetrachloride and Formaldehyde (SNI 06-3730-1995)

1 g of activated charcoal (passes 60 mesh, oven dried) into exicator that has been saturated with benzene vapor for 24 hours, activated charcoal is weighed again.

Adsorptive Capacity= (A-B)/A x 100% (A is weight of activated charcoal after adsorbing, B is weight of activated charcoal before absorbing).

Microscopic Structure of Activated Carbon

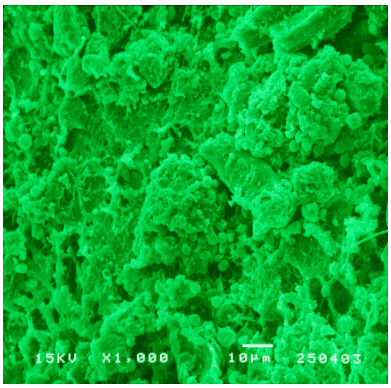
Samples were placed in gold coated container, observed under Electron Microscope.

3. Results and Discussion

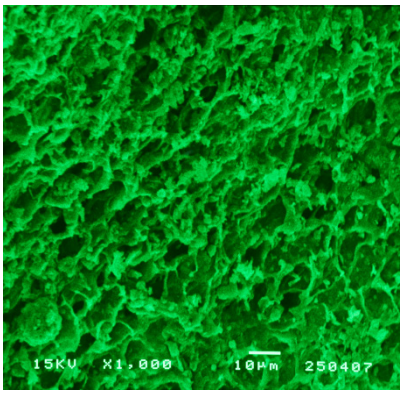
Table 1

Parameter	Treatment															
	60% (steam)			80% (steam)			120% (steam)			150% (steam)			180% (steam)			Commercial
	0%	1%	2%	0%	1%	2%	0%	1%	2%	0%	1%	2%	0%	1%	2%	charcoal
Absorptive capacity toward Benzene (%)	5	7.3	13	9.5	8.3	15	20	18	17	26	17	20	29	25	16	14
Absorptive capacity toward $CHCl_3$ (%)c	8.8	7.7	17	15	21	21	28	30	20	46	33	22	47	37	24	21
Absorptive capacity toward Formaldehyde (%)λ	11	18	26	16	21	33	30	42	45	38	37	49	39	47	45	15
Absorptive capacity toward CCl_4 (%)η	6.8	9.4	12	14	15	20	28	34	18	37	27	26	46	34	21	4
Ash content (%)	4.2	6.2	8.9	4.8	7.4	10	4.3	10	11	6	12	12	4.9	11	10	4.2

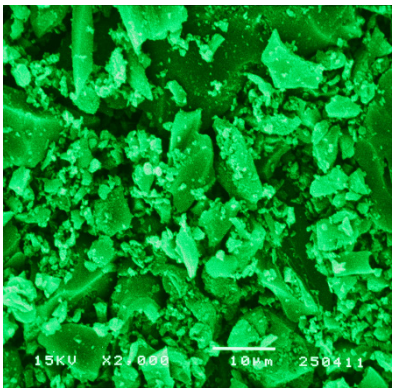
Table 1 shows that activated carbon have high absorptive capacity towards benzene and chloroform if they were steamed more than 120 minutes. Meanwhile, the high absorptive capacity towards formaldehyde was shown by activated carbon which were steamed more than 90 minutes. According to Standard Nasional Indonesia (SNI), there is no value which should be fulfilled in terms of adsorptive capacity towards benzene, chloroform, formaldehyde and carbon tetrachloride. However, all treated activated carbon showed to have higher absorptive capacity towards benzene vapors, chloroform, carbon tetrachloride and formaldehyde compared with commercial activated carbon.



a. Kluwak cells



b. Charcoal of kluwak



c. Activated charcoal of kluwak

Fig. 1

Scanning Electron Microscopy (SEM) showed that activated carbon had pores if they were carbonated in furnace at 500ºC (Figure 1c). During the activation, the pores of charcoal were enlarged from 2 m2/g to 300-2000 m2/g (Sudradjat dan Soleh, 1994). Beukens *et al* (1985) in Pari (2004) stated that macro pores have a size more than 0.025 micrometer. From the SEM data showed that pores size of activated carbon of kluwak are more than 0.025 micrometer.

4. Conclusion

From this study can be concluded that activated carbon which are activated by steaming more than 120 minutes with or without treatment with NaOH have high adsorptive capacity toward benzene, chloroform, formaldehyde and carbon tetrachloride. Microscopic observation under SEM showed that activated charcoal of keluwak shell have a pore size more than 0.025 micrometer.

Acknowledgments

Forestry Research and Development Agency, Jl. Gunung Batu No. 5, Bogor 16610, Indonesia

University of Nusa Bangsa Bogor Indonesia

References

[1]. Hartoyo, dkk. 1990. Pembuatan Arang Aktif dari Tempurung Kelapa dan Kayu Bakau Dengan Cara Aktivasi Uap. Jurnal Penelitian Hasil Hutan. Bogor.

[2]. Hudaya, N dan Hartoyo. 1990. Pembuatan Arang Aktif Dari Tempurung Biji-Bijian Asal Tanaman Hutan dan Perkebunan. Jurnal Penelitian Hasil Hutan. Bogor.

[3]. Pari, G. 1996. Kualitas Arang Aktif Dari 5 Jenis Kayu. Buletin Penelitian Hasil Hutan. Bogor.

[4]. Pari, G. 2004. Kajian Struktur Arang Aktif Dari Serbuk Gergaji Kayu Sebagai Adsorben Emisi Formaldehida Kayu Lapis. Tesis. Sekolah Pasca Sarjana Institut Pertanian Bogor, Bogor.

[5]. Sudradjat, R dan S, Soleh. 1994. Petunjuk Teknis Pembuatan Arang aktif. Bagian proyek Litbang Pemanfaatan Hasil Hutan. Pusat Penelitian dan Pengembangan Kehutanan. Bogor.

[6]. Syarief, N. 1997. Pembuatan dan Uji kualitas Arang AktifAsal Tandan Kelapa Sawit. Skripsi. Universitas Nusa Bangsa. Bogor.

[7]. Tim Penyusun SNI. 1995. Standar Nasional Indonesia 06-3730-1995. Badan Standardisasi Nasional. Jakarta.