

# CHARCOAL FROM PALM KERNEL SHELLS (HOLLOW PLINTH CARBONISATION FURNACE SYSTEM)

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**M**alaysia exports activated carbon to markets such as Japan (31%), Italy (15%) and the United Kingdom (11%) (Roskill, 2003). From the large number of small activated carbon producers in Malaysia, a total production of about 20 000 t yr<sup>-1</sup> has been reported. The demand for activated carbon is forecast to rise by 3%-5% per year in industrialised countries, with the growth in Asian countries projected at 10% per year. There are numerous applications for activated carbon, and some of these are listed in *Table 1*.

The main raw material used for making activated carbon is coconut shell charcoal that is produced domestically. However, it was reported that this supply is depleting as a result of the conversion of coconut planting areas to oil palm plantations. The activated carbon industry is now importing coconut shell charcoal from Indonesia and the Philippines, and the price is increasing. Therefore, there has been some gradual shift in focus towards using oil palm shells as raw material for the production of charcoal and activated carbon, especially for granulated activated carbon. The main concerns in charcoal production are getting a good quality charcoal with higher yield, and using a process which is cost-effective, as well as environmental friendly.

TABLE 1. APPLICATIONS OF ACTIVATED CARBON FOR GASES AND LIQUIDS

Gas	Liquid
Industrial gas purification	Municipal water treatment
CO <sub>2</sub> purification in breweries and manufacture of carbonated drinks	Industrial waste water treatment De-chlorination in breweries
Industrial and military gas masks	Purification of alcohol
Removal of radioactive gases in nuclear plants	Desalination plants
Chemical warfare protective clothing	Portable water filters
Air purification in aircraft and submarines	Aquarium filters
Preservation of fruits and vegetables	Kidney machines
Refrigerator odour removers	Purifying electroplating solutions
Air conditioners and air cleaners	De-colourisation of solutions and chemicals
Pharmaceutical applications	Oil removal from condensate
Laboratory uses	Recovery of gold from ore
Cooker hoods and laboratory fume hoods	Purification of used dry cleaning solvents
Cigarette filters	
Solvent recovery	

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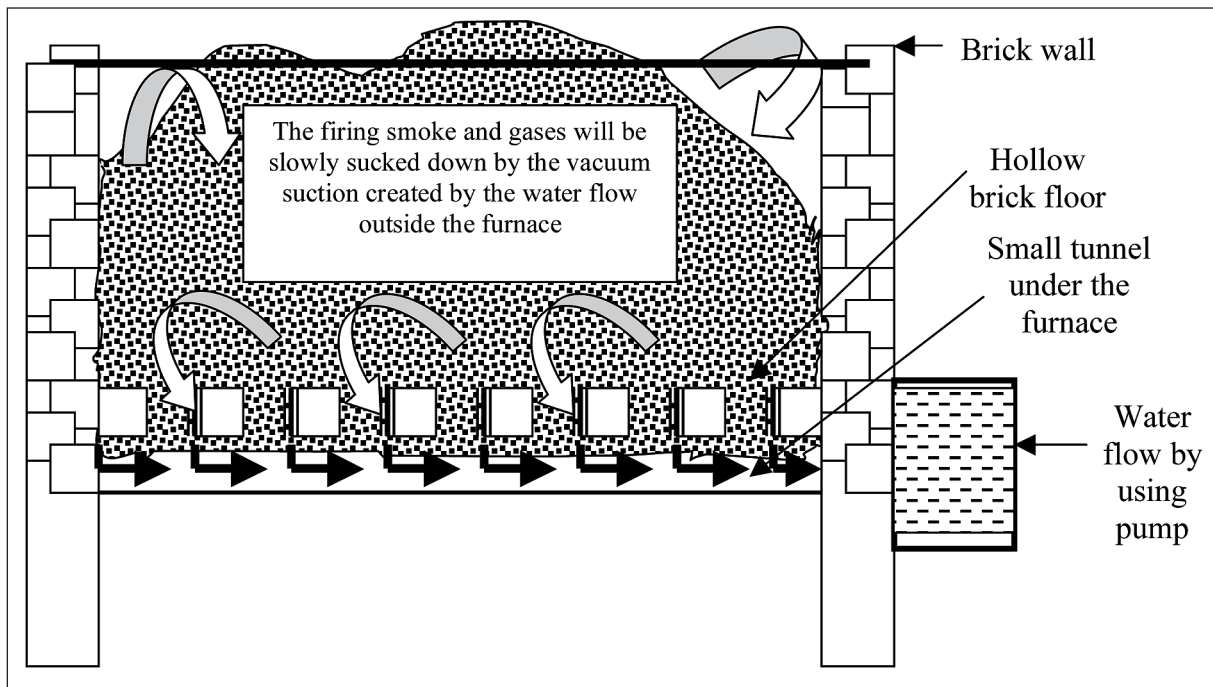


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## DESCRIPTION OF SYSTEM

The system that we are introducing is a low-cost brick furnace system. It comprises a 3 m x 3 m brick furnace which has a series of small tunnels under the floor to provide the airways for suctioning out of smoke during the carbonisation process. *Figure 1* illustrates the system: The vacuum condition in the system is created by the suction effect of the burning palm shells at the

bottom as well as from the suction pump. The suction of smoke from the bottom reduces the emission of smoke to the environment; at the same time the smoke is channeled into a scrubber to be treated. The treated smoke flows out from the scrubber and out through a 9 m chimney, complying with the allowable smoke emission standard imposed by the Department of Environment (*Figure 2*).



*Figure 1. Brick furnace carbonisation system.*



(a) Building the system

(b) Input of raw material

(c) Carbonisation

*Figure 2. The system and the carbonisation process.*

**TABLE 2. A SIMPLIFIED ECONOMIC CALCULATION FOR THE PROCESS OF CARBONISING OIL PALM SHELLS ON A PER MONTH BASIS**

Activity	Cost (RM)
Cost of the system (investment)	56000.00
Raw material @ RM 150.00 t <sup>-1</sup> (7 carbonisation runs per month)	10500.00
Transportation of raw material (RM 200.00/10 t)	1400.00
Electricity	700.00
Water usage	100.00
Labour cost (2 persons) @ RM 22.00/day	1320.00
<b>Total production cost</b>	<b>14020.00</b>
Production of the charcoal: = $32/100 \times 70$ t = 22.4 t (amount of charcoal produced)	625.89
Charcoal cost of production per tonne: = Total production cost/tonne charcoal produced per month = RM 14020.00/22.4 = RM 625.89	
Charcoal market price (t)	780.00
Profit per month: = RM 780.00 - RM 625.89 $\times$ 22.4 t = RM 3452.06	3452.06
Payback period: = Total investment/average profit per month = RM 56 000.00/RM 3452.06 = <b><u>16.22 months</u></b>	

### ECONOMIC ANALYSIS

The system can carbonise 10 t of oil palm shells per run of three days, and gives a yield of 32% charcoal. At seven runs of carbonisation per month, the payback period of this system is about 16.22 months (*Table 2*).

### REFERENCE

ROSKILL INFORMATION SERIES, LTD. (2003). *The Economic of Activated Carbon*. Global Information, Inc., USA

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