

Palm Oil Mill Carbon Dioxide Production Rate: Ready Reckoner, Chart and Equation

N Ravi Menon*

Based on the carbon to carbon dioxide ratio of 5.53: 1 kg of carbon dioxide, an attempt is made to co-relate carbon to the actual raw fuel needed to produce 1 kg of carbon dioxide at

different proportions of mesocarp fibre and palm kernel shell. This to help the millers to compute the good carbon dioxide which their mills are producing using renewable energy.

$$C = 0.2923 A, \quad D = 5.53 - 0.29A, \quad B = (5.53 - 0.29A)/0.53, \quad E = A + B$$

A and B give proportions. The same are given as percentages under A/E % and B/E % for easy reference.

A (kg)	C (kg)	D (kg)	B (kg)	E (A+B)	A/E (%)	B/E (%)	A/E + B/E (%)	Carbon (kg)	CO ₂
1	0.2923	5.2377	10.28	10.57	2.77	97.23	100.00	5.53	1
2	0.5846	4.9454	9.70	10.29	5.68	94.32	100.00	5.53	1
3	0.8769	4.6531	9.13	10.01	8.76	91.24	100.00	5.53	1
4	1.1692	4.3608	8.56	9.73	12.02	87.98	100.00	5.53	1
5	1.4615	4.0685	7.98	9.45	15.47	84.53	100.00	5.53	1
6	1.7538	3.7762	7.41	9.16	19.14	80.86	100.00	5.53	1
7	2.0461	3.4839	6.84	8.88	23.03	76.97	100.00	5.53	1
8	2.3384	3.1916	6.26	8.60	27.19	72.81	100.00	5.53	1
9	2.6307	2.8993	5.69	8.32	31.62	68.38	100.00	5.53	1
10	2.9230	2.6070	5.12	8.04	36.36	63.64	100.00	5.53	1
11	3.2153	2.3147	4.54	7.76	41.45	58.55	100.00	5.53	1
12	3.5076	2.0224	3.97	7.48	46.92	53.08	100.00	5.53	1
13	3.7999	1.7301	3.40	7.19	52.81	47.19	100.00	5.53	1
14	4.0922	1.4378	2.82	6.91	59.19	40.81	100.00	5.53	1
15	4.3845	1.1455	2.25	6.63	66.11	33.89	100.00	5.53	1
16	4.6768	0.8532	1.67	6.35	73.64	26.36	100.00	5.53	1
17	4.9691	0.5609	1.10	6.07	81.87	18.13	100.00	5.53	1
18	5.2614	0.2686	0.53	5.79	90.89	9.11	100.00	5.53	1
18.5	5.4076	0.12245	0.24	5.65	95.75	4.25	100.00	5.53	1

* Malaysian Palm Oil Board, 6, Persiaran Institusi,
Bandar Baru Bangi, 43000 Kajang, Selangor, Malaysia.
E-mail: nravi@mpob.gov.my



Basis: 1 kg of dry mesocarp contains 0.46396 kg of carbon and for shell 0.57909 kg of carbon. When converted to the raw mesocarp and shell at 37% and 12% moisture respectively, becomes 1.5873 kg and 1.13636 kg of the same carbon. The carbon per kg of the raw material will be (0.46396/1.5873) 0.2923 kg and (0.57909/1.13636) 0.5096 kg, respectively.

The equation relating this to the required carbon can be written as:
 $0.2923 A + 0.5096 B = 5.53$ (where, A and B are proportions of mesocarp fibre and palm kernel shell). We may assign different values for A and compute the corresponding values for B to satisfy the equation. For any value of A , the corresponding value of B

$$= \frac{5.53 - (0.29 \times A)}{0.53}$$

A general formulae for carbon dioxide emission may be derived as follows:

$$0.2923 A \text{ kg fibre} + 0.5096 B \text{ kg shell} = 5.53 \text{ kg carbon} = 1 \text{ kg carbon dioxide.}$$

where, A and B represent the proportion of fibre and shell in the fuel mixture. The A/E and B/E give the same proportions in percentages. *e.g.* when $A=16$, $B=1.67$, *i.e.* 73.64% and 23.36%, respectively.

Fibre and shell proportions need for combustion to give constant CO_2 emission in a palm oil mill boiler furnace.