



LAMPIRAN 1

CHEMICAL AND PHYSICAL PROPERTIES OF STAINLESS STEEL

	304	430	410	
Chemical Composition	(Austenitic)	(Ferritic)	(Martenic)	
(Max. unless otherwise noted)				
Carbon	0.08	0.12	0.15	
Manganese	2.00	1.00	1.00	
Phosphorus	0.045	0.04	0.04	
Sulfur	0.03	0.03	0.03	
Silicon	1.00	1.00	1.00	
Chromium	18.00 -20.00	16.00 -18.00	11.5 -13.50	
Nickel	8.00 -10.50			
Tensile Strength				
	Ksi	84	75	70
	MPa	579	517	483
Yield Strength (0.2% offset)				
	Ksi	42	50	45
	MPa	290	345	310
Elongation (in 2" / 50.8 mm)				
	%	55	25	25
Hardness (Rockwell)				
		B80	B85	B80
Modulus of Elasticity in Tension				
	psi x 10 to the 6	28	29	29
	GPa	193	200	200
Modulus of Elasticity in Torsion				

	psi x 10 to the 6	12.5		
	GPa	86.2		
Density				
	lbs/cubic in	0.29	0.28	0.28
	kg/cubic meter	8060	7780	7780
Specific Heat				
	Btu/lb/F	0.12	0.11	0.11
32-212°F (0-100°C)	J/kg.k	503	460	460
Thermal Conductivity				
	Btu/hr/ft/F			
	212°F (100°C)	9.4	15.1	14.4
	932°F (500°C)	12.4	15.2	16.6
	W/m.K			
	212°F (100°C)	16.2	26.1	24.9
	932°F (500°C)	21.5	26.3	28.7
Mean Coefficient of Thermal Expansion				
x10 to -6/F	32-212°F (0-100°C)	9.6	5.8	5.5
	32-600°F (0-315°C)	9.9	6.1	6.3
	32-1000°F (0-538°C)	10.2	6.3	6.4
	32-1200°F (0-648°C)	10.4	6.6	6.5
	32-1800°F (0-982°C)		6.9	
x10 to -6/C	32-212°F (0-100°C)	17.3	10.4	9.9
	32-600°F (0-315°C)	17.9	11	11.4
	32-1000°F (0-538°C)	18.4	11.4	11.6
	32-1200°F	18.8	11.9	11.7

	(0-648°C)			
	32-1800°F (0-982°C)		12.4	
Melting Point				
	F	2550 -2650	2600 -2750	2700 -2790
	C	1400 -1455	1425 -1510	1485 -1535
Electrical Resistivity				
Microhm - mm	Type 304	Type 430	Type 410	S13800
68°F (20°C)	720	600	570	1020
212°F (100°C)	780	675	640	
392°F (200°C)	860	770	720	
752°F (400°C)	1000	925	880	
1112°F (600°C)	1110	1050	1035	
1472°F (800°C)	1210	1150	1110	
1652°F (900°C)	1260			

LAMPIRAN 2

Physical Properties of Copper:

- Malleable and Ductile
- Excellent Electrical Conductor
- Excellent Alloying Characteristics
- Non-Magnetic
- Essential Nutrient to Life
- Resistant to Corrosion
- Machinable
- Formable
- Excellent Heat Transfer Characteristics
- Durable
- Recyclable

Specific Properties of Copper:

- Chemical Symbol : Cu
- Atomic Number : 29
- Atomic Weight : 63.54
- Density : 8960 kg m⁽⁻³⁾
- Melting Point : 1356K
- Specific Heat at 293K : 0.383kJkg⁽⁻¹⁾K⁽⁻¹⁾
- Thermal Conductivity : 394W m⁽⁻¹⁾ K⁽⁻¹⁾
- Electrical Conductivity (%International Annealed Copper Standard): 100%
- Electrical Resistivity : 1.673x10⁽⁻⁸⁾ ohm-m
- Crystal Structure : Face Centered Cubic

LAMPIRAN 3

Pengujian mutu arang aktif dimaksudkan untuk mengetahui kemampuan arang aktif agar dapat berfungsi sebagaimana mestinya. Pengujian mutu arang aktif meliputi :

- Penentuan bagian yang hilang pada pemanasan 950 °C.
- Penentuan kadar air.
- Penentuan kadar abu.
- Daya serap terhadap larutan I₂.

Menurut SII, arang aktif yang baik mempunyai persyaratan seperti yang tercantum pada tabel berikut ini:

Tabel 3.1. Persyaratan Arang Aktif Menurut SII No.0258 -79

JENIS	PERSYARATAN
Bagian yang hilang pada pemanasan 950 °C	Maksimum 15%
Air	Maksimum 10%
Abu	Maksimum 2,5%
Bagian yang tidak diperarang	Tidak nyata
Daya Serap terhadap larutan I	Minimum 20%

Adapun komposisi kimia yang terkandung dalam karbon aktif berdasarkan analisa dari beberapa jenis Arang aktif dapat dilihat pada tabel berikut.

Tabel 3.2. Analisa Dari Beberapa Jenis Arang Aktif

JENIS	PERSEN (%0				ABU
	C	H	S (ORGANIK)	S (ANORGANIK)	
A	88,4	7,8	0,08	0,12	3,2
B	94,4	1,1	-	0,04	3,3
C	91,7	1,7	0,02	0,05	3,2
D	95,3	0,6	0,19	0,43	1,2
E	87,5	2,2	0,12	0,04	2

LAMPIRAN 4

Methanol Properties

Melting Point	: -97.7 0C
Boiling Point	: 65 0C
Relative Density	: 0.79
Formula	: CH3OH
Molecular weight	: 32.042 kg/kmol
Heat of Formation	: -201.3 MJ/kmol
Gibbs Free Energy	: -162.62 MJ/kmol
Freezing point	: -97.7 °C
Boiling point	: 64.6 °C (at atmospheric pressure)

Critical properties:

Critical temperature	= 512.6 K
Critical pressure	= 81 bar abs
Critical volume	= 0.118 m ³ /kmol

Liquid Properties:

Density	= 791 kg/m ³ at 20 °C
Heat of Vaporization	= 35278 kJ/kmol

Viscosity:

$$a = 555.3 \quad b = 260.6$$
$$\text{where } \log(\text{viscosity}) = a * (1/T - 1/b)$$

viscosity: mNs/m² T = °K

Vapor Properties:

Heat capacity:

$$a = 21.152 \quad b = 0.07092 \quad c = 2.59E-05 \quad d = -2.85E-08$$

$$\text{where } C_p = a + b*T + c*T^2 + d*T^3$$

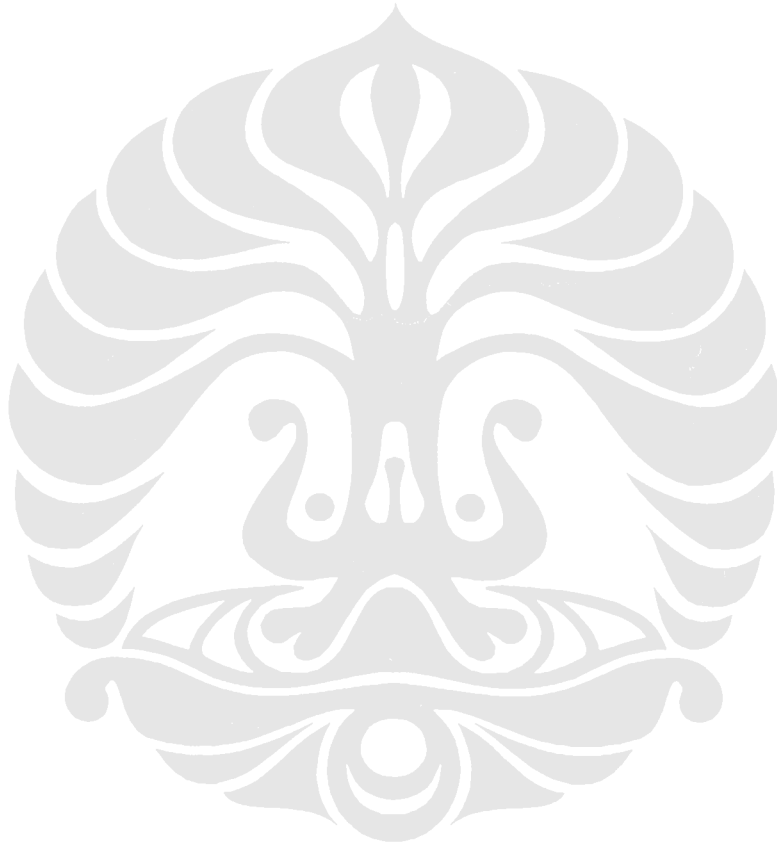
Cp: kJ/kmol.K T: °K

Vapour pressure:

$$a = 18.5875 \quad b = 3626.55 \quad c = -34.29$$

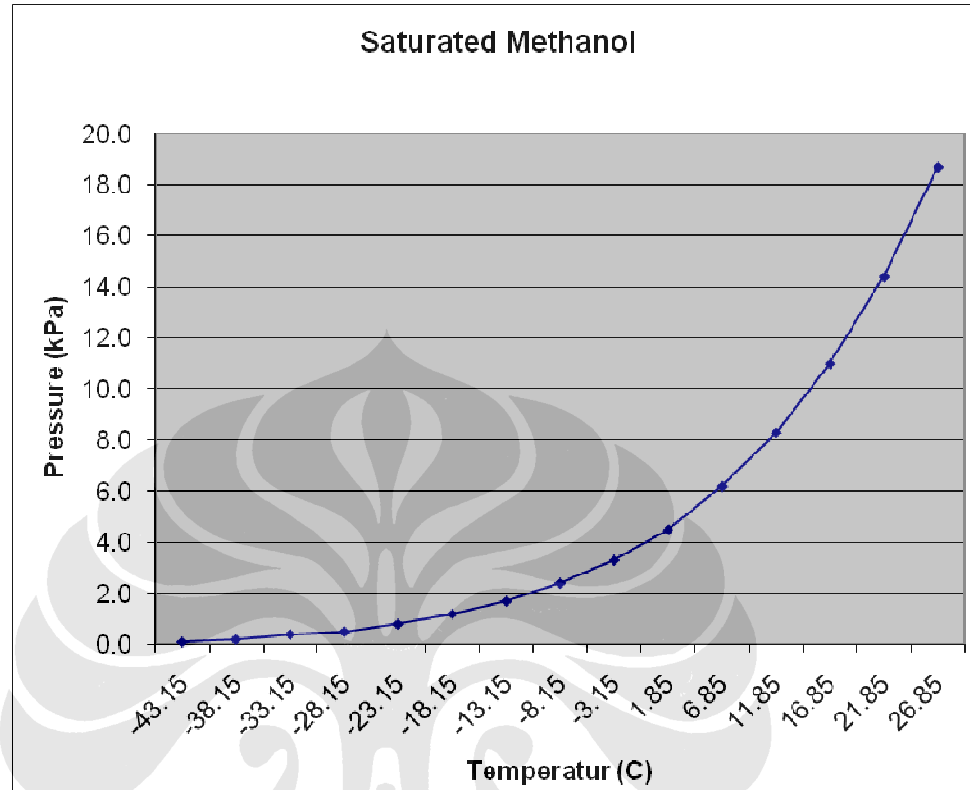
$$\text{where } \ln(P) = a - \frac{b}{(T+c)} \quad P : \text{ mmHg}; \quad T = ^\circ\text{K}$$

within range -16 to 91°C



LAMPIRAN 5

Grafik Saturasi Metanol



LAMPIRAN 6

Tabel Kalor Spesifik dan Kalor Laten

Material	Kalor Spesifik C_p (kJ/Kg·K)	Kalor Laten L_e (kJ/Kg)
Karbon Aktif	900	
Stainless steel	902	
Air	4180	
Metanol	750	1102



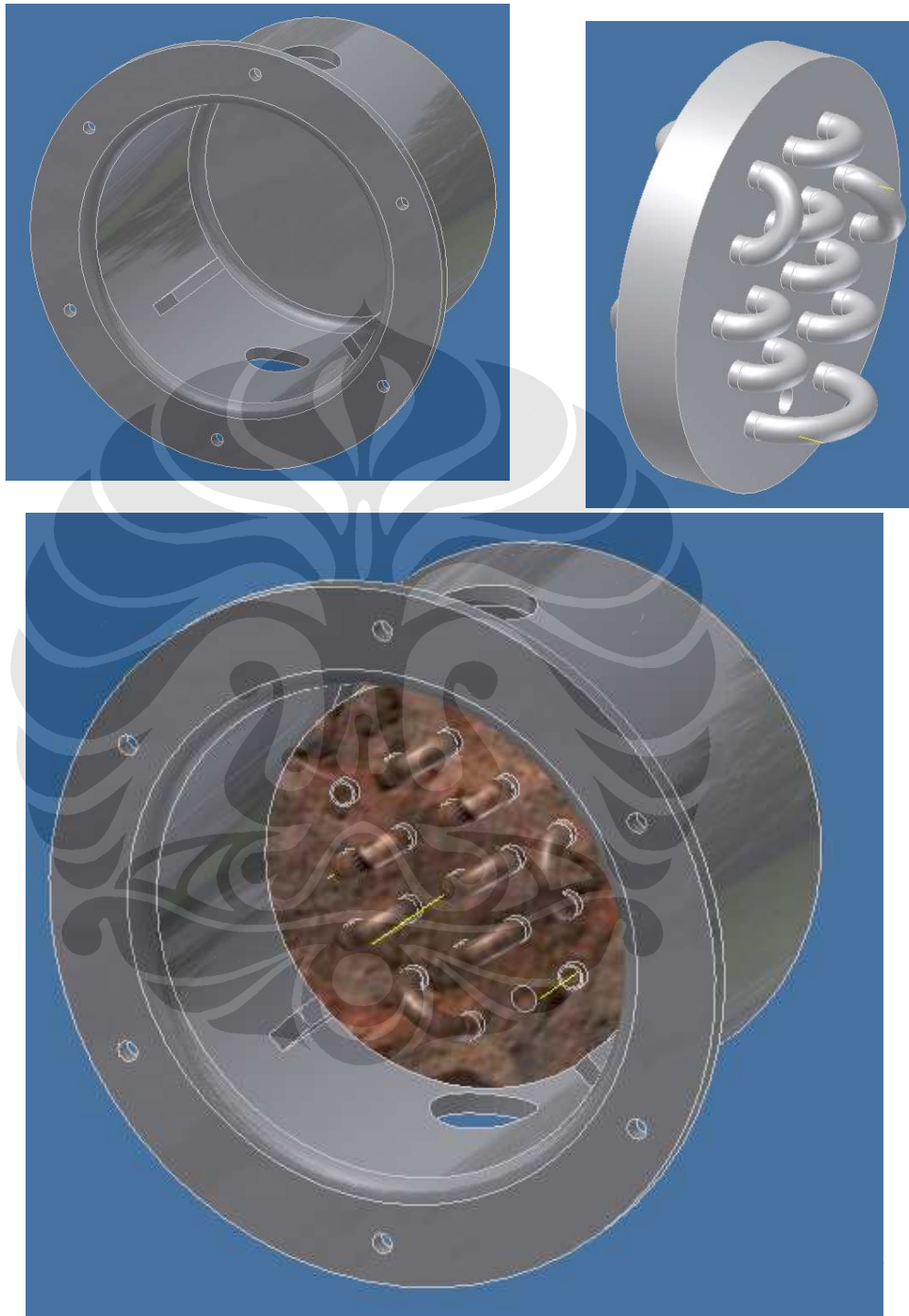
LAMPIRAN 7

Palm Oil Properties

TECHNICAL INFORMATION					
PALM OIL PROPERTIES					
Tempdeg. C	ViscositymPas	Heat Capacity KJ/kg-C	Conductivity W/m-C	Density kg/m3	ViscositycST
20	106.8	1.848	0.1726	890.1	119.99
25	77.19	1.861	0.1721	887.5	86.97
30	57.85	1.875	0.1717	885	65.37
35	44.68	1.888	0.1712	882.5	50.63
40	35.41	1.902	0.1708	880	40.24
45	28.68	1.916	0.1704	877.5	32.68
50	23.68	1.93	0.1699	875.1	27.06
55	19.88	1.944	0.1695	872.6	22.78
60	16.93	1.959	0.1691	870.2	19.46
65	14.61	1.973	0.1687	867.8	16.84
70	12.75	1.988	0.1683	865.4	14.73
75	11.23	2.003	0.1679	863.1	13.01
80	9.99	2.018	0.1675	860.7	11.61
85	8.955	2.034	0.1671	858.4	10.43
90	8.087	2.049	0.1668	856.1	9.45
95	7.351	2.065	0.1664	853.8	8.61
100	6.721	2.081	0.166	851.6	7.89
105	6.179	2.097	0.1657	849.3	7.28
110	5.709	2.113	0.1653	847.1	6.74
115	5.298	2.129	0.165	844.9	6.27
120	4.937	2.146	0.1646	842.7	5.86
130	4.335	2.179	0.164	838.4	5.17
135	4.083	2.197	0.1636	836.3	4.88
140	3.857	2.214	0.1633	834.2	4.62
145	3.653	2.231	0.163	832.1	4.39
150	3.469	2.249	0.1627	830	4.18
155	3.302	2.267	0.1624	828	3.99
160	3.151	2.284	0.1621	825.9	3.82
165	3.012	2.303	0.1618	823.9	3.66
170	2.885	2.321	0.1615	821.9	3.51

175	2.769	2.339	0.1613	819.9	3.38
180	2.662	2.358	0.131	818	3.25
185	2.563	2.377	0.1607	816.1	3.14
190	2.471	2.396	0.1605	814.1	3.04
195	2.387	2.415	0.1602	812.2	2.94
200	2.308	2.434	0.16	810.4	2.85
205	2.234	2.454	0.1597	808.5	2.76
210	2.166	2.473	0.1595	806.7	2.69
215	2.102	2.493	0.1693	804.9	2.61
220	2.042	2.513	0.1591	803.1	2.54
225	1.986	2.533	0.1589	801.3	2.48
230	1.933	2.554	0.1586	799.5	2.42
240	1.836	2.595	0.1582	796.1	2.31
245	1.792	2.616	0.1581	794.4	2.26
250	1.751	2.637	0.1579	792.7	2.21
255	1.711	2.658	0.1577	791	2.16
260	1.674	2.68	0.1575	789.4	2.08
275	1.572	2.745	0.157	784.6	2.00
280	1.542	2.767	0.1569	783	1.97
285	1.513	2.789	0.1568	781.5	1.94
290	1.485	2.812	0.1566	779.9	1.90
295	1.459	2.834	0.1565	778.4	1.87
300	1.434	2.857	0.1564	776.9	1.85

LAMPIRAN 8
Gambar Desain Adsorber Baru





Activated Carbon DGF 8 x 30 AW

Granulated activated Carbon with a main grain diameter of 1 to 2 mm

Product-Description

G A C from Type DGF are produced by steam activation from de-ashed hard coal. The raw material hard-coal and a special manufacturing process will allow a thermal reactivation of the spent activated carbon with minor mass losses. The reactivated carbon will obtain the full adsorption capacity of the original activated carbon.

Typical Properties

Bulk density	[kg/m ³]	450 ± 30
Moisture (as packed)	[wt-%]	< 2,0
Surface area (BET)	[m ² /g]	1050 ± 50
Ash content	[wt-%]	< 8,0
Iodine No.	[mgJ ₂ /g]	>1000
Hardness/ abrasion no.	[ASTM]	>95
Pore volume	[ml/g]	0.8
M.B. value	[mg/g]	>240
Mesh size	[US]	8 x 30
CTC	[wt-%]	63 ± 3
Benzene capacity at 20°C	[wt-%]	
p/p _S =0,9*		39± 2
p/p _S =0,1		34 ± 2
p/p _S =0,01		24 ± 2
p/p _S =0,001		16 ± 2

(*p/p_S = relative saturation/at 20°C = 324 g/m³)

The typical properties are the average of analysis !

