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# Appendix A



## Test Report

SAMPLE NOT DRAWN BY SGS INDIA PVT. LTD.

Report No : CG16-013423.001

Print Date : 30/06/2016

JOE No : CG16-013423

Report Control No : CGR0000570437  
 Sample described by customer as : WOOD CHIPS

Customer Name : SGS LANKA (PVT) LIMITED  
 Customer Address : 1ST FLOOR, 140, VAUXHALL STREET  
 City : COLOMBO  
 Postal Code : 2  
 Country : SRILANKA  
 Sample Type : WOOD CHIPS  
 Received : 22/06/2016  
 Sample Qty. Recd. : 1kg  
 SGS Internal No. : 7660016003  
 Test Start : 22/06/2016  
 Test End Date : 30/06/2016

Test/Parameter	Method	Result	Unit
Total Moisture	ASTM D2961 : 11	36.70	% (w/w)
Ash (on dry basis)	ASTM D3174 : 12	1.47	% (w/w)
Ash (as received basis)	ASTM D3174 : 12	0.93	% (w/w)
Volatile matter (on dry basis)	ASTM D 3175 : 11	81.28	% (w/w)
Volatile matter (as received basis)	ASTM D 3175 : 11	51.45	% (w/w)
Fixed carbon (on dry basis)	ASTM D3172 : 13	17.25	% (w/w)
Fixed carbon (as received basis)	ASTM D3172 : 13	10.92	% (w/w)
Gross calorific value (on dry basis)	ASTM D5865 : 13	4753	kcal/kg
Gross calorific value (as received basis)	ASTM D5865 : 13	3009	kcal/kg
Sulphur (as received basis)	ASTM E 775- 87, Reaff:2008	0.03	% (w/w)
Sulphur (on dry basis)	ASTM E 775- 87, Reaff:2008	0.04	% (w/w)
Carbon (on dry basis)	ASTM D5373 : 2014	48.74	% (w/w)
Carbon (as received basis)	ASTM D5373 : 2014	30.85	% (w/w)
Hydrogen (on dry basis)	ASTM D5373 : 2014	6.97	% (w/w)
Hydrogen (as received basis)	ASTM D5373 : 2014	8.52	% (w/w)
Nitrogen (on dry basis)	ASTM D5373 : 2014	0.35	% (w/w)
Nitrogen (as received basis)	ASTM D5373 : 2014	0.22	% (w/w)
Sulphur (as received basis)	ASTM D5373 : 2014	0.03	% (w/w)
Sulphur (on dry basis)	ASTM D5373 : 2014	0.04	% (w/w)
Ash (on dry basis)	ASTM D5373 : 2014	1.47	% (w/w)
Ash (as received basis)	ASTM D5373 : 2014	0.93	% (w/w)
Oxygen (as received basis)	ASTM D3176 : 2015	59.45	% (w/w)
Oxygen (on dry basis)	ASTM D3176 : 2015	42.43	% (w/w)

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## Test Report

SAMPLE NOT DRAWN BY SGS INDIA PVT. LTD.

Report No : CG16-013423.003

Print Date : 30/06/2016

JOE No : CG16-013423

Report Control No : CGR0000570437

Test/Parameter	Method	Result	Unit
Silica (as SiO <sub>2</sub> )	ASTM C : 114 - 2013	87.90	% (w/w)
Aluminum (as Al <sub>2</sub> O <sub>3</sub> )	ASTM D : 6349 - 2013	1.61	% (w/w)
Iron (as Fe <sub>2</sub> O <sub>3</sub> )	ASTM D : 6349 - 2013	1.30	% (w/w)
Calcium (as CaO)	ASTM D : 6349 - 2013	1.41	% (w/w)
Magnesium (as MgO)	ASTM D : 6349 - 2013	0.79	% (w/w)
Sodium (as Na <sub>2</sub> O)	ASTM D : 6349 - 2013	0.07	% (w/w)
Manganese (as MnO)	ASTM D : 6349 - 2013	0.07	% (w/w)
Potassium (as K <sub>2</sub> O)	ASTM D : 6349 - 2013	1.47	% (w/w)
Sodium (as Na)	ASTM D : 6349 - 2013	0.05	% (w/w)
Titanium (as TiO <sub>2</sub> )	ASTM D : 6349 - 2013	0.27	% (w/w)
Phosphorous (as P <sub>2</sub> O <sub>5</sub> )	ASTM D : 6349 - 2013	1.39	% (w/w)
Sulphur trioxide (as SO <sub>3</sub> )	ASTM C : 114 - 2013	0.773	% (w/w)

Per pro SGS India Private Ltd

L\_SIVAKUMAR  
Authorized Signatory

\*\*\*\*End of Report\*\*\*\*

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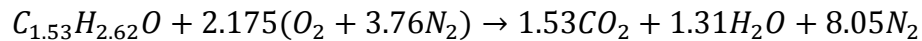
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## Appendix B

### Stoichiometric air and gasification air flow rate calculation

Required air flow rate calculation should be done according to biomass formulas developed based on analysis report and assume that nitrogen is leaving without reaction. Balanced Stoichiometric equations for all biomass materials are as following

Rubber Wood



Stoichiometric air required is calculated as for Rubber wood.

Molecular weight of rubber wood = 36.98 g

$$\text{Oxygen-Fuel mass ratio} = \frac{2.175 \times 32}{1 \times 36.98} = 1.88 \text{ kg of oxygen /kg of fuel}$$

Oxygen in air by mass percent is 21 so we need

$$1.88 \times \frac{100}{21} = 8.96 \text{ kg of air /kg of feed}$$

$$\text{Airflowrate} = \frac{ER \times FCR \times \text{Stoichiometricairfuelratio}}{\rho_{\text{of air}}}$$

Air flow rate for different ER

ER	Air flow rate kg/hr	Air flow rate lb/hr
0.2	8.6	18.92
0.25	10.75	23.65
0.3	12.9	28.38
0.35	15.05	33.1