



# SGS - FAME EN 14214

*Biofuel B100 – October 28, 2020*



Biofuel is a form of renewable energy derived from a wide range of biomass-based products. There are currently two main forms: bioethanol and Fatty Acid Methyl Ester (FAME). The FAME is produced by extracting vegetable oil from various plants; such as switchgrass, and then esterifying it.

The FAME is blended with gasoline and diesel to produce biofuels, which can be used in unmodified engines.

In November 2020, the independent and accredited laboratory SGS analyzed a sample of pure bio-heating oil treated with **XBEE Enzyme Fuel Technology**.

The analysis demonstrated that such fuel, also known as FAME or B100, remains in compliance with the EN 14214 standard.

Analyses	Methods	Without XBEE	With XBEE	Units	Limits
Ester content in FAME by GC • Ester content • Saturated ester content	EN 14103	97.3 13.6	97.6 13.5	mass %	96.5 min 16.0 max
Kinematic viscosity at 40°C	EN ISO 3104	4.448	4.448	mm <sup>2</sup> /s	3.50 – 5.00
Density at 15°C	EN ISO 12185	882.8	883.0	kg/m <sup>3</sup>	860 – 900
Flash point closed cup (cor.)	EN ISO 3679	162.0	157.0	°C	101 min
Cetane number (measured)	EN ISO 5165	55.4	55.1	mgKOH/g	51.0 min
Copper corrosion (3h at 50°C)	EN ISO 2160	1	1	mg/kg	Class 1
Introduction period Temperature	EN 15751	14.1 +110	15.3 +110	Hours °C	8.0 min
Acid number	EN 14104	0.38	0.40	mgKOH/g	0.50 max
Iodine Value	EN 14111	103	104	g/100 g	120 max
Linolenic acid methyl ester content	EN 14103	6.0	6.0	mass %	12.0 max
Polyunsaturated FAME content (PUFA)	EN 15779	0.69	0.70	mass %	1.0 max
Methanol	EN 14110	0.04	0.05	mass %	0.20 max
... next page					

# SGS - FAME EN 14214

*Biofuel B100 – October 28, 2020*

Analyses	Methods	Without XBEE	With XBEE	Units	Limits
<ul style="list-style-type: none"><li>• Monoglyceride</li><li>• Diglyceride</li><li>• Triglyceride</li><li>• Free glycerol</li><li>• Total glycerol</li></ul>	EN 14105	0.38 <0.10 <0.10 0.018 0.119	0.26 <0.10 <0.10 0.001 0.070	mass %	0.70 max 0.20 max 0.20 max 0.02 max 0.25 max
Water content	EN ISO 12937	0.035	0.035	mass %	0.050 max
Total contamination	EN 12662	24.0	23.5	mg/kg	24.0 max
Sulfated ash	NF ISO 3987	<0.005	<0.005	mass %	0.02 max
Sulfur content	EN ISO 20846	5.2	5.2	mg/kg	10.0 max
Calcium, magnesium, sodium, potassium by ICP OES <ul style="list-style-type: none"><li>• Calcium</li><li>• Magnesium</li><li>• Calcium + magnesium</li><li>• Sodium</li><li>• Potassium</li><li>• Sodium + potassium</li></ul>	EN 14538	<1.0 <1.0 <1.0 <1.0 <1.0 <1.0	<1.0 <1.0 <1.0 <1.0 <1.0 <1.0	mg/kg	5.0 max
Phosphorus	EN 14107	<4.0	<4.0	mg/kg	4.0 max
Cloud point	EN ISO 3015	-4	-4	°C	0 max
Cold filter plugging point	EN 116	-10	-11	°C	-5 max

Although the results remain humble, it is interesting to observe that XBEE helped to reduce total contamination by 2.1%. Cold filter plugging point is more remarkably improved by 10%.

# Annexes

Original reports

# CERTIFICATE OF ANALYSIS

Client **XBEE SA**  
File Nr **2060681**

Operation **XBEE SA**  
Product **Biodiesel B100**  
SGS OGC Nr **LV2015056d**

Sample Ref **A T0: B100 Without additivation**  
Receipt on **10/19/2020**

ANALYSIS	METHODS	UNITS	RESULTS	MIN	TYPICAL	MAX
<b>Ester Content in FAME by GC</b>	<b>NF EN 14103</b>					
Ester Content		Mass Pct	<b>97.3</b>	96.5		
Saturated Ester Content		Mass Pct	<b>13.6</b>			16
<b>Density at 15°C</b>	<b>NF EN ISO 12185</b>	kg/m3	<b>882.8</b>	<b>860</b>		<b>900</b>
<b>Viscosity at 40 °C</b>	<b>NF EN ISO 3104</b>	mm2/s	<b>4.448</b>	<b>3.50</b>		<b>5.00</b>
<b>Flashpoint closed up (corrected)</b>	<b>NF EN ISO 3679</b>	°C	<b>162.0</b>	<b>101</b>		
<b>Cetane Number (measured)</b>	<b>NF EN ISO 5165</b>		<b>55.4</b>	<b>51.0</b>		
<b>Copper Corrosion, 3 hrs/50°C</b>	<b>NF EN ISO 2160</b>		<b>1</b>		<b>Classe 1</b>	
<b>Induction period</b>	<b>NF EN 15751</b>	Hours	<b>14.1</b>	<b>8.0</b>		
<b>Temperature</b>	<b>NF EN 15751</b>	°C	<b>+110</b>			
<b>Acid Number</b>	<b>NF EN 14104</b>	mgKOH/g	<b>0.38</b>			<b>0.50</b>
<b>Iodine Value</b>	<b>NF EN 14111</b>	g of iodine/100g	<b>103</b>			<b>120</b>
<b>Linolenic Acid Methyl Ester Content</b>	<b>NF EN 14103</b>	Mass Pct	<b>6.0</b>			<b>12.0</b>
<b>Polyunsaturated FAME Content (PUFA)</b>	<b>NF EN 15779</b>	Mass Pct	<b>0.69</b>			<b>1.0</b>
<b>Methanol</b>	<b>NF EN 14110</b>	Mass Pct	<b>0.04</b>			<b>0.20</b>
<b>Monoglyceride</b>	<b>NF EN 14105</b>	Mass Pct	<b>0.38</b>			<b>0.70</b>
<b>Diglyceride</b>	<b>NF EN 14105</b>	Mass Pct	<b>&lt; 0.10</b>			<b>0.20</b>
<b>Triglyceride</b>	<b>NF EN 14105</b>	Mass Pct	<b>&lt; 0.10</b>			<b>0.20</b>
<b>Free Glycerol</b>	<b>NF EN 14105</b>	Mass Pct	<b>0.018</b>			<b>0.02</b>
<b>Total Glycerol</b>	<b>NF EN 14105</b>	Mass Pct	<b>0.119</b>			<b>0.25</b>
<b>Water Content</b>	<b>NF EN ISO 12937</b>	Mass Pct	<b>0.035</b>			<b>0.050</b>
<b>Total Contamination</b>	<b>NF EN 12662</b>	mg/kg	<b>24.0</b>			<b>24</b>
<b>Sulfated Ash</b>	<b>NF ISO 3987</b>	Mass Pct	<b>&lt; 0.005</b>			<b>0.02</b>
<b>Sulfur Content</b>	<b>NF EN ISO 20846</b>	mg/kg	<b>5.2</b>			<b>10.0</b>
<b>Calcium, Magnesium, Sodium, Potassium by ICP OES</b>	<b>NF EN 14538</b>					
Calcium		mg/kg	<b>&lt; 1.0</b>			
Magnesium		mg/kg	<b>&lt; 1.0</b>			
Calcium and Magnesium		mg/kg	<b>&lt; 1.0</b>			<b>5.0</b>

## In specification parameters.

Compliance established excluding results uncertainty.

This document is issued by the Company under its General Conditions of Service accessible at [http://www.sgs.com/terms\\_and\\_conditions.htm](http://www.sgs.com/terms_and_conditions.htm). Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not constitute parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Uncertainties are related to precision and bias as mentioned into standard methods or calculated for internal methods (available on request). The results shown in this test report specifically refer to the sample(s) tested as received unless otherwise stated. All the tests have been performed using the latest revision of the methods indicated, unless specifically marked otherwise on the report. Precision parameters apply in the determination of the below results. Users of analytical results, when establishing conformance with commercial or regulatory requirements should note the full provision of ASTM D3244, IP 367 or ISO 4259 in that context, the default confidence level of petroleum testing having been set at the 95% confidence level. Your attention is specifically drawn to Section 7.3.6, 7.3.7 and 7.3.8 of ASTM D3244. With respect to the UOP methods listed in the report below the user is referred to the method and the statement therein, regarding that the precision statements were determined using UOP Method 999. For dated references, only the edition cited applies. For undated references, the latest edition of the publication referred to applies (including amendments).

For any sample not collected by SGS, the issued results are applied to the sample as received by the company. The information provided by the customer and on the report are not the responsibility of the company SGS France.

\*\* (Data given by the client)

PORT DE BOUC on, 29/10/2020

Michael Ercolino  
Chemist

# CERTIFICATE OF ANALYSIS

**Client** XBEE SA  
**File Nr** 2060681

**Operation** XBEE SA  
**Product** Biodiesel B100  
**SGS OGC Nr** LV2015056d

**Sample Ref** A T0: B100 Without additivation  
**Receipt on** 10/19 2020

ANALYSIS	METHODS	UNITS	RESULTS	MIN	TYPICAL	MAX
Sodium		mg/kg	< 1.0			
Potassium		mg/kg	< 1.0			
Sodium + Potassium		mg/kg	< 1.0			5.0
<b>Phosphorus</b>	<b>NF EN 14107</b>	mg/kg	< <b>4.0</b>			<b>4.0</b>
<b>Cloudpoint</b>	<b>NF EN ISO 3015</b>	°C	<b>-4</b>			<b>0</b>
<b>Cold Filter Plugging Point</b>	<b>NF EN 116</b>	°C	<b>-10</b>			<b>-5</b>
<b>(s) Heat of Combustion, Net</b>	<b>ASTM D 240</b>	MJ/KG	<b>37.290</b>			

A T0: B100 Without additivation.

(s) Test performed by other laboratory.

## In specification parameters.

Compliance established excluding results uncertainty.

This document is issued by the Company under its General Conditions of Service accessible at [http://www.sgs.com/terms\\_and\\_conditions.htm](http://www.sgs.com/terms_and_conditions.htm). Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that the information contained herein reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Uncertainties are related to precision and bias as mentioned into standard methods or calculated for internal methods (available on request). The results shown in this test report specifically refer to the sample(s) tested as received unless otherwise stated. All the tests have been performed using the latest revision of the methods indicated, unless specifically marked otherwise on the report. Precision parameters apply in the determination of the below results. Users of analytical results, when establishing conformance with commercial or regulatory requirement should note the full provision of ASTM D3244, IP 367 or ISO 4259 in that context, the default confidence level of petroleum testing having been set at the 95% confidence level. Your attention is specifically drawn to Section 7.3.6, 7.3.7 and 7.3.8 of ASTM D3244. With respect to the UOP methods listed in the report below the user is referred to the method and the statement with it as editing that the production statements were determined using UOP Method 999. For called references, only the edition referred to applies. For undated references, the latest edition of the publication referred to applies (including amendments).

For any sample not collected by SGS, the issued results are applied to the sample as received by the company. The informations provided by the customer and on the report are not the responsibility of the company SGS France.

\*\* (Data given by the client)

**PORT DE BOUC on, 29/10/2020**

**Michael Ercolino**  
**Chemist**

# CERTIFICATE OF ANALYSIS

Client **XBEE SA**  
File Nr **2060681**

Operation **XBEE SA**  
Product **Biodiesel B100**  
SGS OGC Nr **LV2015137**

Sample Ref **A J+15: B100 avec ajout additif à 1/4000**  
Receipt on **2020-10-19**

ANALYSIS	METHODS	UNITS	RESULTS	MIN	TYPICAL	MAX
<b>Ester Content in FAME by GC</b>	<b>NF EN 14103</b>					
Ester Content		Mass Pct	97.6	96.5		
Saturated Ester Content		Mass Pct	13.5			16
<b>Density at 15 °C</b>	<b>NF EN ISO 12185</b>	kg/m3	883.0	860		900
<b>Viscosity at 40 °C</b>	<b>NF EN ISO 3104</b>	mm <sup>2</sup> /s	4.448	3.50		5.00
<b>Flashpoint closed up (corrected)</b>	<b>NF EN ISO 3679</b>	°C	157.0	101		
<b>Cetane Number (measured)</b>	<b>NF EN ISO 5165</b>		55.1	51.0		
<b>Copper Corrosion, 3 hrs/50°C</b>	<b>NF EN ISO 2160</b>		1		Classe 1	
<b>Induction period</b>	<b>NF EN 15751</b>	Hours	15.3	8.0		
<b>Temperature</b>	<b>NF EN 15751</b>	°C	+110			
<b>Acid Number</b>	<b>NF EN 14104</b>	mgKOH/g	0.40			0.50
<b>Iodine Value</b>	<b>NF EN 14111</b>	g of iodine/100g	104			120
<b>Linolenic Acid Methyl Ester Content</b>	<b>NF EN 14103</b>	Mass Pct	6.0			12.0
<b>Polysaturated FAME Content (PUFA)</b>	<b>NF EN 15779</b>	Mass Pct	0.70			1.0
<b>Methanol</b>	<b>NF EN 14110</b>	Mass Pct	0.05			0.20
<b>Monoglyceride</b>	<b>NF EN 14105</b>	Mass Pct	0.26			0.70
<b>Diglyceride</b>	<b>NF EN 14105</b>	Mass Pct	< 0.10			0.20
<b>Triglyceride</b>	<b>NF EN 14105</b>	Mass Pct	< 0.10			0.20
<b>Free Glycerol</b>	<b>NF EN 14105</b>	Mass Pct	0.001			0.02
<b>Total Glycerol</b>	<b>NF EN 14105</b>	Mass Pct	0.070			0.25
<b>Water Content</b>	<b>NF EN ISO 12937</b>	Mass Pct	0.035			0.050
<b>Total Contamination</b>	<b>NF EN 12662</b>	mg/kg	23.5			24
<b>Sulfated Ash</b>	<b>NF ISO 3987</b>	Mass Pct	< 0.005			0.02
<b>Sulfur Content</b>	<b>NF EN ISO 20846</b>	mg/kg	5.2			10.0
<b>Calcium, Magnesium, Sodium, Potassium by ICP OES</b>	<b>NF EN 14538</b>					
Calcium		mg/kg	< 1.0			
Magnesium		mg/kg	< 1.0			
Calcium and Magnesium		mg/kg	< 1.0			5.0

### In specification parameters.


Compliance established excluding results uncertainty.

This document is issued by the Company under its General Conditions of Service accessible at [http://www.sgs.com/terms\\_and\\_conditions.htm](http://www.sgs.com/terms_and_conditions.htm). Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained herein reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unnotified alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Uncertainties are related to precision and bias as mentioned into standard methods or calculated for internal methods (available on request). The results shown in this test report specifically refer to the sample(s) tested as received unless otherwise stated. All the tests have been performed using the latest revision of the methods indicated, unless specifically marked otherwise on the report. Precision parameters apply in the determination of the below results. Users of analytical results, when establishing conformance with commercial or regulatory requirements should note the full provision of ASTM D3244, IP 367 or ISO 4259 in that context, the default confidence level of petroleum testing having been set at the 95% confidence level. Your attention is specifically drawn to Section 7.3.6, 7.3.7 and 7.3.8 of ASTM D3244. With respect to the UOP methods listed in the report below the user is referred to the method and the statement within it as editing that the precision statements were determined using UOP Method 999. For dated references, only the edition referred to applies. For undated references, the latest edition of the publication referred to applies (including amendments).

For any sample not collected by SGS, the issued results are applied to the sample as received by the company. The information provided by the customer and on the report are not the responsibility of the company SGS France.

\*\* (Data given by the client)

**PORT DE BOUC on, 2020-11-17**  
**Magali Augier**  
**Chemist**



# CERTIFICATE OF ANALYSIS

Client **XBEE SA**  
File Nr **2060681**

Operation **XBEE SA**  
Product **Biodiesel B100**  
SGS OGC Nr **LV2015137**

Sample Ref **A J+15: B100 avec ajout additif à 1/4000**  
Receipt on **2020-10-19**

ANALYSIS	METHODS	UNITS	RESULTS	MIN	TYPICAL	MAX
Sodium		mg/kg	< 1.0			
Potassium		mg/kg	< 1.0			
Sodium + Potassium		mg/kg	< 1.0			5.0
Phosphorus	NF EN 14107	mg/kg	< 4.0			4.0
Cloudpoint	NF EN ISO 3015	°C	-4			0
Cold Filter Plugging Point	NF EN 116	°C	-11			-5

**A J+15: B100 avec ajout additif XBEE à 1/4000 en v/v**

## In specification parameters.

Compliance established excluding results uncertainty.

This document is issued by the Company under its General Conditions of Service accessible at [http://www.sgs.com/terms\\_and\\_conditions.htm](http://www.sgs.com/terms_and_conditions.htm). Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained herein reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unnotified alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Uncertainties are related to precision and bias as mentioned into standard methods or calculated for internal methods (available on request). The results shown in this test report specifically refer to the sample(s) tested as received unless otherwise stated. All the tests have been performed using the latest revision of the methods indicated, unless specifically marked otherwise on the report. Precision parameters apply in the determination of the below results. Users of analytical results, when establishing conformance with commercial or regulatory requirement should note the full provision of ASTM D3244, IP 367 or ISO 4259 in that context, the default confidence level of petroleum testing having been set at the 95% confidence level. Your attention is specifically drawn to Section 7.3.6, 7.3.7 and 7.3.8 of ASTM D3244. With respect to the UOP methods listed in the report below the user is referred to the method and the statement within it as editing that the production statements were determined using UOP Method 999. For dated references, only the edition referred to applies. For undated references, the latest edition of the publication referred to applies (including amendments).

For any sample not collected by SGS, the issued results are applied to the sample as received by the company. The informations provided by the customer and on the report are not the responsibility of the company SGS France.

\*\* (Data given by the client)

**PORT DE BOUC on, 2020-11-17**  
**Magali Augier**  
**Chemist**

