

THE SCIENTIFIC AND TECHNOLOGICAL RESEARCH COUNCIL OF TURKEY
MARMARA RESEARCH CENTER
INSTITUTE OF CHEMICAL TECHNOLOGY

P.O. Box 21, 41470 GEBZE – KOCAELİ / TURKEY
T +90 262 677 20 00 F +90 262 641 23 09
<http://www.mam.gov.tr>

ANALYSIS REPORT
(Industrial Services)

Report no : 68110102-125.05 – 89-577
Report date : 11.02.2019
Requested by : ALFOEX SAVUNMA VE GÜVENLİK SİSTEMLERİ A.Ş.
Address : Yıldırımlar Sanayi Sitesi İnönü Mahallesi 1738. Cadde No:1 Kat:4 No:6 Batıkent, Yenimahalle/ANKARA
Subject : Miscellaneous Analysis

The results in this report are valid only for the analyzed samples.

Approved by



PhD. Merve GÜRTEKİN SEDEN
Institute of Chemical Technology
Industrial Services Responsible Representative

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Address	: Yıldırım Sanayi Sitesi İnönü Mahallesi 1738. Cadde No:1 Kat:4 No:6 Batıkent, Yenimahalle/ANKARA		
Sample	: ALFOEx 573	Expiry date	: -
Number of samples	: 1	Institute sample register no:	18G/606/01
Sample handling	: by hand	Acceptance date and time	: 29/11/2018
Condition of sample at acceptance:	in plastic bag	Date of the analysis	: 28/01/2019
Information on retention samples:			
<input type="checkbox"/> Sample returned to the customer <input type="checkbox"/> Witness sample available <input checked="" type="checkbox"/> Witness sample is not taken			
<h3>Results</h3> <p>The November 29, 2018 dated application form which was sent by ALFOEX SAVUNMA VE GÜVENLİK SİSTEMLERİ A.Ş was recorded as 6033 MRC document record number. The "miscellaneous analysis" of the sample, which was sent with the application form and named as "ALFOEx 573" was performed in our laboratories.</p> <p>The ALFOEx 573 was kept in different fuel samples (Gasoline-Containing National Marker, Gasoline-National Marker Free, Diesel-Containing National Marker, Diesel-National Marker Free, Ethyl alcohol and Jet-A1) for 14 days and then chromatographic and parametric analysis of these fuel samples were carried out in our laboratories.</p>			
Notes:			
Authorized Signatures:			
 53593		 53692	
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Sample Preparation:

The product, called **ALFOEx 573**, was randomly placed in a 1 liter capped graduated cylinder at a level of about 1 liter and then the total weigh of ALFOEx 573 was recorded. As a result of 6 different measurements, the average bulk density of ALFOEx 573 was calculated as 46.68 g/L.

Different types of fuels (Gasoline-Containing National Marker, Gasoline- National Marker Free, Diesel-Containing National Marker, Diesel-National Marker Free, Ethyl alcohol and Jet-A1) were added on "ALFOEx 573" containing capped graduated cylinders at a level of about 1 liter. These samples were kept at room temperature and away from direct sunlight for 14 days.

Table 1 shows the mass changes in 6 different fuels after 14 days and the fuel adsorption ratios of ALFOEx 573. As a result of the calculations the fuel adsorption ratio of "ALFOEx 573" ranged between 3.285-4.065% by weight.

Notes: The "ALFOEx 573" named product specified as "explosion-suppression material for flammable-liquid and gaseous which are stored in storage tank and cylinder etc." by the applicant.

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Table 1	ALFOEx 573 bulk density ⁺ (g/L)	t ₀		t ₁₄		
		Mass of ALFOEx 573 containing fuel (g)	Mass of ALFOEx 573 free fuel ⁺⁺ (g)	Fuel evaporation ratio ⁺⁺⁺ (% wt.)	Residue fuel ratio ⁺⁺⁺⁺ (% wt.)	Fuel adsorbion ratio ⁺⁺⁺⁺⁺ (% wt.)
Gasoline-containing National Marker	46.27	731.1	698.5	0.225	0.94	3.285
Gasoline-National Marker Free	48.60	747.6	714.5	0.095	0.96	3.365
Diesel-containing National Marker	46.66	824.6	791.2	0.050	0.27	3.730
Diesel-National Marker Free	46.27	826.5	789.5	0.055	0.35	4.065
Jet-A1	46.02	790.3	760.4	0.003	0.13	3.647
Ethyl alcohol, 99.9 %	46.28	785.4	754.4	0.017	0.2	3.723

(⁺): Weigh of "ALFOEx 573" which was randomly placed in 1 liter graduated cylinder.

(⁺⁺): Fuel with "ALFOEx 573" was transferred to another graduated cylinder and fuel weigh was measured.

(⁺⁺⁺): The average evaporation ratio was calculated by using the evaporation ratio of fuel with and without "ALFOEx 573" are given.

(⁺⁺⁺⁺): Residue ratio was calculated by transferring the fuel without "ALFOEx 573" to another graduated cylinder.

(⁺⁺⁺⁺⁺): Fuel adsorbion ratio is given as the adsorbion at the first discharge.

Notes: All fuel samples were filled to 1 liter volume in graduated cylinder.

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Figure 1. The Gasoline-Containing National Marker samples with ALFOEx 573 (a) and without ALFOEx 573 (b) after 14 days

At the end of 14 days, the chromatograms obtained from Gas (FID) Chromatography analysis were examined, and it was seen that gasoline (Containing National Marker) with and without **ALFOEx 573** had similar peaks.

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Table 2. Results of Gasoline- Containing National Marker samples with ALFOEx 573 and without ALFOEx 573 after 14 days

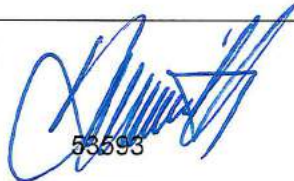
Property	Units	TS EN 228 Limits		Gasoline (Containing National Marker) with ALFOEx 573	Gasoline (Containing National Marker) without ALFOEx 573	Test method
		min	max			
Density, 15°C	kg/m ³	720	775	736	737	EN ISO 12185
*Existent gum content (solvent washed)	mg/100mL	-	5,00	0,6	0,4	EN ISO 6246
*Oxidation stability	minutes	360	-	= >360	= >360	EN ISO 7536
*Final Boiling Point FBP	°C	-	210	189	187	EN ISO 3405
*Distillation residue	% (v/v)	-	2,0	0,9	0,6	
% Evaporated at 70°C, E70	% (v/v)	20,0 (Summer) 22,0 (Winter)	48,0 (Summer) 50,0 (Winter)	41,8	42,0	
% Evaporated at 100°C, E100	% (v/v)	46,0 (Summer) 46,0 (Winter)	71,0	60,7	60,6	
% Evaporated at 150°C, E150	% (v/v)	75,0	-	88,6	88,9	EN ISO 2160
*Copper strip corrosion (3 h at 50 °C)	Rating	Class 1		1a	1a	

Table 2 gives the density, existent gum content, oxidation stability, final boiling point, distillation residue, evaporation ratios (different temperatures) and copper strip corrosion analysis results performed in gasoline (Containing National Marker) samples according to TS EN 228 standard.

As a result of the analysis, it was determined that both Gasoline-Containing National Marker with and without **ALFOEx 573** have similar test results and that both of these two samples are in compliance with TS EN 228 standard.

Notes: *The analyzes given in the table were carried out by Energy Institute and accredited by TÜRKAK (Turkish Accreditation Agency)

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Figure 2. The Gasoline-National Marker Free samples with ALFOEx 573 (a) and without ALFOEx 573 (b) after 14 days

At the end of 14 days, the chromatograms obtained from Gas (FID) Chromatography analysis were examined, and it was seen that gasoline (National Marker Free) with and without **ALFOEx 573** had similar peaks.

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Table 3. Results of Gasoline-National Marker Free samples with ALFOEx 573 and without ALFOEx 573 after 14 days

Property	Units	TS EN 228 Limits		Gasoline (National Marker Free) with ALFOEx 573	Gasoline (National Marker Free) without ALFOEx 573	Test method
		min	max			
Density, 15°C	kg/m ³	720	775	753	753	EN ISO 12185
*Existent gum content (solvent washed)	mg/100mL	-	5,00	0,6	0,2	EN ISO 6246
*Oxidation stability	minutes	360	-	= >360	= >360	EN ISO 7536
*Final Boiling Point FBP	°C	-	210	191,3	190	EN ISO 3405
*Distillation residue	% (v/v)	-	2,0	0,9	1,2	
% Evaporated at 70°C, E70	% (v/v)	20,0 (Summer) 22,0 (Winter)	48,0 (Summer) 50,0 (Winter)	30,5	30,9	
% Evaporated at 100°C, E100	% (v/v)	46,0 (Summer) 46,0 (Winter)	71,0	51,4	51,5	
% Evaporated at 150°C, E150	% (v/v)	75,0	-	88,2	88,0	EN ISO 2160
*Copper strip corrosion (3 h at 50 °C)	Rating	Class 1		1a	1a	

Table 3 gives the density, existent gum content, oxidation stability, final boiling point, distillation residue, evaporation ratios (different temperatures) and copper strip corrosion analysis results performed in gasoline (National Marker Free) samples according to TS EN 228 standard.

As a result of the analysis, it was determined that both Gasoline- National Marker Free with and without **ALFOEx 573** have similar test results and that both of these two samples are in compliance with TS EN 228 standard.

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Figure 3. The Diesel-Containing National Marker samples with ALFOEx 573 (a) and without ALFOEx 573 (b) after 14 days

At the end of 14 days, the chromatograms obtained from Gas (FID) Chromatography analysis were examined, and it was seen that diesel (Containing National Marker) with and without **ALFOEx 573** had similar peaks.

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Table 4. Results of Diesel-Containing National Marker samples with ALFOEx 573 and without ALFOEx 573 after 14 days

Property	Units	TS EN 590 Min Max		Diesel (Containing National Marker) with ALFOEx 573	Diesel (Containing National Marker) without ALFOEx 573	Test method
Density, 15°C	kg/m ³	820	845	828	828	TS EN ISO 12185
* Oxidation stability	g/m ³	-	25	2	1	TS EN ISO 12205
*Distillation						TS EN ISO 3405
% (V/V) recovered at 250°C	%(v/v)	-	< 65	22,8	23,2	
% (V/V) recovered at 350°C	%(v/v)	85	-	92,4	92,1	
95 % (V/V) recovered at	°C	-	360	356,8	357,3	
* Copper strip corrosion (3 h at 50 °C)	-	-	1	1a	1a	TS 2741 EN ISO 2160

Summer: April 1 – October 31 (±15 days)

Winter: Rest of summer term

Table 4 gives the Density, oxidation stability, distillation and copper strip corrosion analysis results performed in diesel (Containing National Marker) samples according to TS EN 590+A1 standard.

As a result of the analysis, it was determined that both Diesel-Containing National Marker with and without **ALFOEx 573** have similar test results and that both of these two samples are in compliance with TS EN 590+A1 standard.

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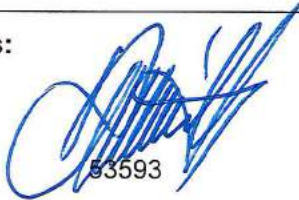


Figure 4. The Diesel-National Marker Free samples with ALFOEx 573 (a) and without ALFOEx 573 (b) after 14 days

At the end of 14 days, the chromatograms obtained from Gas (FID) Chromatography analysis were examined, and it was seen that diesel (National Marker Free) with and without **ALFOEx 573** had similar peaks.

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Table 5. Results of Diesel-National Marker Free samples with ALFOEx 573 and without ALFOEx 573 after 14 days

Property	Units	TS EN 590 Min Max		Diesel (National Marker Free) with ALFOEx 573	Diesel (National Marker Free)without ALFOEx 573	Test method
Density, 15°C	kg/m ³	820	845	829	829	TS EN ISO 12185
*Oxidation stability	g/m ³	-	25	2	1	TS EN ISO 12205
*Distillation % (V/V) recovered at 250°C	%(v/v)	-	< 65	16,0	15,7	TS EN ISO 3405
% (V/V) recovered at 350°C	%(v/v)	85	-	90,9	91,0	
95 % (V/V) recovered at	°C	-	360	359,8	359,7	
*Copper strip corrosion (3 h at 50 °C)	-	-	1	1a	1a	TS 2741 EN ISO 2160

Summer: April 1 – October 31 (±15 days) **Winter:** Rest of summer term

Table 5 gives the Density, oxidation stability, distillation and copper strip corrosion analysis results performed in diesel (National Marker Free) samples according to TS EN 590+A1 standard.

As a result of the analysis, it was determined that both Diesel-National Marker Free with and without **ALFOEx 573** have similar test results and that both of these two samples are in compliance with TS EN 590+A1 standard.

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Figure 5. The Jet-A1 samples with ALFOEx 573 (a) and without ALFOEx 573 (b) after 14 days

At the end of 14 days, the chromatograms obtained from Gas (FID) Chromatography analysis were examined, and it was seen that Jet-A1 with and without **ALFOEx 573** had similar peaks.

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Table 6. Results of Jet-A1 samples with ALFOEx 573 and without ALFOEx 573 after 14 days

Property	Units	ASTM D 1655 Jet A1 Limits		JET – A1 with ALFOEx 573	JET – A1 without ALFOEx 573	Test method
		Min	Max			
Density (15°C)	kg/m ³	775	840	799	799	EN ISO 12185
*Distillation						
Initial boiling point	°C	-	-	152,2	153,3	ASTM D 86
10 % recovered, temperature	°C	-	205	171,1	170,6	
50 % recovered, temperature	°C	-	-	201,2	201,4	
90 % recovered, temperature	°C	-	-	241,1	241,6	
Final boiling point, temperature	°C	-	300	264,0	264,4	
Distillation residue, %	% (v/v)	-	1,5	0,8	0,8	
Distillation loss, %	% (v/v)	-	1,5	0,7	0,6	
*Copper strip corrosion 2 hours ,100°C	-	-	No.1	1a	1a	ASTM D 130
* Existent gum	mg/100 mL	-	7	0,4	0,4	ASTM D 381
*(JFTOT) Thermal Stability (2.5 h at control temperature of 260 °C min)	mL			450	450	ASTM D 3241
Differential pressure	mmHg	-	25	1	1	
Tube deposit rating	visual	-	3	1	1	

Table 6 gives the density, distillation, copper strip corrosion, existent gum and thermal stability analysis results performed in Jet-A1 samples according to ASTM D 1655 standard.

As a result of the analysis, it was determined that both Jet-A1 with and without **ALFOEx 573** have similar test results and that both of these two samples are in compliance with ASTM D 1655 standard.

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Figure 6. The Ethyl alcohol samples with ALFOEx 573 (a) and without ALFOEx 573 (b) after 14 days

At the end of 14 days, the chromatograms obtained from Gas (FID) Chromatography analysis were examined, and it was seen that Ethyl alcohol with and without **ALFOEx 573** had similar peaks.

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Table 7. Results of Ethyl alcohol samples with ALFOEx 573 and without ALFOEx 573 after 14 days

Property	Units	Ethyl alcohol with ALFOEx 573	Ethyl alcohol without ALFOEx 573	Test method
Density (15°C)	kg/m ³	794	794	TS EN ISO 12185
*Distillation				
Initial boiling point	°C	76,2	76,3	ASTM D 86
10 % recovered, temperature	°C	77,7	77,9	
50 % recovered, temperature	°C	78,0	78,0	
90 % recovered, temperature	°C	78,0	78,0	
Final boiling point, temperature	°C	78,3	78,3	
Distillation residue, %	% (v/v)	0,7	0,8	
Distillation loss, %	% (v/v)	0,7	0,6	
*Copper strip corrosion 3 hours, 50°C	-	1a	1a	ASTM D 130
*Existent gum	mg/100 mL	0,2	0,2	ASTM D 381
*Oxidation stability	dk	>1440	>1440	EN ISO 7536

As a result of the analysis, it was determined that both Ethyl alcohol with and without **ALFOEx 573** have similar test results

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ALFOEx 573 product has been kept in different types of fuels for 14 days. At the end of 14 days the fuel samples with **ALFOEx 573** and without **ALFOEx 573** were analysed by GC and as a result of comparasion of the chromatograms it was determined that the chromatograms of samples (with **ALFOEx 573** and without **ALFOEx 573**) are similar to each other. Also the comparasion of parametric analysis shows that the results of data obtained for the samples (with **ALFOEx 573** and without **ALFOEx 573**) are close to each other.

GC Model : Agilent 6890N Network GC System
Dedector : FID (Flame ionization detector)
Column : Ultra 2 (25mx0.32mmx0.52µm)

It is kindly submitted to your information.

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