ECOENGINEERS
People Driven Solutions

300 E. Locust, Ste 313
Des Moines, Iowa 50309
Phone: 515-985-1260
www.ecoengineers.us

November 11, 2016

Joseph P. Riley
Corn Oil One
4400 E University Ave
Pleasant Hill, IA 50327

RE: REVIEW OF CORN OIL ONE FEEDSTOCK FOR CONFORMANCE TO THE DEFINITION OF "NON-FOOD GRADE CORN OIL" UNDER 40 CFR 80 SUBPART M

1.0 PURPOSE

The purpose of this regulatory analysis is to determine whether EcoEngineers considers the Corn Oil One feedstock to classify under the EPA definition of "non-food grade corn oil" and is eligible as a feedstock for biodiesel and renewable diesel production under the Renewable Fuel Standard (RFS) 40 CFR 80 Subpart M. Furthermore, this analysis will determine whether EcoEngineers considers this feedstock to be a "biointermediate" under the proposed "REGS" rulemaking and biofuel gallons produced from the feedstock eligible to be validated under the EcoEngineers EPA Approved Q-RIN Quality Assurance Program.

Please note that this determination from EcoEngineers is not a substitute for a determination from the EPA and does not provide Corn Oil One nor any biofuel producer who processes Corn Oil One feedstock any indemnification under the Renewable Fuel Standard, 40 CFR 80 Subpart M.

2.0 RFS REGULATORY FRAMEWORK

USEPA Definition of Corn Oil:
According to the EPA determination letter addressed to the Corn Refiners Association, dated October 24, 2013:

"In the context of the Renewable Fuel Standard (RFS) and Table 1 to §80.1426, non-food grade corn oil refers to corn oil produced at a dry mill corn ethanol plants by extraction from the Distiller Grains (DG) co-product… only biodiesel and renewable diesel from corn oil that was produced by the extraction process at dry mill corn ethanol plants would be eligible to generate RINs under the existing non-food grade corn oil pathways in Table 1 to §80.1426. The existing pathway does not apply to corn oil derived by fractionation at a dry mill corn ethanol plant or corn oil derived from corn wet milling."

USEPA Definition of a Biointermediate Feedstock:
According to the preamble of the proposed rulemaking, "Renewables Enhancement and Growth Support Rule" (REGS), pre-published on October 3, 2016, "*the definition of a "biointermediate feedstock" is any renewable fuel feedstock material that meets all of the following criteria:*

- *It is derived from renewable biomass*

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- *It does not meet the definition of renewable fuel and RINs were not generated for it*
- *It is produced at a facility that is registered with the EPA, but which is different than the facility at which it is used to produce renewable fuel*
- *It is made from the feedstock and will be used to produce the renewable fuel in accordance with the processes listed in the approved pathway*
- *It is processed in such a way that it is substantially altered from the feedstock listed in the approved pathway*

In addition, we are proposing that any feedstock listed in Table 1 to 40 CFR 80.1426 or in an approved pathway pursuant to 80 CFR 80.1416 is not a biointermediate, and that a mere form change to renewable biomass does not create a biointermediate … In addition, certain processing of feedstocks would not result in sufficient alteration to result in a biointermediate … We are proposing that renewable biomass subject to these types of processing (chopping, filtering, degumming vegetable oils, drying, adding water) would be excluded from the definition of biointermediate and, therefore, that such activities can be conducted at a different facility than the facility producing renewable fuel without triggering the need for the additional recordkeeping, reporting, and registration requirements being proposed for producers of biointermediates."

3.0 CORN OIL ONE FEEDSTOCK ANALYSIS

Description of Corn Oil One Feedstock:
Non-Food Grade Corn oil is produced at the Southwest Iowa Renewable Energy (SIRE) Dry-Mill Ethanol Plant (or other dry-mill ethanol plants). The corn oil enters the co-located Corn Oil One facility where a dilute solvent (composed of ethanol and water) is added in order to solubilize soaps out of the corn oil. The final Corn Oil One feedstock is corn oil which has had Free Fatty Acids (FFAs), moisture and waxes removed.

Laboratory Analysis from Iowa Central Fuel Testing Labs (ICFTL):
Two (2) samples of crude corn oil and two (2) samples of Corn Oil One feedstock were submitted to Iowa Central Fuel Testing Laboratory for feedstock forensic analysis testing by gas chromatograph on November 7, 2016. ICFTL is an ISO-9001:2008 accredited laboratory and has analyzed over 100 feedstock samples by gas chromatograph under the EcoEngineers Q-RIN Quality Assurance Program. Tables 1 and 2 summarize the results of the laboratory analysis.

Table 1: Summary of Crude Corn Oil Samples: 84683, 87846

Component	% Sample 84683	% Sample 87846
Triglycerides	76.42	70.41
Diglycerides	5.49	5.64
Glycerol	.04	.04
Methyl Esters	0	0
Ethyl Esters	2.14	3.39
Fatty Acids	14.59	18.57
Monoglycerides	0.17	.22
Squalene	.09	.14

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Tocopherol	.08	.11
Sterols	.86	1.21
Other	.13	.28

Table 2: Summary of Corn Oil One samples: 85050, 88612

Component	% Sample 85050	% Sample 88612
Triglycerides	89.27	89.12
Diglycerides	5.3	6.31
Glycerol	0	0
Methyl Esters	0	0
Ethyl Esters	3.72	3.02
Fatty Acids	.41	.35
Monoglycerides	.08	.1
Squalene	.12	.08
Tocopherol	.08	.08
Sterols	.87	.81
Other	.14	.12

ICFTL confirmed that the both the crude corn oil samples and the Corn Oil One samples contained the presence of squalene and ethyl esters, which is consistent with a corn oil feedstock profile. Furthermore, the presence of squalene and ethyl esters did not significantly change between the crude corn oil and Corn Oil One samples.

The only significant change in composition between the crude corn oil samples and the Corn Oil One feedstock was noted in Fatty Acid content, which decreased from (15%-19%) to (0.4%) and Triglycerides, which increased from (70%-76%) to (89%).

4.0 Determination and Conclusion

Does the Corn Oil One feedstock meet the definition of Non-Food Grade Corn Oil?
The crude corn oil produced at the SIRE dry-mill ethanol plant is extracted from the distiller grains co-product. This has been confirmed by the Third-Party Engineering Review and site visit conducted on November 5, 2015 by Jim Ramm, PE. Corn Oil One must continue to utilize crude corn oil produced at dry-mill ethanol plants via extraction from distiller grains co-product in order to produce a qualifying Corn Oil One feedstock.

Jim Ramm, PE reviewed the laboratory results from the Iowa Central Fuel Testing Laboratory and concluded that the decrease in Fatty Acid content and increase in Triglyceride content between the crude corn oil and Corn Oil One feedstock does not constitute a substantial alteration of the corn oil feedstock. Furthermore, the unchanged presence of key corn oil indicators (squalene and ethyl esters) between the crude corn oil and Corn Oil One feedstock suggest no substantial alteration between crude corn oil and Corn Oil One feedstock.

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Does the Corn Oil One feedstock meet the proposed definition as a "biointermediate"?
The definition of "bio-intermediate" has not been finalized by the EPA, and we cannot state conclusively how Corn Oil One feedstock will ultimately be treated in the final rulemaking. However, EcoEngineers believes that the type of processing that occurs for Corn Oil One feedstock does not constitute a substantial alteration from the definition of Non-food grade corn oil in Table 1 of §80.1426.

As a result of this analysis, EcoEngineers considers the Corn Oil One feedstock to meet the USEPA definition of "non-food grade corn oil" and is an eligible feedstock to produce biodiesel and renewable diesel under the Renewable Fuel Standard 40 CFR 80 Subpart M. EcoEngineers will include Corn Oil One feedstock as part of the list of "approved feedstock suppliers" under the EcoEngineers EPA-approved Q-RIN Quality Assurance Program from the date of this letter moving forward until further notice.

Regards,

Karyn Jones
COO
EcoEngineers
kjones@ecoengineers.us

Encl: 10/24/2013 EPA Letter of Determination to the Corn Refiners Association
IA Central Fuel Testing Laboratory Corn Oil Analysis

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OCT 2 4 2013

OFFICE OF
AIR AND RADIATION

Mr. John W. Bode
President and C.E.O.
Corn Refiners Association
1701 Pennsylvania Avenue, NW
Suite 950
Washington, D.C. 20006-5806

Dear Mr. Bode:

Thank you for the letter from your organization dated November 29, 2012, we apologize for the delay in responding. That letter requested clarification of the type or grade of corn oil that is approved as eligible feedstock for biodiesel and renewable diesel production under 40 C.F.R. § 80.1426, Table 1. The biodiesel and renewable diesel pathways in Table 1 to § 80.1426 refer to "non-food grade corn oil", and the letter from your organization requested a clarification of what is included in the category non-food grade corn oil.

In the context of the Renewable Fuel Standard (RFS) and Table 1 to § 80.1426, non-food grade corn oil refers to corn oil produced at dry mill corn ethanol plants by extraction from the Distiller Grains (DG) co-product. As discussed in the final rule published on March 26, 2010 (75 FR 14670) (the "March 2010 RFS rule"), dry mill corn ethanol plants have two different technological methods to withdraw corn oil during the ethanol production process. The fractionation process withdraws corn oil before the production of the DG co-product. The extraction process withdraws corn oil after the production of the DG coproduct. In contrast to corn dry mill plants, corn wet mill facilities separate the kernel prior to processing into its component parts (germ, fiber, protein, and starch) and in turn produce other co-products (including corn oil) in addition to DG. Only biodiesel and renewable diesel from corn oil that was produced by the extraction process at dry mill corn ethanol plants would be eligible to generate RINs under the existing non-food grade corn oil pathways in Table 1 to § 80.1426. The existing pathway does not apply to corn oil derived by fractionation at a dry mill corn ethanol plant or corn oil derived from corn wet milling.

Although the regulations do not define non-food grade corn oil as that term is used in § 80.1401, we believe that the U.S. Environmental Protection Agency's March 2010 RFS rule clearly describes the type of production process that the EPA intended to include in the non-food grade corn oil pathway in Table 1 to § 80.1426.

In response to some of the additional points raised in the letter, the Preamble to the March 2010 RFS rule discusses the updated FASOM and FAPRI–CARD modeling that the EPA conducted for this pathway, indicating that we "model[ed] corn oil from the dry mill ethanol extraction process as a new source of biodiesel." The EPA also indicates that "it is estimated that 70% of dry mill ethanol plants will withdraw corn oil via extraction (from DGS), resulting in corn oil that is non-food grade and can only be used as a biodiesel source; 20% will withdraw corn oil via fractionation (prior to the creation of DGS), resulting in corn oil that is food-grade". This specifically indicates that the EPA considered corn oil from the extraction process as non-food grade for purposes of the pathway for biodiesel production and that we considered oil produced from the fractionation process as food grade corn oil.

When analyzing the feedstock production GHG impacts of non-food grade corn oil we considered both the direct and indirect impacts. As with other feedstocks analyzed as part of the March 2010 RFS rule this was done with our FASOM and FAPRI-CARD models. The documentation to the FASOM model[1] indicates that the model includes "the potential for corn oil to be derived from either extraction from DG or fractionation prior to the creation of DG. Corn oil from fractionation is assumed to be food grade and a perfect substitute for corn oil produced from the wet milling process. Corn oil from extraction, however, is nonfood grade and can only be used in biodiesel production in the model." The FASOM documentation also indicates that the model was modified "to apply different replacement rates for fractionated/extracted DG and traditional DG when used in swine and poultry feed."

Therefore, the indirect GHG impacts of non-food grade corn oil in our analysis was based on the market impacts that corn oil from the dry mill corn ethanol extraction process has on the DG market. This was based on the different quality of the DG with the oil removed. Corn oil from the dry mill corn ethanol fractionation process and corn oil from corn wet milling are modeled as perfect substitutes and used in the vegetable oil food market and would therefore have different market impacts when used for biodiesel as compared to extracted non-food grade corn oil and different indirect GHG impacts as well.

The EPA drew the same distinction when discussing the non-food grade corn oil pathway in the Preamble to the March 2010 RFS rule. For example, the EPA discusses corn ethanol dry mill plants and indicates "there are a growing number of plants using front-end fractionation to produce food-grade corn oil or back-end extraction to produce fuel-grade corn oil for the biodiesel industry."[2] The EPA drew the distinction between food-grade corn oil produced from fractionation and fuel-grade corn oil used to make biodiesel produced from extraction. The Preamble also discusses wet mill corn plants and indicates that they "produce other co-products (usually gluten feed, gluten meal, and food-grade corn oil)".[3] Again, for purposes of this pathway the EPA drew the distinction that wet mill corn plants were considered a source of food grade corn oil, not non-food grade corn oil.

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[1] U.S. Agricultural and Forestry Impacts of the Energy Independence and Security Act: FASOM Results and Model Description Final Report, EPA-HQ-OAR-2005-0161-3178, page 1-23.
[2] 75 FR at 14744.
[3] Id.

Also, in the context of discussing a number of potential biodiesel and renewable diesel feedstocks in the March 2010 RFS rule, the volumes of diesel feedstocks from corn oil that were assumed in the analysis were based on non-food grade corn oil from extraction as the diesel feedstock. The Regulatory Impact Analysis (RIA) of the March 2010 RFS rule states that "approximately 70 percent of projected total ethanol production will implement some type of corn oil extraction system by 2022, generating approximately 680 million gallons per year of corn oil biofuel feedstock".[4] This amount of corn oil matches the indication in the Preamble of non-food grade corn oil from corn dry milling extraction. Table 1.1-25 of the RIA lists 680 million gallons of biodiesel produced from "Corn oil from ethanol production" as used in the analysis for the rulemaking.[5] Therefore, the non-food grade corn oil used in our modeling of biodiesel feedstock for the March 2010 RFS rule was solely from dry mill corn ethanol extraction.

The letter mentions that your organization plans to submit a petition requesting the approval of a fuller range of corn oils. The differences in modeling discussed in this response should help in developing a petition in order for the EPA to consider biodiesel or renewable diesel produced from the dry mill corn ethanol fractionation process or from corn wet milling. The petition process under § 80.1416 of our regulations describe what type of information is required for submitting a petition to the agency, and additional guidance is available on our website (http://www.epa.gov/otaq/fuels/renewablefuels/new-pathways/lca-petition-instructions.htm).

Sincerely,

Karl Simon, Director
Transportation and Climate Division

[4] See p. 55 of the RIA at http://www.epa.gov/otaq/renewablefuels/420r10006.pdf.
[5] Id. at p. 64.

Iowa Central Fuel Testing Laboratory
Four Triton Circle
Fort Dodge, Iowa, USA 50501

Iowa Central
FUEL TESTING LABORATORY

Laboratory Results Report

Customer Name:	EcoEngineers	**Sample ID:**	110116S
Customer Address:	300 East Locust Street, Suite 313	**Customer ID:**	EcoEngineers
	Des Moines, IA 50309	**Received on:**	**11/1/2016**
Customer's Sample ID:	COO 84683	**Completed:**	**11/7/2016**
Sample Type:	Crude Corn Oil		

Test	Method	Result	Unit
Feedstock Forensic Analysis			
See attached summary and chromatograms			
Notes:			

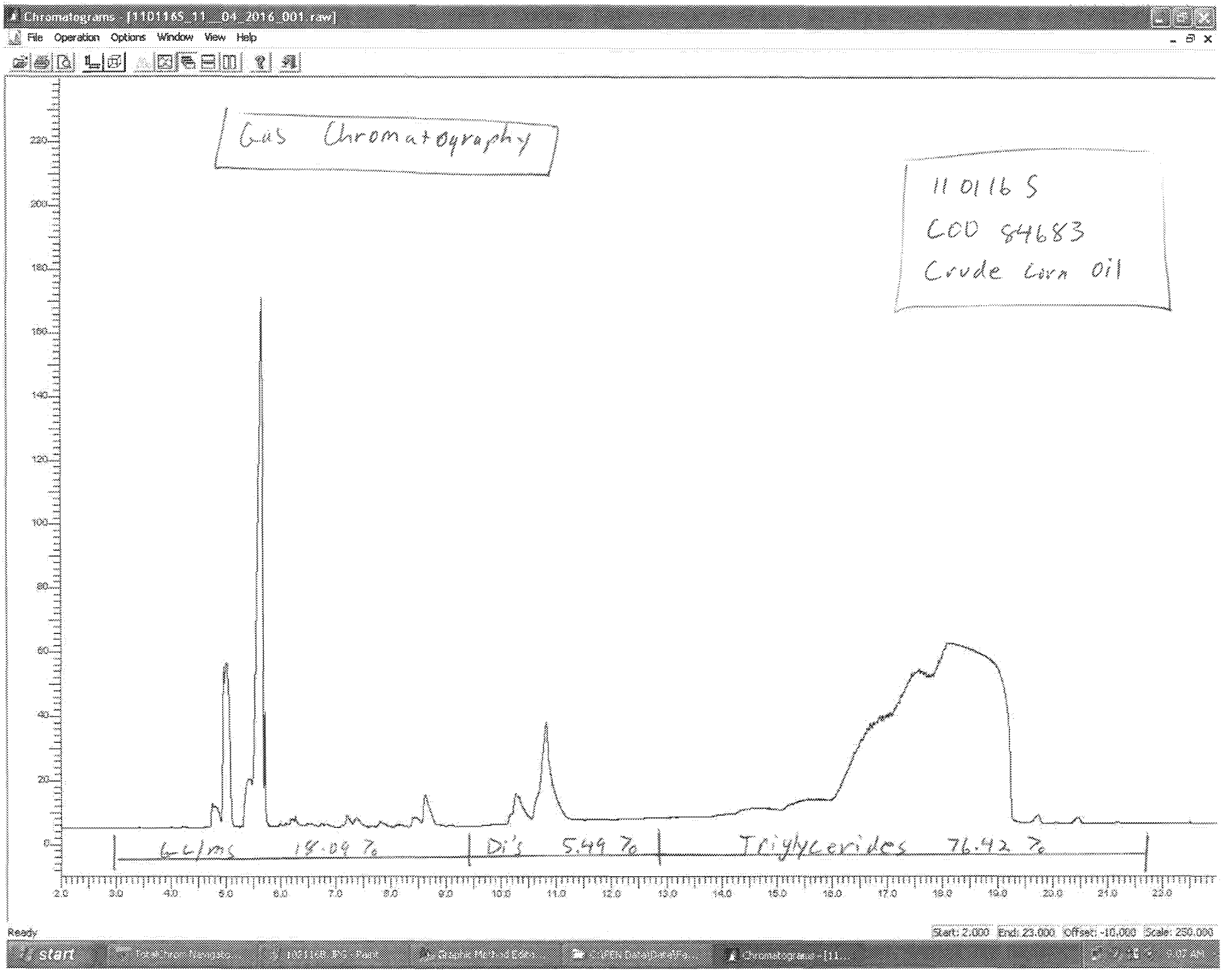
Approval: _____ **Title:** QMR or designee **Date:** November 7, 2016

110116S
COO 84683
Crude Corn Oil

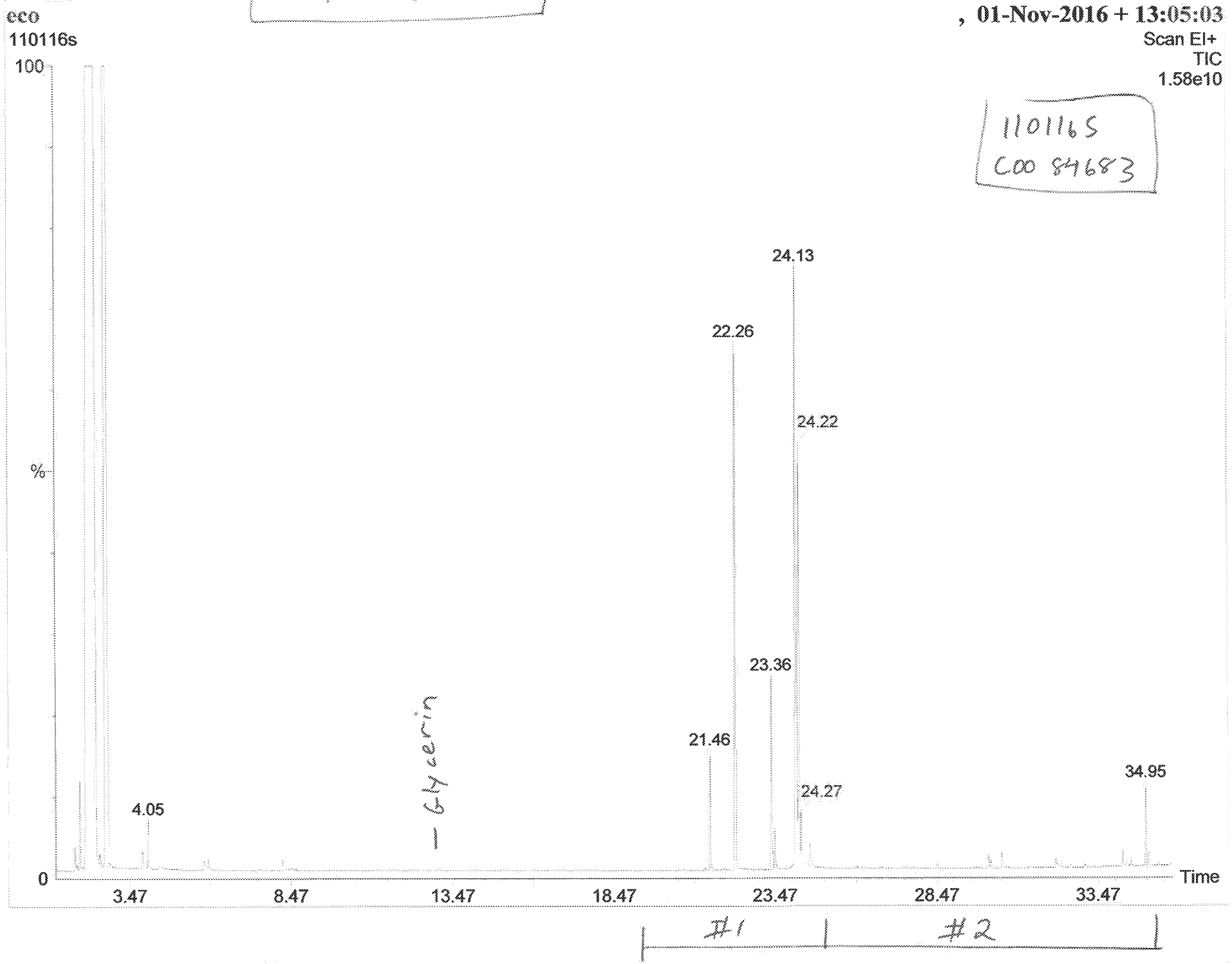
ICFTL received a sample of corn oil feedstock. We analyzed the sample by gas chromatography (maximum oven temperature of 380°C) and also by GC/MS (maximum oven temperature of 355°C).

Analysis by gas chromatography shows that the majority of the sample is in the form of triglycerides (76.42 %). The GC/MS overview sheet shows a small amount of glycerin. The first close-up view shows mainly C16 and C18 fatty acids and ethyl esters, whereas the second close-up view shows several monoglycerides, tocopherols and sterols. Squalene is also noted. The presence of squalene and ethyl esters is consistent with a crude corn oil feedstock. The percent content (by peak area) for each of the major components is listed below.

COMPONENT	PERCENT OF SAMPLE
Triglycerides	76.42
Diglycerides	5.49
Glycerol	0.04
Methyl Esters	0
Ethyl Esters	2.14
Fatty Acids	14.59
Monoglycerides	0.17
Squalene	0.09
Tocopherol	0.08
Sterols	0.86
Other	0.13



GC/MS Overview



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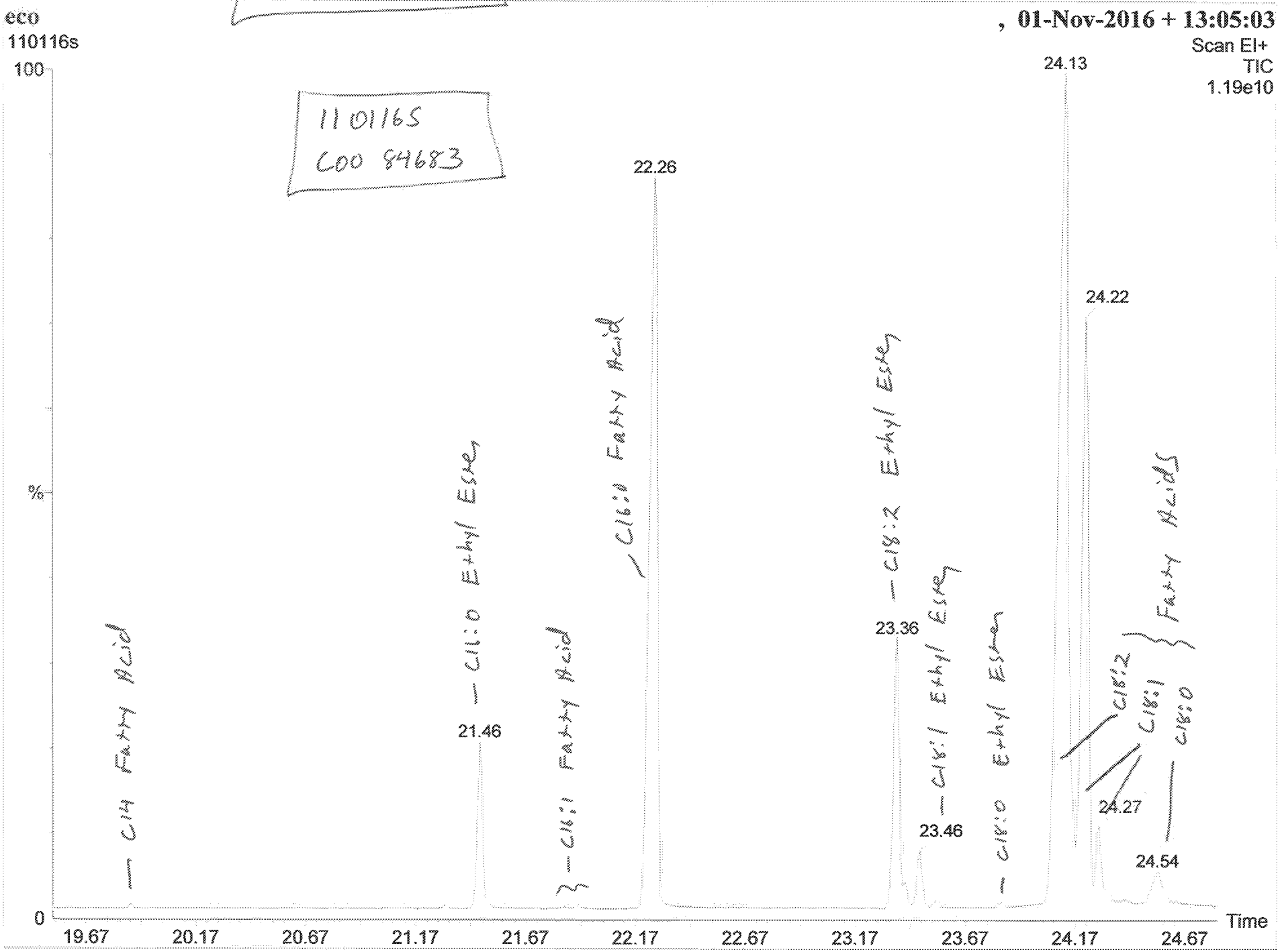
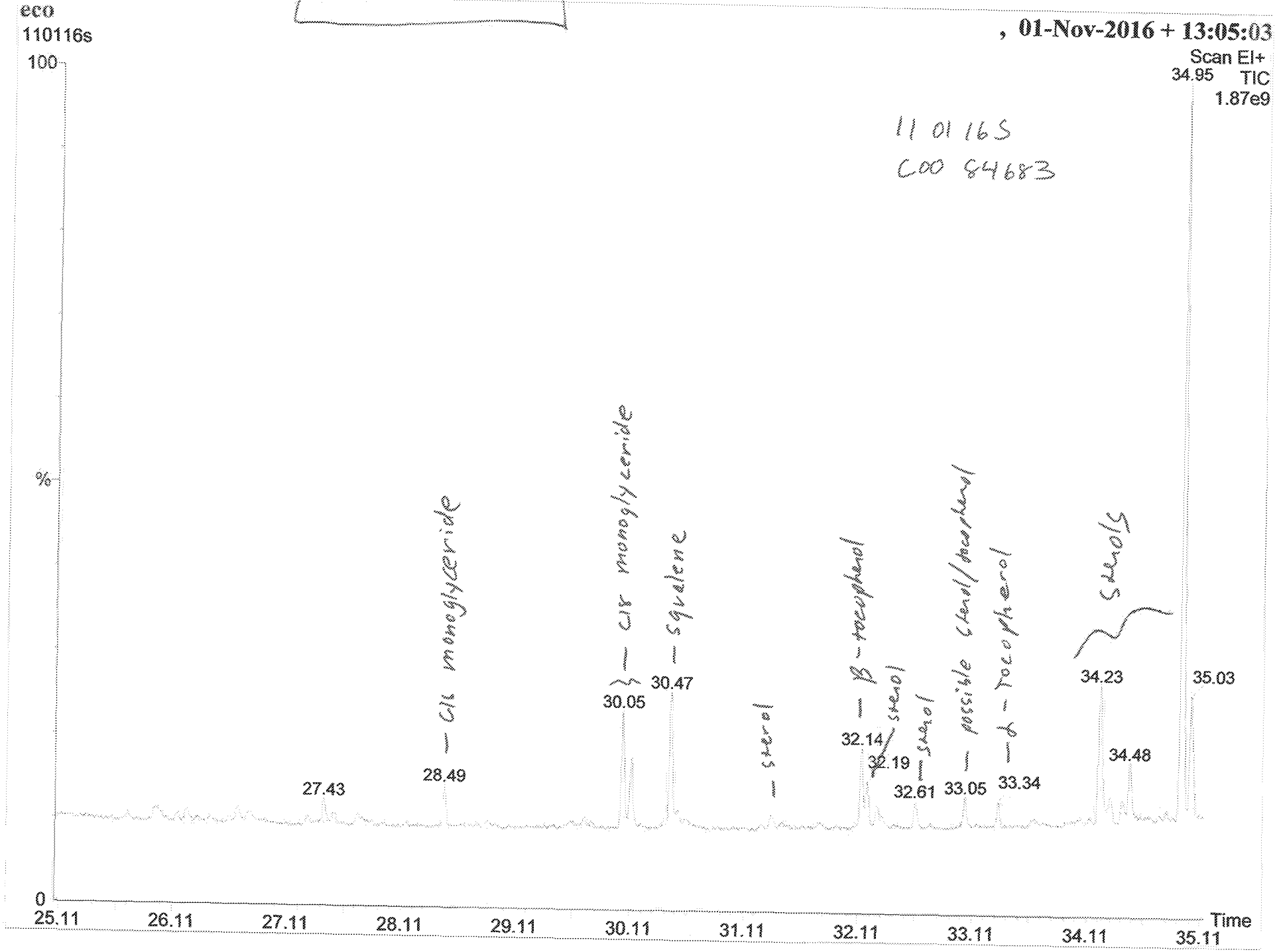


GCMS #2



Iowa Central Fuel Testing Laboratory
Four Triton Circle
Fort Dodge, Iowa, USA 50501

Iowa Central
FUEL TESTING LABORATORY

Laboratory Results Report

Customer Name:	EcoEngineers	**Sample ID:**	110116U
Customer Address:	300 East Locust Street, Suite 313	**Customer ID:**	EcoEngineers
	Des Moines, IA 50309	**Received on:**	**11/1/2016**
Customer's Sample ID:	COO 87846	**Completed:**	**11/7/2016**
Sample Type:	Crude Corn Oil		

Test	Method	Result	Unit
Feedstock Forensic Analysis			
See attached summary and chromatograms			
Notes:			

Approval: _____ **Title:** QMR or designee **Date:** November 7, 2016

Printed copies are uncontrolled

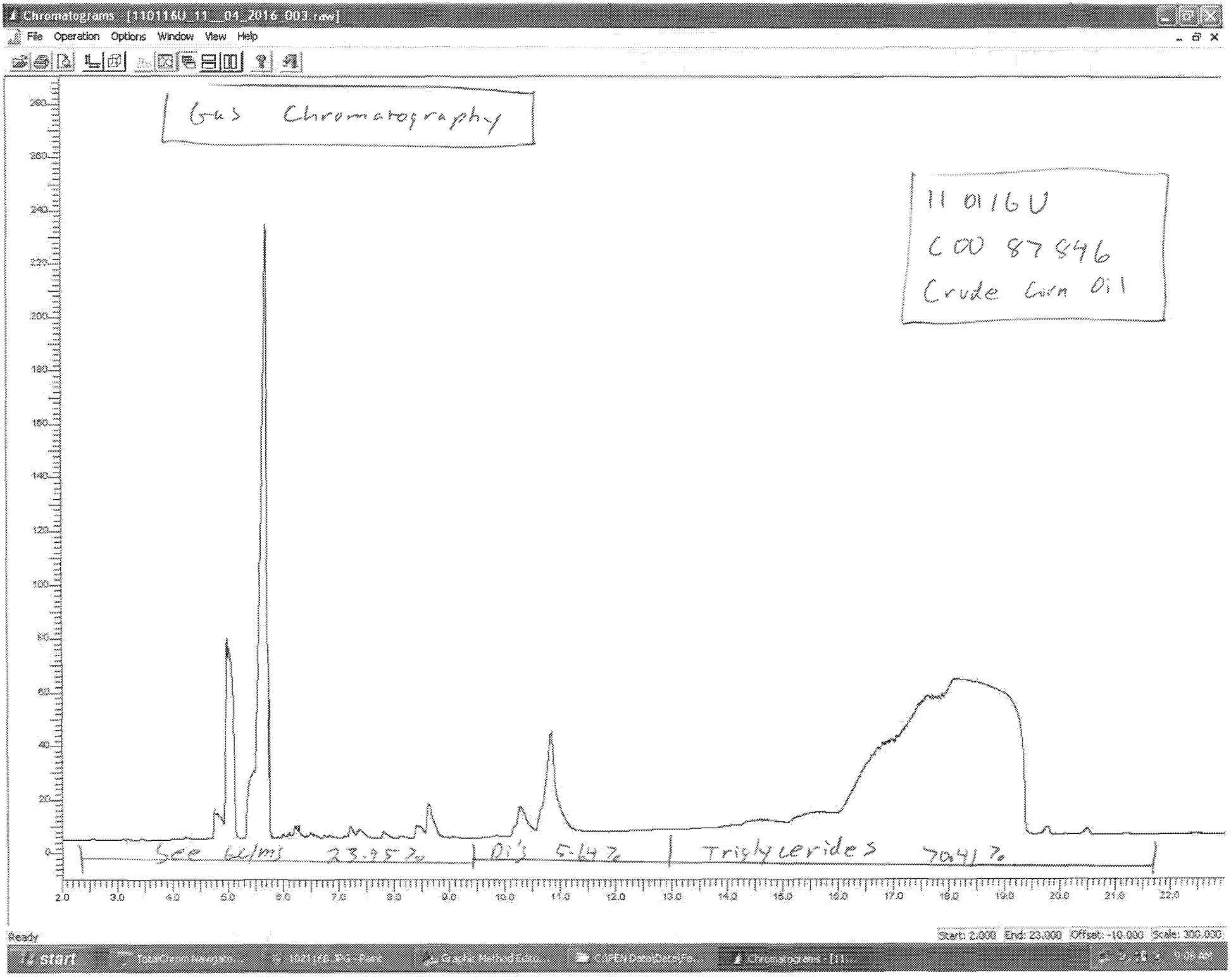
REC 7.1.5 V-1.0 Effective 9-14-2011

110116U
COO 87846
Crude Corn Oil

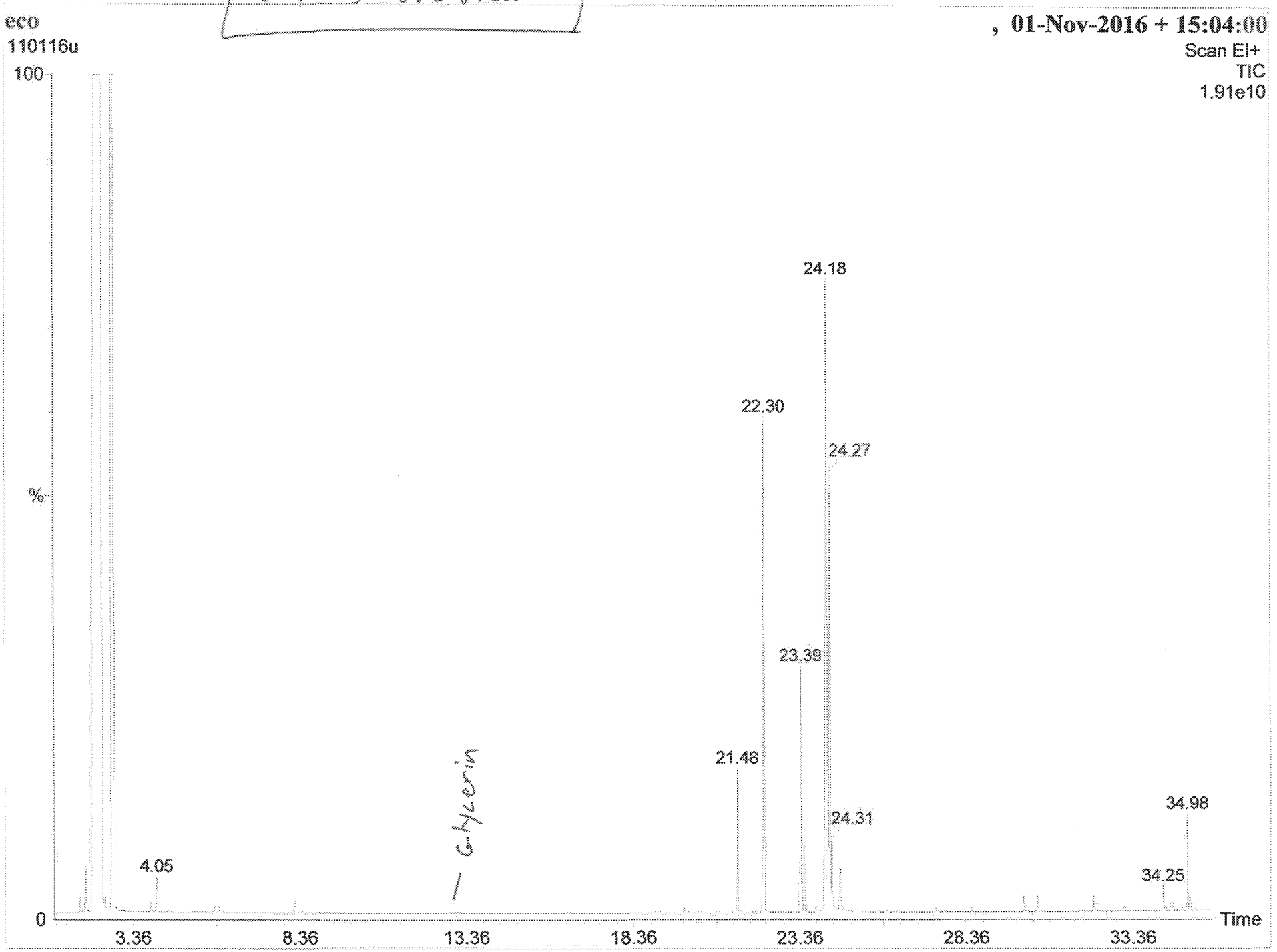
ICFTL received a sample of crude corn oil feedstock. We analyzed the sample by gas chromatography (maximum oven temperature of 380°C) and also by GC/MS (maximum oven temperature of 355°C).

Analysis by gas chromatography shows that the majority of the sample is in the form of triglycerides (70.41 %). The GC/MS sheet shows a small glycerin peak. The first close-up view shows mainly C16 and C18 fatty acids and ethyl esters, whereas the second close-up view shows several monoglycerides, tocopherols and sterols. Squalene is also noted. The presence of squalene and ethyl esters is consistent with a corn oil feedstock. The percent content (by peak area) for each of the major components is listed below.

COMPONENT	PERCENT OF SAMPLE
Triglycerides	70.41
Diglycerides	5.64
Glycerol	0.04
Methyl Esters	0
Ethyl Esters	3.39
Fatty Acids	18.57
Monoglycerides	0.22
Squalene	0.14
Tocopherol	0.11
Sterols	1.21
Other	0.28



GC/MS Overview



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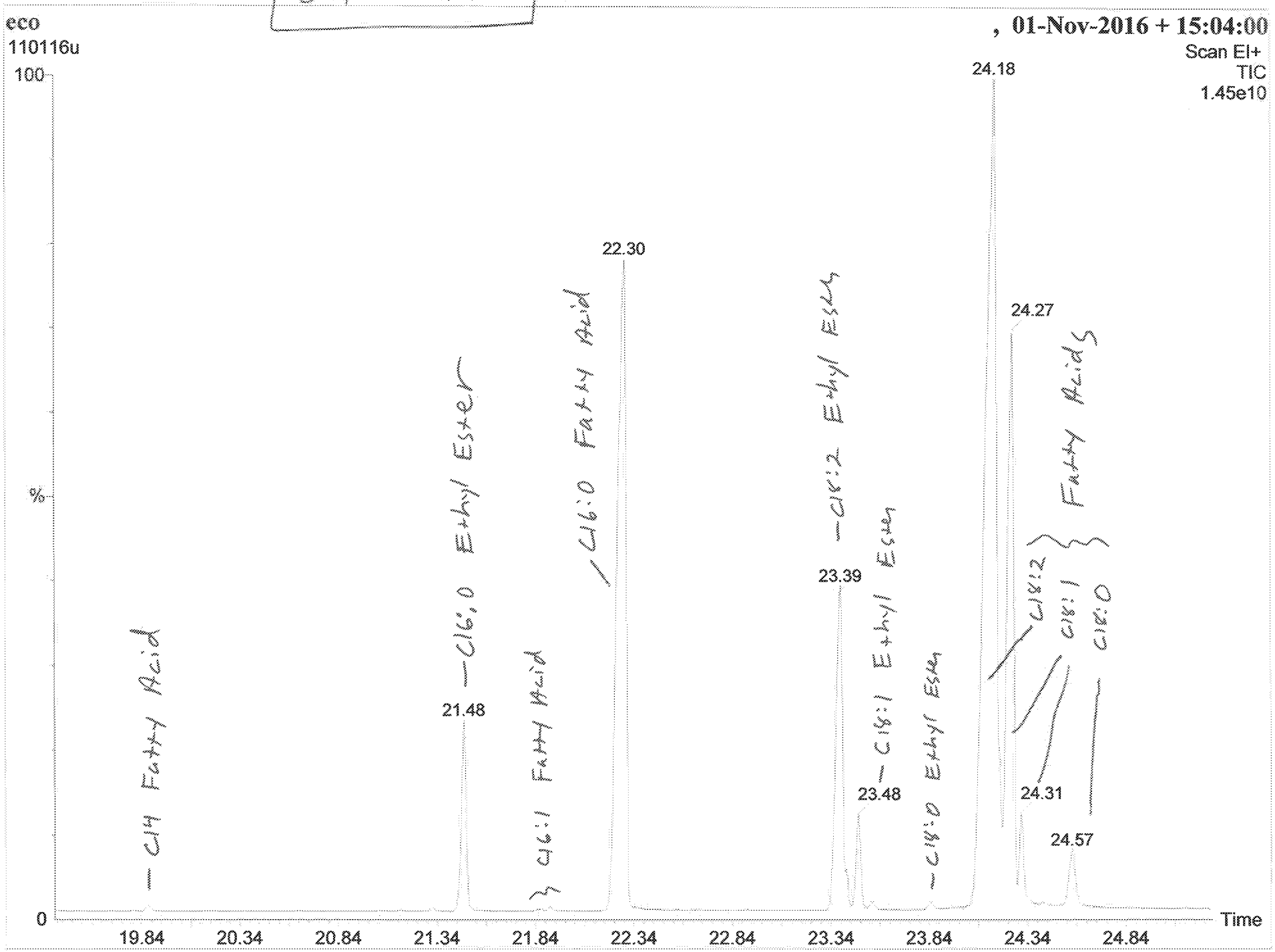

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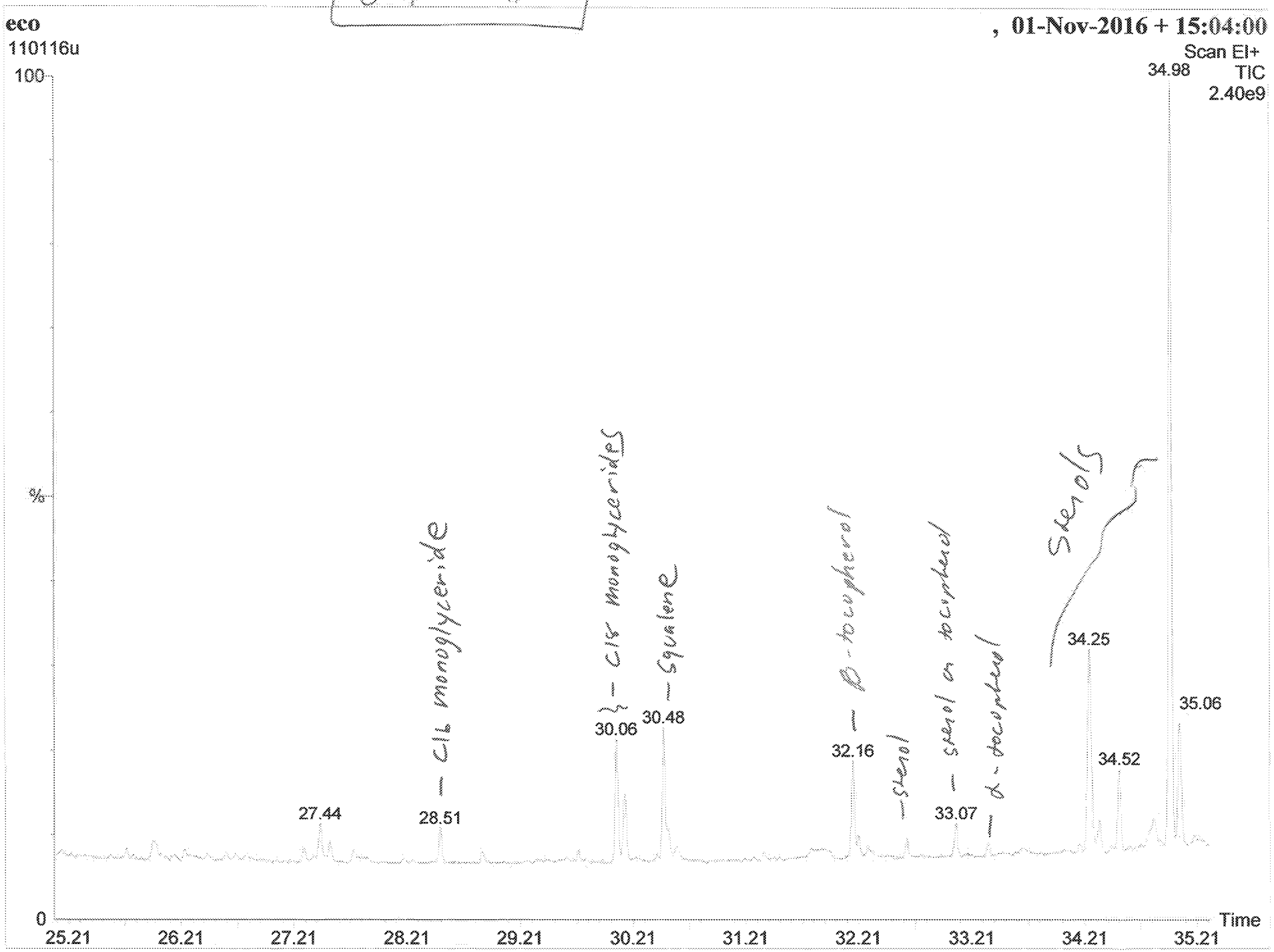


Iowa Central Fuel Testing Laboratory
Four Triton Circle
Fort Dodge, Iowa, USA 50501

Iowa Central
FUEL TESTING LABORATORY

Laboratory Results Report

Customer Name:	EcoEngineers	**Sample ID:**	110116T
Customer Address:	300 East Locust Street, Suite 313	**Customer ID:**	EcoEngineers
	Des Moines, IA 50309	**Received on:**	**11/1/2016**
Customer's Sample ID:	COO 85050	**Completed:**	**11/7/2016**
Sample Type:	CO1 refined corn oil		

Test	Method	Result	Unit
Feedstock Forensic Analysis			
See attached summary and chromatograms			
Notes:			

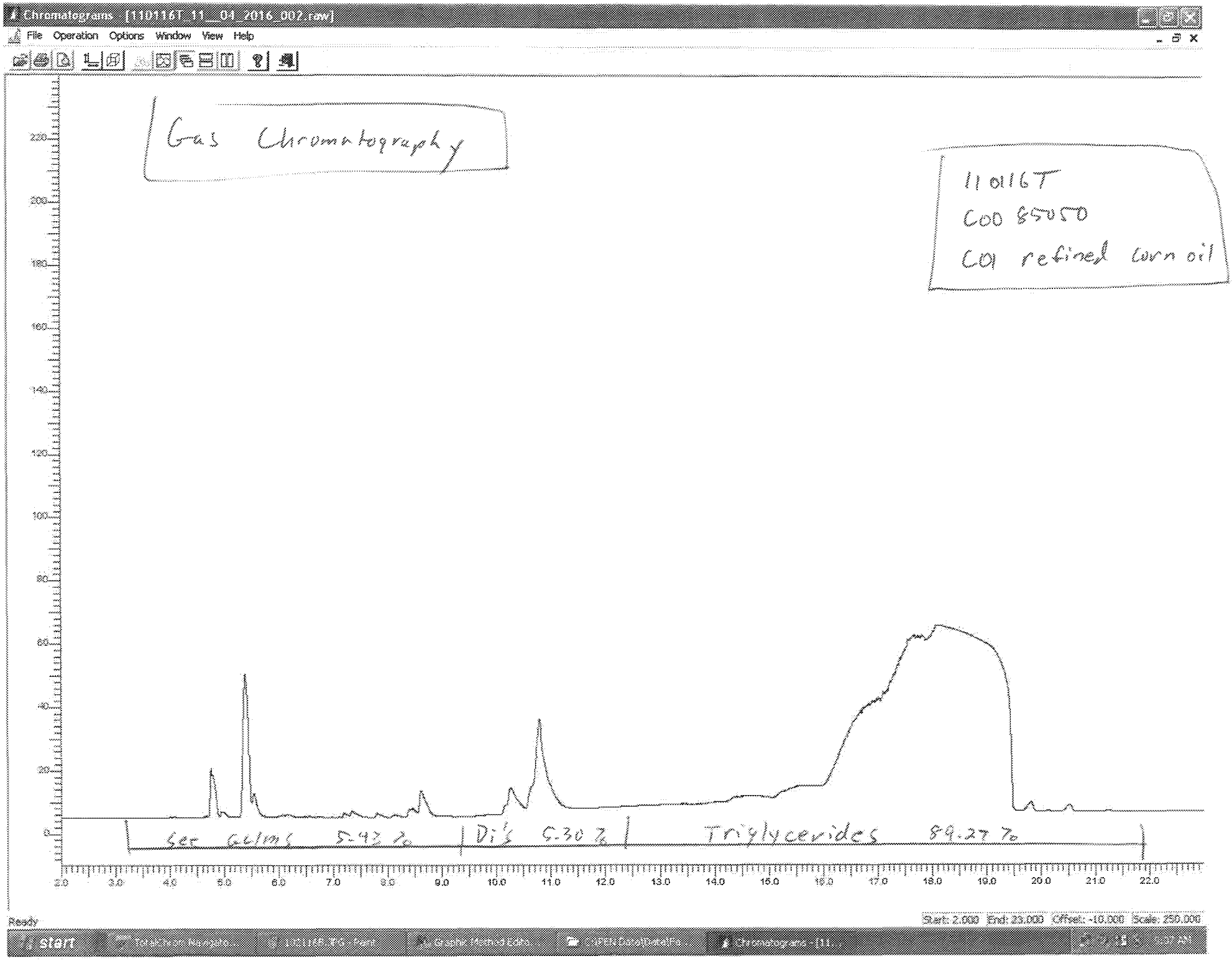
Approval: _____ **Title:** QMR or designee **Date:** November 7, 2016

110116T
COO 85050
CO1 Refined Corn Oil

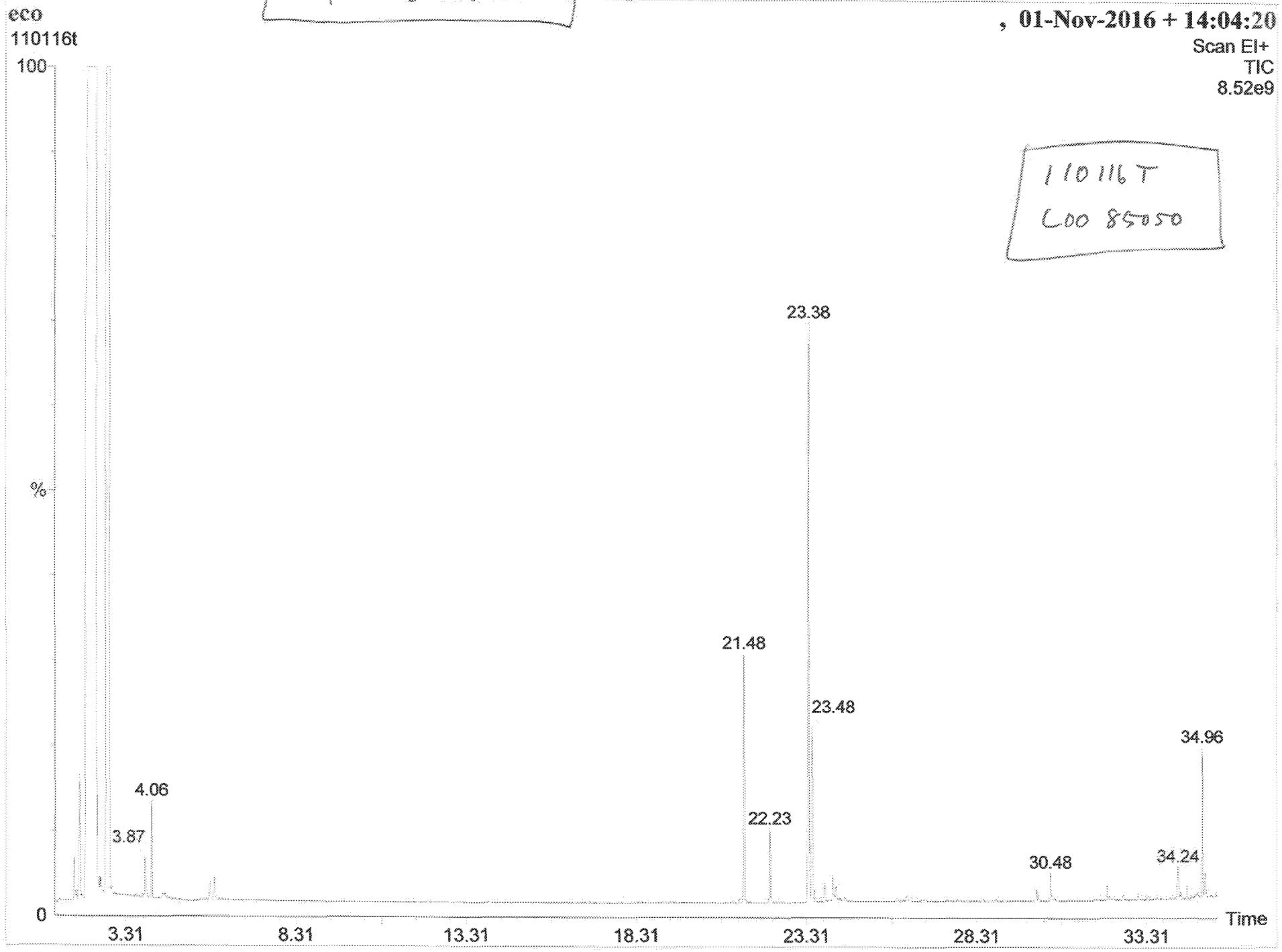
ICFTL received a sample of corn oil feedstock. We analyzed the sample by gas chromatography (maximum oven temperature of 380°C) and also by GC/MS (maximum oven temperature of 355°C).

Analysis by gas chromatography shows that the majority of the sample is in the form of triglycerides (89.27 %). Glycerin was not detected in this sample. The first close-up view shows mainly C16 and C18 fatty acids and ethyl esters, whereas the second close-up view shows several monoglycerides, tocopherols and sterols. Squalene is also noted. The presence of squalene and ethyl esters is consistent with a corn oil feedstock. The percent content (by peak area) for each of the major components is listed below.

COMPONENT	PERCENT OF SAMPLE
Triglycerides	89.27
Diglycerides	5.30
Glycerol	0
Methyl Esters	0
Ethyl Esters	3.72
Fatty Acids	0.41
Monoglycerides	0.08
Squalene	0.12
Tocopherol	0.08
Sterols	0.87
Other	0.14



Gc/ms Overview



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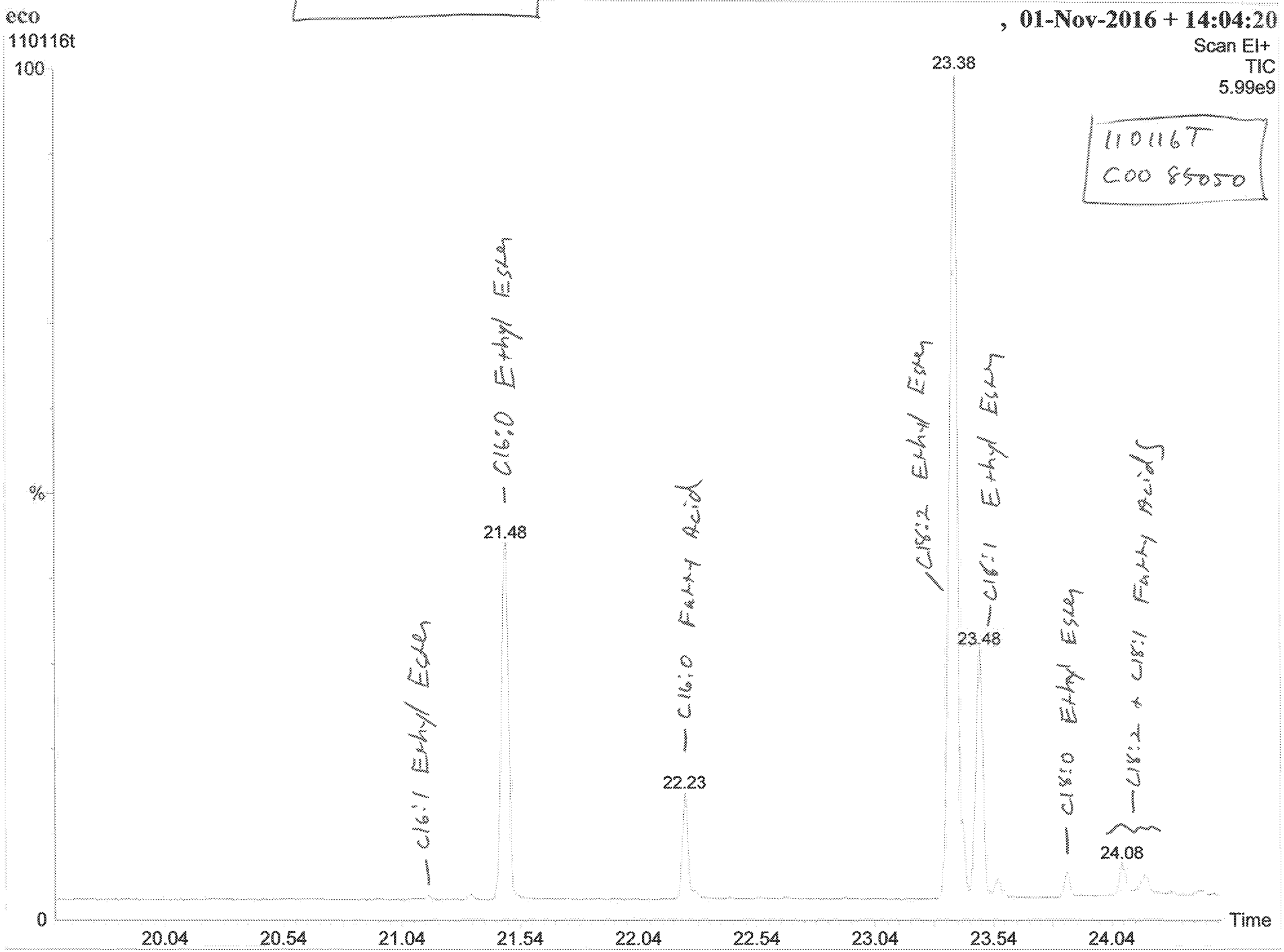
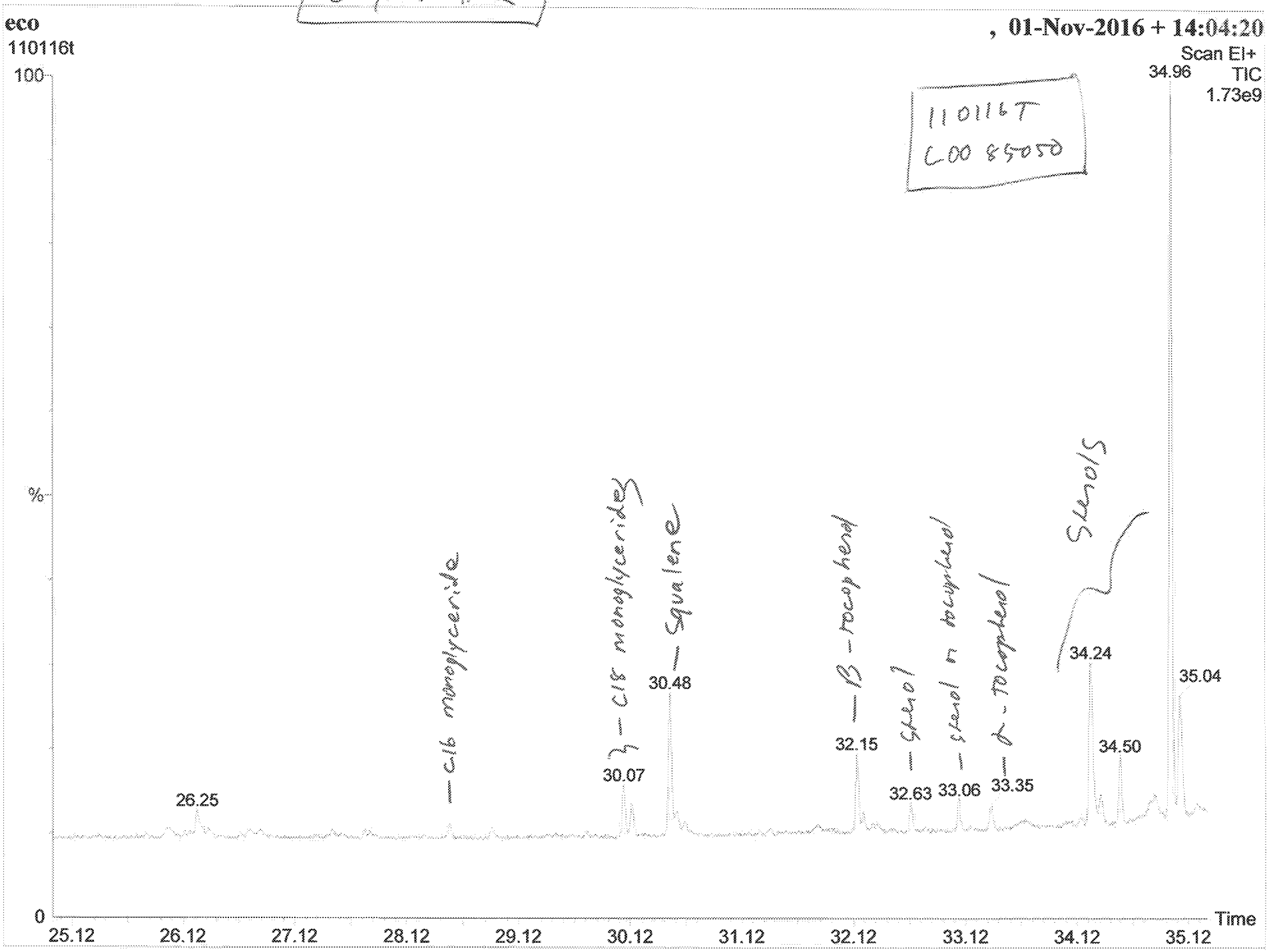


110116T
COO 85050

GC/MS #2



Iowa Central Fuel Testing Laboratory
Four Triton Circle
Fort Dodge, Iowa, USA 50501

Iowa Central
FUEL TESTING LABORATORY

Laboratory Results Report

Customer Name:	EcoEngineers	**Sample ID:**	110116V
Customer Address:	300 East Locust Street, Suite 313	**Customer ID:**	EcoEngineers
	Des Moines, IA 50309	**Received on:**	**11/1/2016**
Customer's Sample ID:	COO 88612	**Completed:**	**11/7/2016**
Sample Type:	CO1 refined corn oil		

Test	Method	Result	Unit
Feedstock Forensic Analysis			
See attached summary and chromatograms			
Notes:			

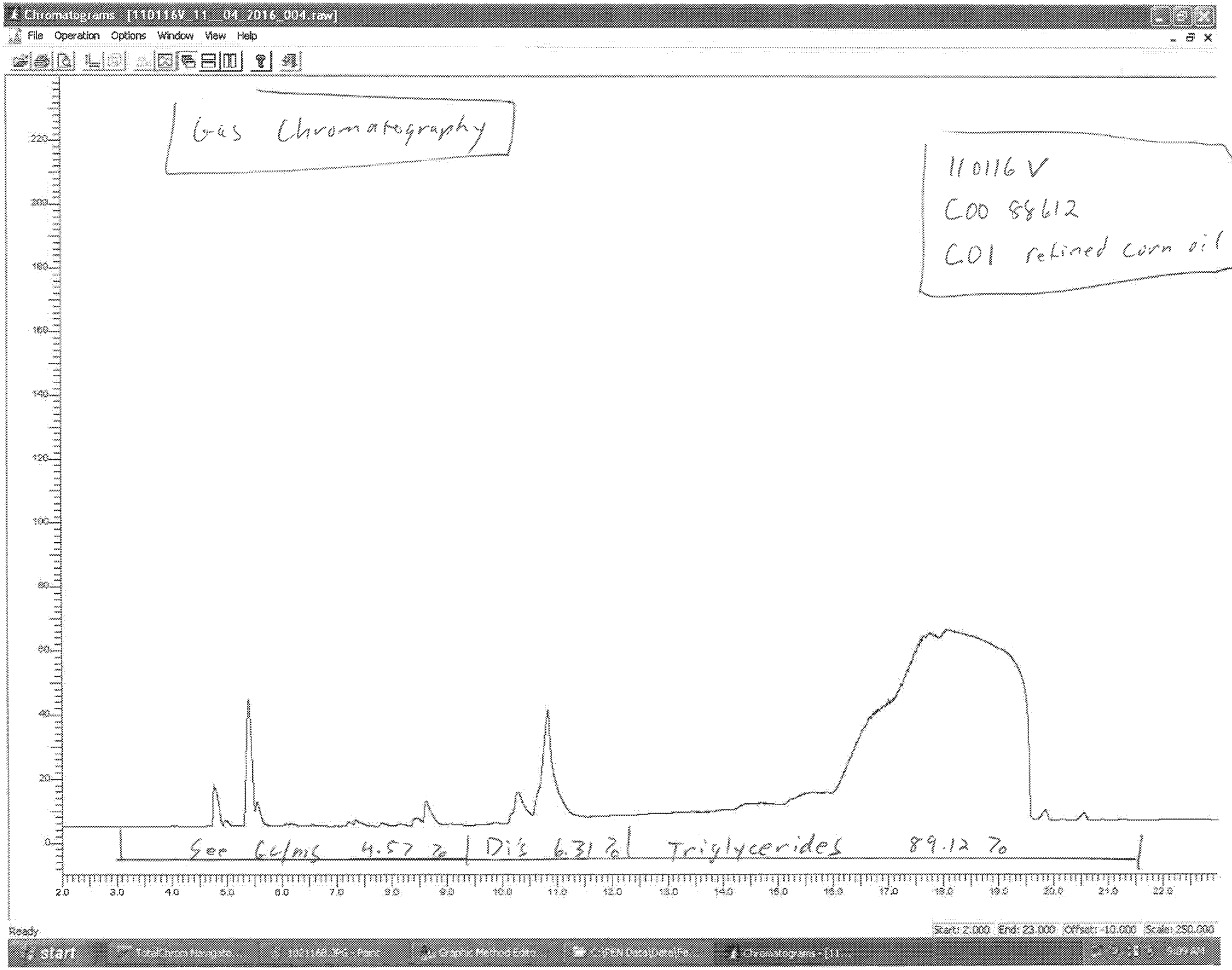
Approval: _____ **Title:** QMR or designee **Date:** November 7, 2016

110116V
COO 88612
CO1 Refined Corn Oil

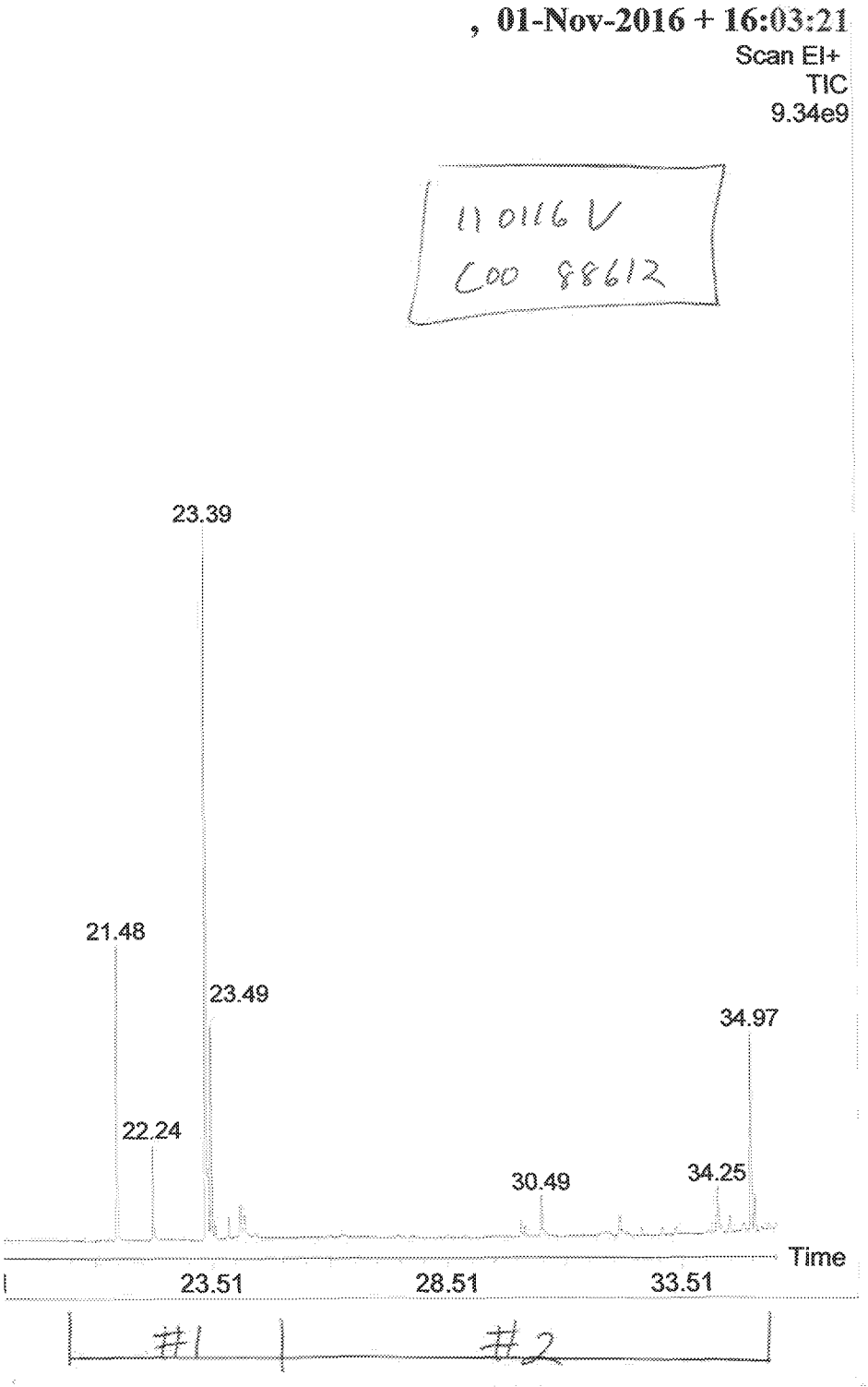
ICFTL received a sample of crude corn oil feedstock. We analyzed the sample by gas chromatography (maximum oven temperature of 380°C) and also by GC/MS (maximum oven temperature of 355°C).

Analysis by gas chromatography shows that the majority of the sample is in the form of triglycerides (89.12 %). Glycerin was not detected in this sample. The first close-up view shows mainly C16 and C18 fatty acids and ethyl esters, whereas the second close-up view shows several monoglycerides, tocopherols and sterols. Squalene is also noted. The presence of squalene and ethyl esters is consistent with a corn oil feedstock. The percent content (by peak area) for each of the major components is listed below.

COMPONENT	PERCENT OF SAMPLE
Triglycerides	89.12
Diglycerides	6.31
Glycerol	0
Methyl Esters	0
Ethyl Esters	3.02
Fatty Acids	0.35
Monoglycerides	0.10
Squalene	0.08
Tocopherol	0.08
Sterols	0.81
Other	0.12



GC/MS Overview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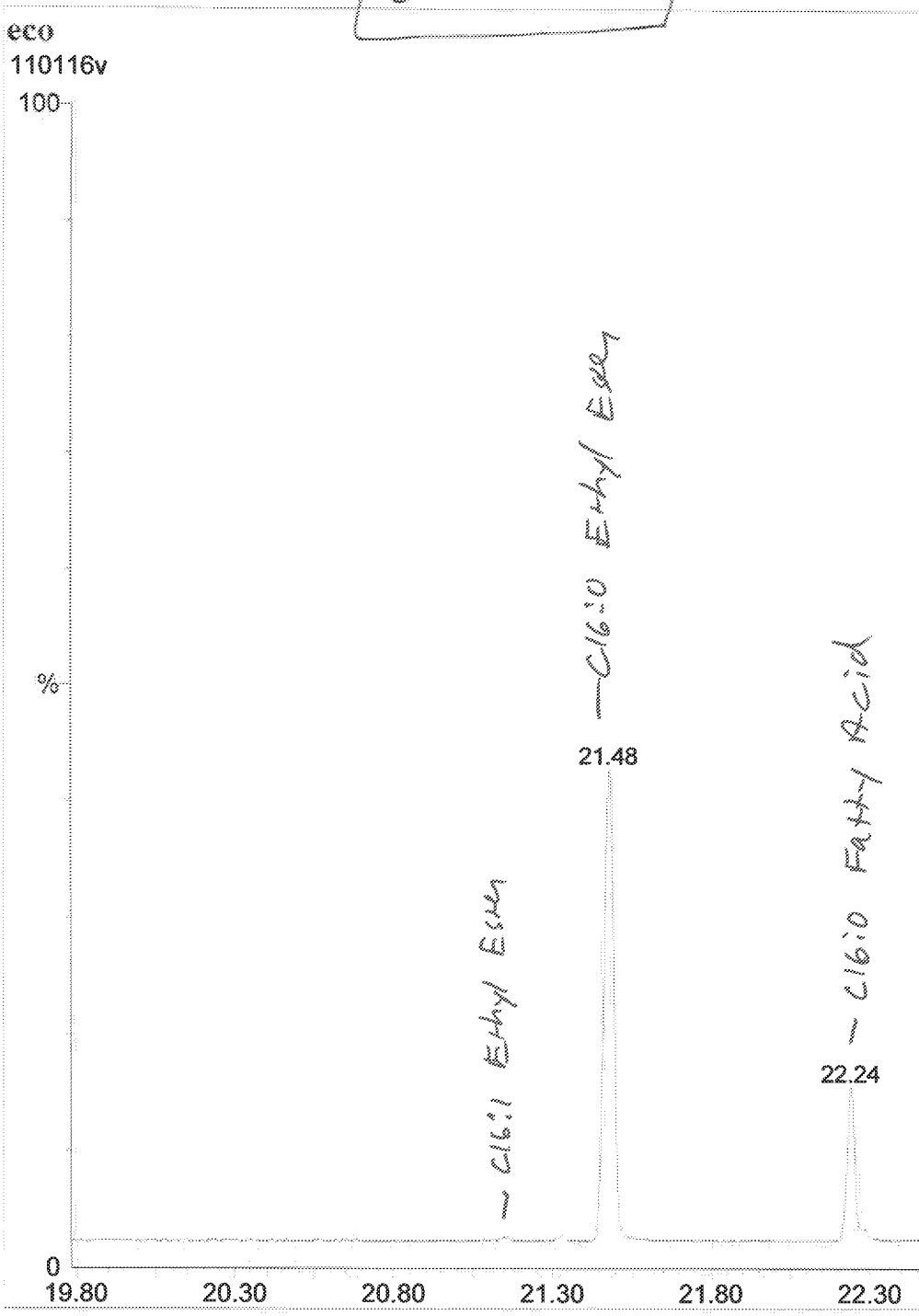
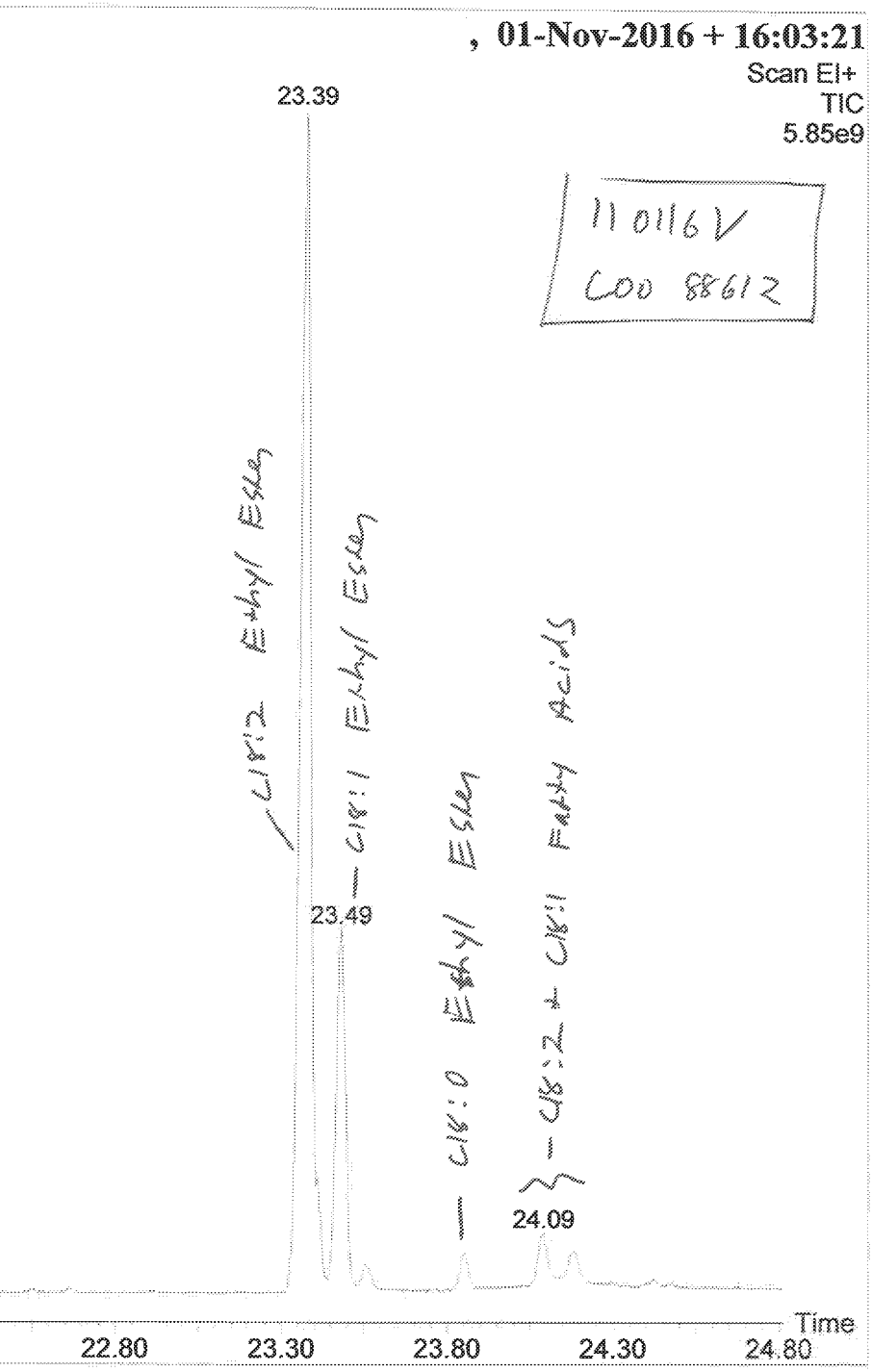
GC/MS #1

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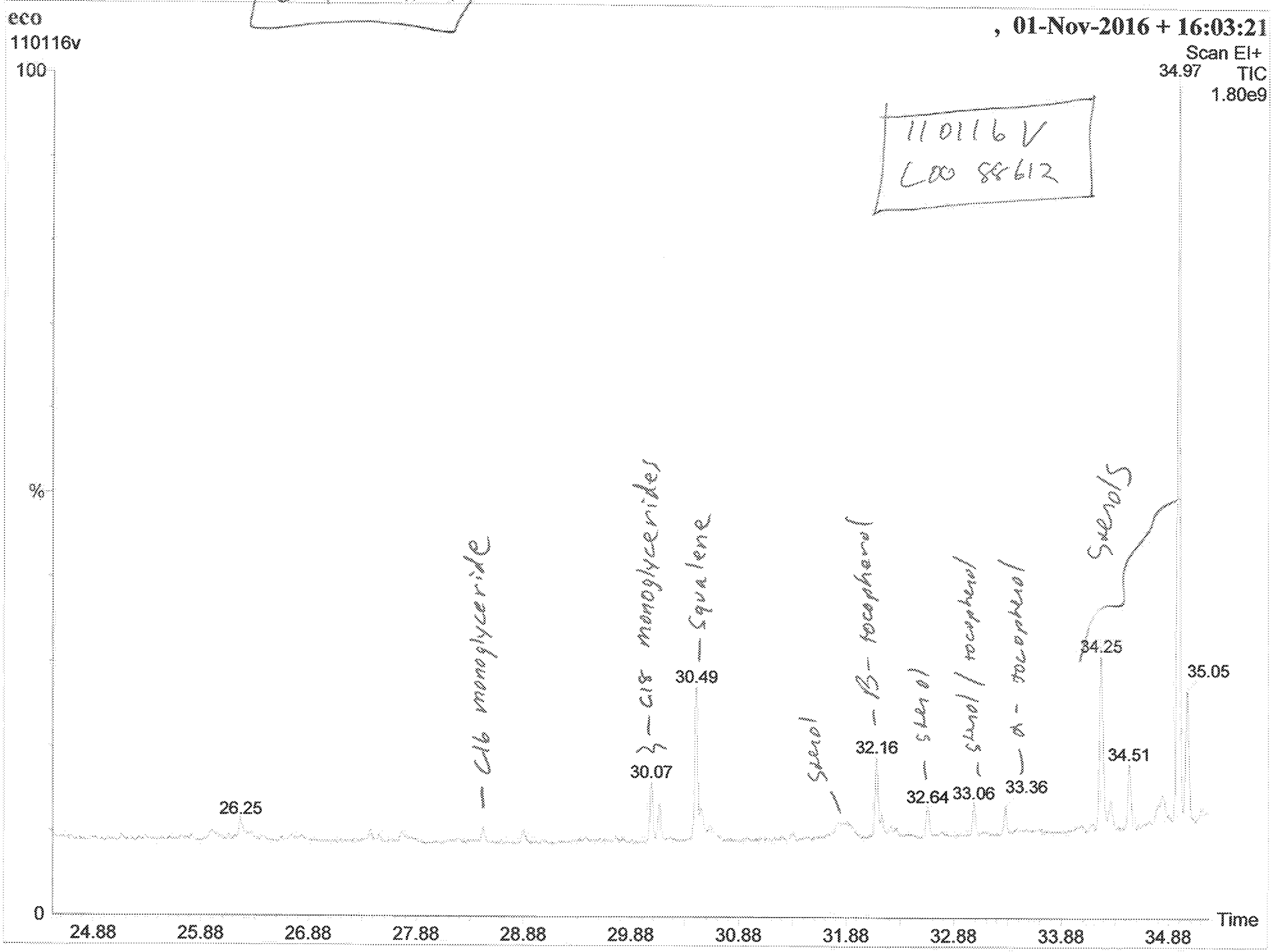
Scan EI+
TIC
5.85e9
23.39
23.49
24.09
C18:2 Ethyl Ester
C18:1 Ethyl Ester
C16:0 Ethyl Ester
C18:2 + C18:1 Fatty Acids
Time
22.80
23.30
23.80
24.30
24.80

GC/MS #2



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