Appendix H. Estimated Daily Intake of Corn Oil

Corn oil like other oils is typically consumed as a component of food mixtures that contain oil as an ingredient. Many foods reported in the dietary component of the National Health and Nutrition Examination Survey (NHANES) that contain oil do not comprehensively disaggregate foods into the oil component. Additionally, because oil blends are used in commercial applications, food recipes do not necessarily identify oils by specific vegetable source. Estimates of corn oil were therefore derived using three approaches based on the available data. The following three approaches to estimate corn oil intake based on NHANES include analyses utilizing the (1) Food Pattern Equivalents Database (FPED) and NHANES data, (2) USDA published consumption estimates based on FPED intakes, and the (3) Food Commodity Intake Database (FCID) and NHANES data. The following sections describe the data and method used in this analysis in more detail.

1. FPED Analysis and WWEIA/NHANES

Data Source and Methods

Corn oil consumption estimates were based on dietary recall records collected in the What We Eat in America (WWEIA) component of NHANES conducted in 2013-2014 and 2015-2016. This continuous survey is a complex multistage probability sample designed to be representative of the civilian US population (NCHS 2016, 2018). The NHANES datasets provide nationally representative nutrition and health data and prevalence estimates for nutrition and health status measures in the United States. Statistical weights are provided by the National Center for Health Statistics (NCHS) to adjust for the differential probabilities of selection. As part of the examination, trained dietary interviewers collected detailed information on all foods and beverages consumed by respondents in the previous 24 hour time period (midnight to midnight). A second dietary recall was administered by telephone three to ten days after the first dietary interview, but not on the same day of the week as the first interview. The dietary component of the survey is conducted as a partnership between the US Department of Agriculture (USDA) and the US Department of Health and Human Services (DHHS). DHHS is responsible for the sample design and data collection, and USDA is responsible for the survey's dietary data collection methodology, maintenance of the databases used to code and process the data, and data review and processing. A total of 14,601 individuals in the survey period 2013-2016 provided two complete days of dietary recalls.

Identification of Oils and Oils in Foods

The Food Pattern Equivalents Database (FPED) comprehensively disaggregates each food reported consumed in the WWEIA, NHANES into components of oils and other dietary components (e.g., fruits, vegetables, grains, protein foods, etc.) used to evaluate food patterns and diet quality. The FPED oils component includes all unhydrogenated vegetables oils (except palm oil, palm kernel oil, and coconut oil) and fats naturally present in nuts, seeds, avocado, olives, and seafood. Values in the FPED database for the oils component reflect the gram weight of all unhydrogenated vegetable oils per 100 grams food plus the weight of some fats in plants foods and seafood. Using the FPED database, the total oil gram amount per 100 grams food was identified in foods reported consumed during NHANES 2013-2016 (USDA 2017, 2018a,) and included in the assessment.

Analysis

Using the WWEIA consumption data, the 2-day average intake of total oil for the US population was estimated. For each respondent in the survey, the 2-day average intake of total oil was estimated by multiplying the reported intake of oil-containing foods from the WWEIA data with its corresponding oil content from FPED and the cumulative sum over the two 24-hr recalls was divided by two.

Estimates were calculated on a per user basis, where a user was defined as anyone who reported consuming any type of oil or oil-containing foods on either of the survey days. The analysis was limited to individuals who provided two complete and reliable dietary recalls as determined by the NCHS. The intakes were calculated using statistical weights that compensate for variable probabilities of selection and adjust for non-response. The resulting estimated intakes of oil are representative of consumption by the US population. Estimates of intake were calculated using Exponent's Foods and Residue Evaluation Program (FARE® version 13.03).

The FPED total oils component is a measure of total oil intake and does not provide detail on the source of the oils. To estimate the daily intake of corn oil, the estimated intake of total oil calculated with the FPED oils component was adjusted to reflect the proportion that is corn oil. It was assumed that corn oil is 10% of total oils consumed based on the default used in the USDA recipe database USDA's Food and Nutrient Database for Dietary Studies (FNDDS) (USDA 2018b) for food code 82101000, Vegetable oil, not-further-specified (NFS). This 10% corn oil apportionment estimate was derived by USDA based on data from food availability and products from the USDA and the Economic Research Service (ERS).

Estimates of oil intake could alternatively have been derived using 8-digit foodcodes for oil and oil ingredients in the "FNDDS Ingredients" database in combination with dietary recall records; however, the "FNDDS Ingredients" database does not break down each oil-containing food mixture to the level of oil ingredients. Use of the FPED oils component has the advantage of fully disaggregating each food into an oils component.

Results

Estimated daily intakes of both total oils and corn oil by the US population two years and older are presented in Table G-1. Assuming that corn oil is 10% of the total oil intake as described above, the per user mean and 90th percentile intakes of corn oil are 2.6 g/day and 4.7 g/day, respectively. The resulting corn oil intake estimate is likely conservatively high since total oil intake includes more oils (e.g., all type of oils plus fats naturally present in nuts, seeds, avocado, olives and seafood) than those varieties assigned to NFS vegetable oil (corn, soybean, canola, and olive).

Table G-1. Two-day Average Estimated Daily Intake of Vegetable Oil and Corn Oil by the US population 2+ y; NHANES 2013-2016

Oil type	N[a]	% User	Per Capita (g/day)		Per User (g/day)	
			Mean	90th Percentile	Mean	90th Percentile
Total vegetable oil	13,583	99.9	26.3	47.2	26.4	47.2
Corn oil[b]	13,583	99.9	2.6	4.7	2.6	4.7

[a] Unweighted number of users; %user, per capita and per user estimates based on WWEIA/NHANES and were derived using the statistical weights provided by the NCHS.
[b] Assumes corn oil is 10% of vegetable oil consumption, based on the % corn oil assumed by USDA for food code 82101000, Vegetable oil, NFS.

2. USDA Published Data

Publicly available USDA food consumption data tables based on the What We Eat in America (WWEIA) component of the National Health and Nutrition Examination Surveys (NHANES) provide another approach for estimating consumption of corn oil in the US. These data tables include estimates of edible oil intake by survey release and therefore provide an alternate approach to examine oil intake as summarized in approach 1.

The total average edible oil intake among the US population two years and older has been published by the USDA and ranges from 21.6 – 27.1 g/day based on first day dietary records analyzed from the last four individual NHANES survey cycles (NHANES 2009-10, 2011-12, 2013-14, and 2015-16) (USDA 2018). The reported oil intake included all unhydrogenated vegetables oils (except palm oil, palm kernel oil, and coconut oil) and fats naturally present in nuts, seeds, avocado, olives, and seafood.

The USDA has also provided data on corn oil apportionment of 10% to vegetable oil not-further-specified (NFS) (food code 82101000) in the recipe database used for foods in WWEIA, namely the Food and Nutrient Database for Dietary Studies (FNDDS). The 10% corn oil apportionment is derived by USDA based on data from food availability and products from the USDA and the Economic Research Service (ERS) and is the default value used for many recipes of FNDDS. While the USDA recipe database (i.e., FNDDS) disaggregates some food mixtures into component ingredients such as corn oil, it does not comprehensively capture all types of oils in all foods.

To conservatively estimate corn oil intake, the maximum amount of edible oils of 27.1 g/day consumed by the US based on the WWEIA, NHANES (USDA 2018a) was adjusted with the proportion of vegetable oil allotted to corn oil of 10% (USDA 2018b). Although estimates calculated by USDA are on a per capita basis, it is reasonable to assume that nearly everyone is a consumer of edible oils and thus, 27.1 g/day can be representative of per user estimates. The resulting conservative corn oil intake estimate at the mean, based on short-term (24-hour daily) intake, is 2.7 g/day (i.e., 27.1 g/day total edible oil X 10% corn oil) and the pseudo-estimate at the 90th percentile of intake is calculated to be 5.4 g/day (i.e., mean X 2 → 2.7 g/day X 2) based on an approach used by the FDA (2006).

3. WWEIA/NHANES and FCID Analysis

The estimated daily intake (EDI) of corn oil was based on food consumption records collected as part of the WWEIA, NHANES conducted in 2007-2008 and 2009-2010 (CDC 2010, 2012). The combined NHANES 2007-2008 and 2009-2010 is a complex multistage probability sample designed to be representative of the civilian US population.

As part of the NHANES examination, trained dietary interviewers collect detailed information on all foods and beverages consumed by respondents in the previous 24 hour time period (midnight to midnight). A second dietary recall is administered by telephone 3 to 10 days after the first dietary interview, but not on the same day of the week as the first interview. The dietary component of the survey is conducted as a partnership between the US Department of Agriculture (USDA) and the US Department of Health and Human Services (DHHS). DHHS is responsible

for the sample design and data collection, and USDA is responsible for the survey's dietary data collection methodology, maintenance of the databases used to code and process the data, and data review and processing. A total of 16,244 individuals in the combined survey period 2007-2010 provided 2 complete days of dietary recalls as determined by the National Center for Health Statistics (NCHS).

Each food reported consumed by survey respondents is identified by an 8-digit number based on the USDA's food coding scheme. The NHANES consumption data were used in conjunction with EPA's Food Commodity Intake Database (FCID) to determine the amount of corn oil in foods. For each food reported in NHANES, the FCID database provides information on food constituents (or ingredients) at the raw agricultural commodity level. The following FCID ingredients were identified and included in the assessment to estimate corn oil intake:

1500125000 Corn, field, oil
1500125001 Corn, field, oil-babyfood

Analysis

For each survey respondent, corn oil estimates were derived by multiplying the amount of food consumed with the corn oil fraction. Intakes of corn oil were summed for each survey respondent and the 2-day average intake was calculated by dividing the sum by two. Estimates of corn oil at the mean and 90th percentile of intake were calculated for the US population 2 years and older.

The 2-day average intakes were estimated using Exponent's Foods and Residues Evaluation Program (FARE® version 10.0) software. All estimates were generated with statistical weights provided by the NCHS for the surveys to adjust for the differential probabilities of selection.

Results

The EDI of corn oil for the US population 2 years and older is provided in Table G-2and shows the mean and the 90th percentile intakes, respectively, in units of g/day, on both the per capita (all individuals) and per users (only those who consume foods that contain corn oil) basis.

During the two days of dietary recall, an estimated 98.5% of the US population age 2 years and older reported consumption of at least one food that contains corn oil. Among the total population age 2 years and older, the per user 2-day average EDIs at the mean and the 90th percentile intakes are 1.3 g/day and 2.5 g/day, respectively.

Table G-2. Two-day Average Estimated Daily Intake of Corn Oil by the US Population 2+ y; NHANES 2007-2010

Oil Type	Un-weighted No. of Users	% Users	Per Capita (g/day)		Per User (g/day)	
			Mean	90th Percentile	Mean	90th Percentile
Corn oil	14,820	98.5	1.3	2.5	1.3	2.5

EDI Summary

Intake estimates for corn oil were derived using three approaches since the recipe data for foods reported in the dietary component of the NHANES do not comprehensively disaggregate foods, particularly for food crops such as oil. Using the FPED (approach 1), the per user 90th percentile intake of corn oil was estimated to be 4.7 g/day for the US population 2+ y. Using the USDA

published FPED consumption estimates (approach 2), the pseudo-90th percentile of intake of corn oil was calculated to be 5.4 g/day for the US population 2+ y. Based on the FCID (approach 3), the per user corn oil intake at the 90th percentile was estimated to be 2.5 g/day for the US population 2+ y. Overall, based on the highest estimate of corn oil intake, approach 2 with a pseudo-90th percentile estimate of 5.4 g/day, corn oil intake among the US 2+ y is no more than 6 g/day.

Appendix I. COZ Corn Oil Stability Study Reports

1. Accelerated shelf-life at 40C for 91 days
2. Ambient shelf-life for 273 days

Accelerated Shelf-life Study

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REPORT OF ANALYSIS

For: (36293) CORN OIL ONE
13190
Accelerated Shelf Life (40C)
Corn Oil COz Batch 1

Analysis	Level Found As Received	Units	Reporting Limit	Method	Analyst-Date	Verified-Date
Sample ID: **Day 0** Lab Number: **60037324** Date Sampled: **2018-02-15**						
Sensory evaluation of foods	See Comments	None	None	VARIABLE *	jps0-2018/02/16	bch0-2018/02/16
p-anisidine value	3		2	AOCS Cd 18-90	ees0-2018/02/16	bch0-2018/02/16
Totox number	10.2	n/a	1.0	Calculation	Auto-2018/02/16	Auto-2018/02/16
Peroxide value	3.6	meq/kg fat	2.0	AOAC 965.33	kap7-2018/02/16	cmw4-2018/02/16
Sample ID: **Day 14** Lab Number: **60037325** Date Sampled: **2018-03-01**						
Sensory evaluation of foods	See Comments	None	None	VARIABLE *	jps0-2018/03/05	keb1-2018/03/05
p-anisidine value	4		2	AOCS Cd 18-90	ees0-2018/03/02	keb1-2018/03/05
Totox number	17.8	n/a	1.0	Calculation	Auto-2018/03/02	Auto-2018/03/05
Peroxide value	6.9	meq/kg fat	2.0	AOAC 965.33	kap7-2018/03/02	cmw4-2018/03/02
Sample ID: **Day 28** Lab Number: **60037326** Date Sampled: **2018-03-15**						
Sensory evaluation of foods	See Comments	None	None	VARIABLE *	jps0-2018/03/20	bch0-2018/03/23
p-anisidine value	4		2	AOCS Cd 18-90	jeb2-2018/03/23	bch0-2018/03/23
Totox number	13.0	n/a	1.0	Calculation	Auto-2018/05/16	Auto-2018/05/16
Peroxide value	4.5	meq/kg fat	2.0	AOAC 965.33	pgr4-2018/03/22	cmw4-2018/03/23
Sample ID: **Day 42** Lab Number: **60037327** Date Sampled: **2018-03-29**						
Sensory evaluation of foods	See Comments	None	None	VARIABLE *	jps0-2018/04/05	bch0-2018/04/05
p-anisidine value	3		2	AOCS Cd 18-90	keb1-2018/04/02	srp3-2018/04/02
Totox number	21.6	n/a	1.0	Calculation	Auto-2018/04/03	Auto-2018/04/05
Peroxide value	9.3	meq/kg fat	2.0	AOAC 965.33	kap7-2018/04/03	cmw4-2018/04/03

The result(s) issued on this report only reflect the analysis of the sample(s) submitted.

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REPORT OF ANALYSIS

For: (36293) CORN OIL ONE
13190
Accelerated Shelf Life (40C)
Corn Oil COz Batch 1

Analysis	Level Found As Received	Units	Reporting Limit	Method	Analyst-Date	Verified-Date
Sample ID: **Day 56** Lab Number: **60037328**	Date Sampled: **2018-04-12**					
Sensory evaluation of foods	See Comments	None	None	VARIABLE *	jps0-2018/04/16	srp3-2018/04/16
p-anisidine value	5		2	AOCS Cd 18-90	alq6-2018/04/17	srp3-2018/04/17
Totox number	16.6	n/a	1.0	Calculation	Auto-2018/04/17	Auto-2018/04/17
Peroxide value	5.8	meq/kg fat	2.0	AOAC 965.33	kap7-2018/04/16	cmw4-2018/04/17
Butyric (C4:0)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Caproic (C6:0)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Caprylic (C8:0)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Capric (C10:0)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Lauric (C12:0)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Tridecanoic (C13:0)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Myristic (C14:0)	0.04	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Myristoledic (C14:1 Trans)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Myristoleic (C14:1 Cis)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Pentadecanoic (C15:0)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Palmitic (C16:0)	11.2	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Palmitelaidic (C16:1 Trans)	0.04	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Palmitoleic (C16:1 Cis)	0.11	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Heptadecanoic (C17:0)	0.069	g/100g	0.010	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
10-Heptadecanoic (C17:1)	0.04	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25

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Corn Oil COz Batch 1

Analysis	Level Found As Received	Units	Reporting Limit	Method	Analyst-Date	Verified-Date
Sample ID: Day 56 Lab Number: **60037328** (con't)						
Stearic (C18:0)	1.68	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Eliadic (C18:1 Trans)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Oleic (C18:1 Cis)	29.5	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Linolelaidic (C18:2 Trans)	0.03	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Linoleic (C18:2 Cis)	54.1	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
gamma-Linolenic (C18:3 gamma)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Nonadecanoic (C19:0)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
alpha-Linolenic (C18:3 alpha)	1.22	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Arachidic (C20:0)	0.35	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
11-Eicosenoic (C20:1)	0.24	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
11-14 Eicosadienoic (C20:2)	0.02	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Homo-gamma linolenic (C20:3)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
11-14-17 Eicosatrienoic (C20:3)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Arachidonic (C20:4)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Eicosapentaenoic (C20:5)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Heneicosanoic (C21:0)	0.01	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Behenic (C22:0)	0.12	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Erucic (C22:1)	0.03	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Docosadienoic (C22:2)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25

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Analysis	Level Found As Received	Units	Reporting Limit	Method	Analyst-Date	Verified-Date
Sample ID: Day 56 Lab Number: **60037328** (con't)						
Docosapentaenoic (C22:5)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Docosahexaenoic (C22:6)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Tricosanoic (C23:0)	0.02	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Lignoceric (C24:0)	0.16	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Nervonic (C24:1)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Saturated fat (total)	13.7	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Polyunsaturated fats (total)	55.4	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Monounsaturated fats (total)	30.0	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Trans fatty acids (total)	0.04	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Omega 3 fatty acids (total)	1.22	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Omega 6 fatty acids (total)	54.1	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Omega 9 fatty acids (total)	29.6	g/100g	0.01	AOAC 996.06	amw7-2018/05/25	tjp8-2018/05/25
Fat (acid hydrolysis)	99.0	%	0.10	AOAC 954.02 (mod)	kap7-2018/05/21	cmw4-2018/05/21
Sample ID: **Day 70** Lab Number: **60037329** Date Sampled: **2018-04-26**						
Sensory evaluation of foods	See Comments	None	None	VARIABLE *	jps0-2018/04/30	srp3-2018/04/30
p-anisidine value	5		2	AOCS Cd 18-90	alq6-2018/04/30	srp3-2018/04/30
Totox number	42.4	n/a	1.0	Calculation	Auto-2018/04/30	Auto-2018/04/30
Peroxide value	18.7	meq/kg fat	2.0	AOAC 965.33	cmw4-2018/04/26	cmw4-2018/04/27
Butyric (C4:0)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25

The result(s) issued on this report only reflect the analysis of the sample(s) submitted.

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REPORT OF ANALYSIS

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Accelerated Shelf Life (40C)
Corn Oil COz Batch 1

Analysis	Level Found As Received	Units	Reporting Limit	Method	Analyst-Date	Verified-Date
Sample ID: Day 70 Lab Number: **60037329** (con't)						
Caproic (C6:0)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Caprylic (C8:0)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Capric (C10:0)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Lauric (C12:0)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Tridecanoic (C13:0)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Myristic (C14:0)	0.04	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Myristoledic (C14:1 Trans)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Myristoleic (C14:1 Cis)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Pentadecanoic (C15:0)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Palmitic (C16:0)	11.1	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Palmitelaidic (C16:1 Trans)	0.05	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Palmitoleic (C16:1 Cis)	0.11	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Heptadecanoic (C17:0)	0.068	g/100g	0.010	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
10-Heptadecanoic (C17:1)	0.04	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Stearic (C18:0)	1.66	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Eliadic (C18:1 Trans)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Oleic (C18:1 Cis)	29.2	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Linolelaidic (C18:2 Trans)	0.03	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Linoleic (C18:2 Cis)	53.5	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25

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PLEASANT HILL IA 50327

REPORT OF ANALYSIS

For: (36293) CORN OIL ONE
13190
Accelerated Shelf Life (40C)
Corn Oil COz Batch 1

Analysis	Level Found As Received	Units	Reporting Limit	Method	Analyst-Date	Verified-Date
Sample ID: Day 70 Lab Number: **60037329** (con't)						
gamma-Linolenic (C18:3 gamma)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Nonadecanoic (C19:0)	0.01	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
alpha-Linolenic (C18:3 alpha)	1.20	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Arachidic (C20:0)	0.35	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
11-Eicosenoic (C20:1)	0.24	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
11-14 Eicosadienoic (C20:2)	0.02	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Homo-gamma linolenic (C20:3)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
11-14-17 Eicosatrienoic (C20:3)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Arachidonic (C20:4)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Eicosapentaenoic (C20:5)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Heneicosanoic (C21:0)	0.01	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Behenic (C22:0)	0.12	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Erucic (C22:1)	0.02	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Docosadienoic (C22:2)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Docosapentaenoic (C22:5)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Docosahexaenoic (C22:6)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Tricosanoic (C23:0)	0.01	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Lignoceric (C24:0)	0.17	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Nervonic (C24:1)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25

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For: (36293) CORN OIL ONE
13190
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Corn Oil COz Batch 1

Analysis	Level Found As Received	Units	Reporting Limit	Method	Analyst-Date	Verified-Date
Sample ID: Day 70 Lab Number: **60037329** (con't)						
Saturated fat (total)	13.5	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Polyunsaturated fats (total)	54.8	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Monounsaturated fats (total)	29.6	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Trans fatty acids (total)	0.05	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Omega 3 fatty acids (total)	1.20	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Omega 6 fatty acids (total)	53.5	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Omega 9 fatty acids (total)	29.2	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Fat (acid hydrolysis)	98.0	%	0.10	AOAC 954.02 (mod)	kap7-2018/05/21	cmw4-2018/05/21
Sample ID: **Day 91** Lab Number: **60037330** Date Sampled: **2018-05-17**						
Sensory evaluation of foods	See Comments	None	None	VARIABLE *	jps0-2018/05/24	srp3-2018/05/24
p-anisidine value	5		2	AOCS Cd 18-90	alq6-2018/05/23	srp3-2018/05/23
Totox number	14.6	n/a	1.0	Calculation	Auto-2018/05/23	Auto-2018/05/25
Peroxide value	4.8	meq/kg fat	2.0	AOAC 965.33	kap7-2018/05/23	cmw4-2018/05/25
Butyric (C4:0)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Caproic (C6:0)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Caprylic (C8:0)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Capric (C10:0)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Lauric (C12:0)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Tridecanoic (C13:0)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25

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REPORT OF ANALYSIS

For: (36293) CORN OIL ONE
13190
Accelerated Shelf Life (40C)
Corn Oil COz Batch 1

Analysis	Level Found As Received	Units	Reporting Limit	Method	Analyst-Date	Verified-Date
Sample ID: Day 91 Lab Number: **60037330** (con't)						
Myristic (C14:0)	0.04	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Myristoledic (C14:1 Trans)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Myristoleic (C14:1 Cis)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Pentadecanoic (C15:0)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Palmitic (C16:0)	11.2	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Palmitelaidic (C16:1 Trans)	0.04	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Palmitoleic (C16:1 Cis)	0.11	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Heptadecanoic (C17:0)	0.070	g/100g	0.010	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
10-Heptadecanoic (C17:1)	0.04	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Stearic (C18:0)	1.68	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Eliadic (C18:1 Trans)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Oleic (C18:1 Cis)	29.5	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Linolelaidic (C18:2 Trans)	0.03	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Linoleic (C18:2 Cis)	54.0	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
gamma-Linolenic (C18:3 gamma)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Nonadecanoic (C19:0)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
alpha-Linolenic (C18:3 alpha)	1.21	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Arachidic (C20:0)	0.35	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
11-Eicosenoic (C20:1)	0.24	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25

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Corn Oil COz Batch 1

Analysis	Level Found As Received	Units	Reporting Limit	Method	Analyst-Date	Verified-Date
Sample ID: Day 91 Lab Number: **60037330** (con't)						
11-14 Eicosadienoic (C20:2)	0.02	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Homo-gamma linolenic (C20:3)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
11-14-17 Eicosatrienoic (C20:3)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Arachidonic (C20:4)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Eicosapentaenoic (C20:5)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Heneicosanoic (C21:0)	0.01	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Behenic (C22:0)	0.12	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Erucic (C22:1)	0.02	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Docosadienoic (C22:2)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Docosapentaenoic (C22:5)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Docosahexaenoic (C22:6)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Tricosanoic (C23:0)	0.01	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Lignoceric (C24:0)	0.17	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Nervonic (C24:1)	n.d.	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Saturated fat (total)	13.7	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Polyunsaturated fats (total)	55.3	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Monounsaturated fats (total)	29.9	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Trans fatty acids (total)	0.04	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Omega 3 fatty acids (total)	1.21	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25

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REPORT OF ANALYSIS

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Corn Oil COz Batch 1

Analysis	Level Found As Received	Units	Reporting Limit	Method	Analyst-Date	Verified-Date
Sample ID: Day 91 Lab Number: **60037330** (con't)						
Omega 6 fatty acids (total)	54.0	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Omega 9 fatty acids (total)	29.5	g/100g	0.01	AOAC 996.06	amw7-2018/05/24	tjp8-2018/05/25
Fat (acid hydrolysis)	98.9	%	0.10	AOAC 954.02 (mod)	pgr4-2018/05/23	cmw4-2018/05/25
Aerobic plate count	n.d.	cfu/g	10	AOAC 990.12	lar4-2018/05/19	nfo4-2018/05/19
E. coli (generic)	n.d.	cfu/g	10	AOAC 991.14	lar4-2018/05/19	nfo4-2018/05/19
Salmonella	negative	org/25g	1	RapidChek/AOAC RI 030301	tma2-2018/05/19	nfo4-2018/05/19
Yeast	n.d.	cfu/g	10	FDA/BAM Chapt. 18	arj0-2018/05/22	jag7-2018/05/22
Mold count	n.d.	cfu/g	10	FDA/BAM Chapt. 18	arj0-2018/05/22	jag7-2018/05/22
Enterobacteriaceae	n.d.	cfu/g	10	AOAC 2003.01	lar4-2018/05/18	jag7-2018/05/18

Sensory Evaluation: Golden to Dark yellow viscous oily liquid that is translucent. When opening bottle there is a faint corn/grain aroma that fades quickly.
Day 14: Faint oxidized fat/oil smell when first opening the bottle,otherwise unchanged.
Day 28: Rancid note to the aroma has intensified, cloudy mass has formed at the bottom of the bottles, floats throughout the oil when the bottle is agitated but settles again when left undisturbed.
Day 42: Unchanged.
Day 56: Unchanged.
Day 70: Fermented grain aroma mixed with some rancidity has increased, product otherwise, unchanged.
Day 91:Unchanged.
This report was reissued on 2018-05-25 17:23:33 by tjp8 for the following reason:
shelf life.

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REPORT OF ANALYSIS

For: (36293) CORN OIL ONE
13190
Accelerated Shelf Life (40C)
Corn Oil COz Batch 1

All results are reported on an AS RECEIVED basis., n.d. = not detected , cfu = colony forming unit

For questions please contact:

Craig Ebel
Feed Coordinator
cebel@midwestlabs.com (402)590-2962

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Corn Oil COz Batch 1

Detailed Method Description(s)

Anisidine value

Anal;ysis follows MWL FO 063 which is based on modified AOCS Cd 18-90. The fat in a sample is extracted and then dissolved into iso-octane. The p-anisidine reagent is added and the resultant solution read at 350 nm.

Calculation

Analytical results are entered into applicable formulas to provide a calculated result which is reported.

Peroxide Value

Peroxide value is used as a measurement of the rancidity of a material. If a fat or oil has a large amount of double bonds (unsaturated), the oils can undergo a process of autooxidation where peroxides are formed as intermediate chemicals. The testing procedure involves adding a chloroform/acetic acid mixture. The chloroform functions to dissolve the fats. Potassium iodide is added to provide levels of iodine in the solution. As the level of peroxide increase, more iodide is liberated. The level of iodide is determined using sodium thiosulfate as a titrant and starch as an indicator.

Fatty Acid Profile

Sample prep follows MWL HPLC 008 and analysis follows HPLC 004 which are both based on AOAC 996.06. The fat in the sample is extracted and saponified and the fatty acids methylated to form the fatty acid methyl esters (FAMEs). The methyl ester extract (FAMEs) is injected into a GC that uses a flame ionization detector (GC/FID). The response generated during analyses of the individual FAME is compared to standards which are used to quantitate the levels of fatty acids found in the sample. The standard reporting level is 0.01% of the fat.

Acid Hydrolysis Fat

Analysis follows FD 027 which is based on AOAC 954.02. A sample is treated with ethanol and hydrochloric acid to help release fat in the sample. Separate treatments of ethyl ether and petroleum ether is used to extract the fat and the ethers collected in a pre-weighed beaker. The ether is evaporated and dried at 70 degrees C to remove remaining ether and moisture and the material remaining in the beaker is reported as "fat".

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Corn Oil COz Batch 1

Aerobic Plate Count AOAC

Sample analysis follows MWL MI 293 which is based on AOAC 990.12. A representative 25 +/- 0.5 g sample is obtained and placed in a stomacher bag along with 225 mL of phosphate buffer. The stomacher bag is blended to homogenize the sample. Aliquots of the sample are withdrawn and placed on the Petrifilm plates. After the plates are prepared, they are incubated for 48 +/- 3 hours to allow for growth of the organisms at 35 +/- 1C. After plates are incubated, the colonies found on the plates are counted and the levels reported as colony forming units (cfu) per gram.

E. coli and Total Coliform using 3M Petrifilm

Sample analysis follows MWL MI 292 which is based on AOAC 991.14. A representative 25 +/- 0.5 g is obtained and placed in a stomacher bag along with 225 mL of phosphate buffer. If the sample is en environmental sponge, 15 mL of phosphate buffer is added to each sponge. The stomacher bag is blended or hand-massaged to homogenize the sample. Aliquots of the sample are withdrawn and placed on the Petrifilm plates. After the plates are prepared, they are incubated for 48 +/- 4 hours at 35 +/- 1C. After samples are incubated, plates are counted to determine the number of generic E. coli and total coliform present. The color of the colony and the presence of gas differentiate a generic coliform from E. coli. The levels reported as colony forming units (cfu) per gram.

Salmonella - Lateral Flow

Samples are analyzed following MWL MI 195 which is based on the RapidChek Select Salmonella Test Kit User Guide 3090045 V.10 13/11/12. A representative sample is obtained using aseptic technique. The sample is combined with a primary growth media and allowed to incubate. After the required time, an aliquot of the material is added to a secondary selective media and allowed to incubate. After the second period of incubation, a test strip is used for Salmonella determination. If a single line appears, the sample is negative and if a double line appears, it is positive. This method does not provide a count as it can only report positive or negative results.

Yeast and mold FDA/BAM Chapter 18

Sample analysis follows MWL MI 288 which is based on FDA/BAM Chapter 18. Samples are obtained and added to phosphate buffer at a 9:1 ratio or a pre-determined volume if a swab or sponge. Sample aliquots are removed to provide a dilution series on PDA (potato dextrose agar) and incubated at 25°C for up to five (5) days. Colonies on the plates are counted and the results issued in cfu/g, cfu/swab, cfu/sponge, or other unit depending on the type of sample.

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Enterobacteriaceae - AOAC 2003.01

Sample analysis follows MWL MI 290 which is based on AOAC 2003.01. A representative 5g, 25g, or 125g sample is obtained and placed in a stomacher bag along with a 9:1 ratio of phosphate buffer. The stomacher bag is blended to homogenize the sample. Aliquots of the sample are withdrawn and placed on the Petrifilm plates. After the plates are prepared, they are incubated for 24 +/- 2 hours to allow for growth of the organisms at 35 +/- 1C. After plates are incubated, the colonies found on the plates are counted and the levels reported as colony forming units (cfu) per gram.

REPORT NUMBER
18-047-9537 v9

REPORT DATE
May 25, 2018

SEND TO
36293

RECEIVED DATE
Feb 15, 2018

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ISSUE DATE
May 25, 2018

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GRAPH OF ANALYSIS

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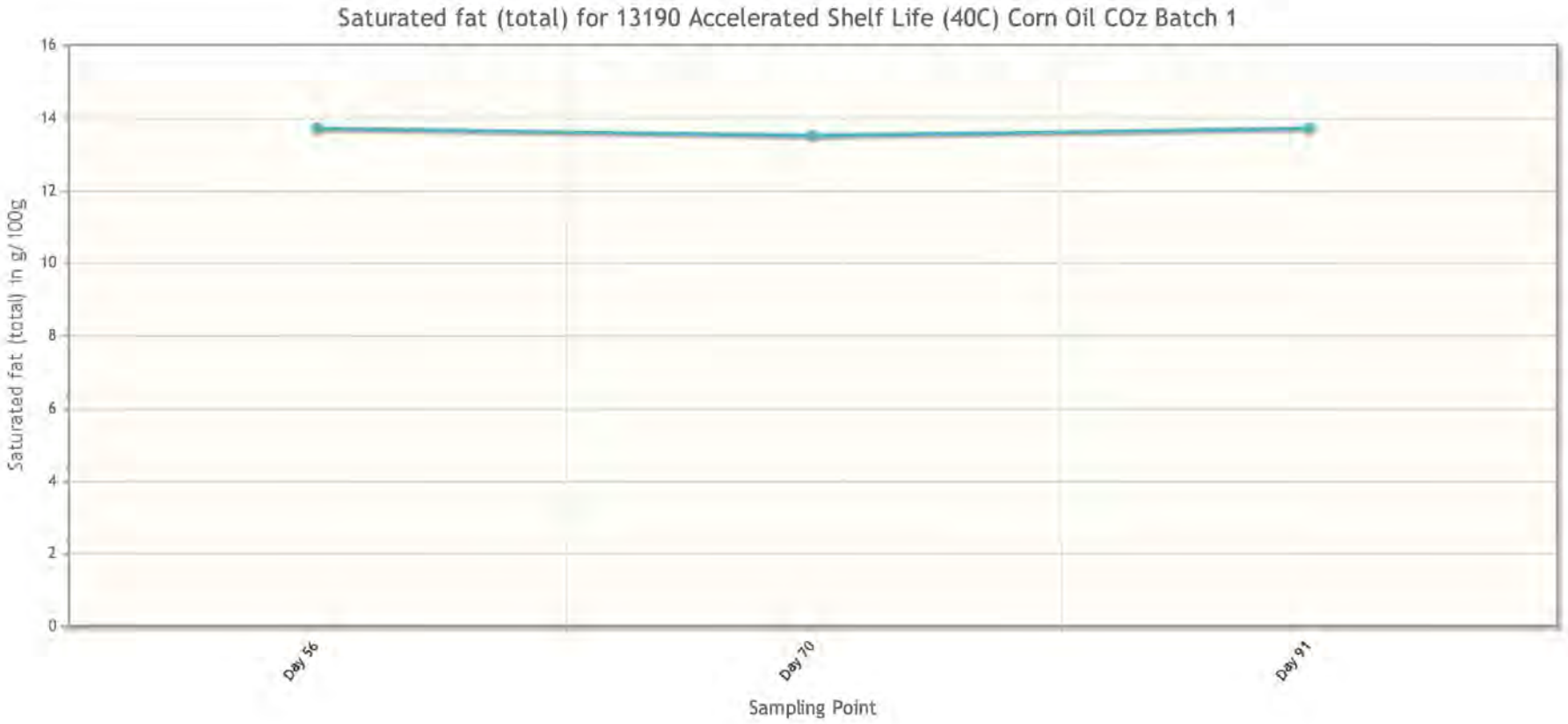

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GRAPH OF ANALYSIS

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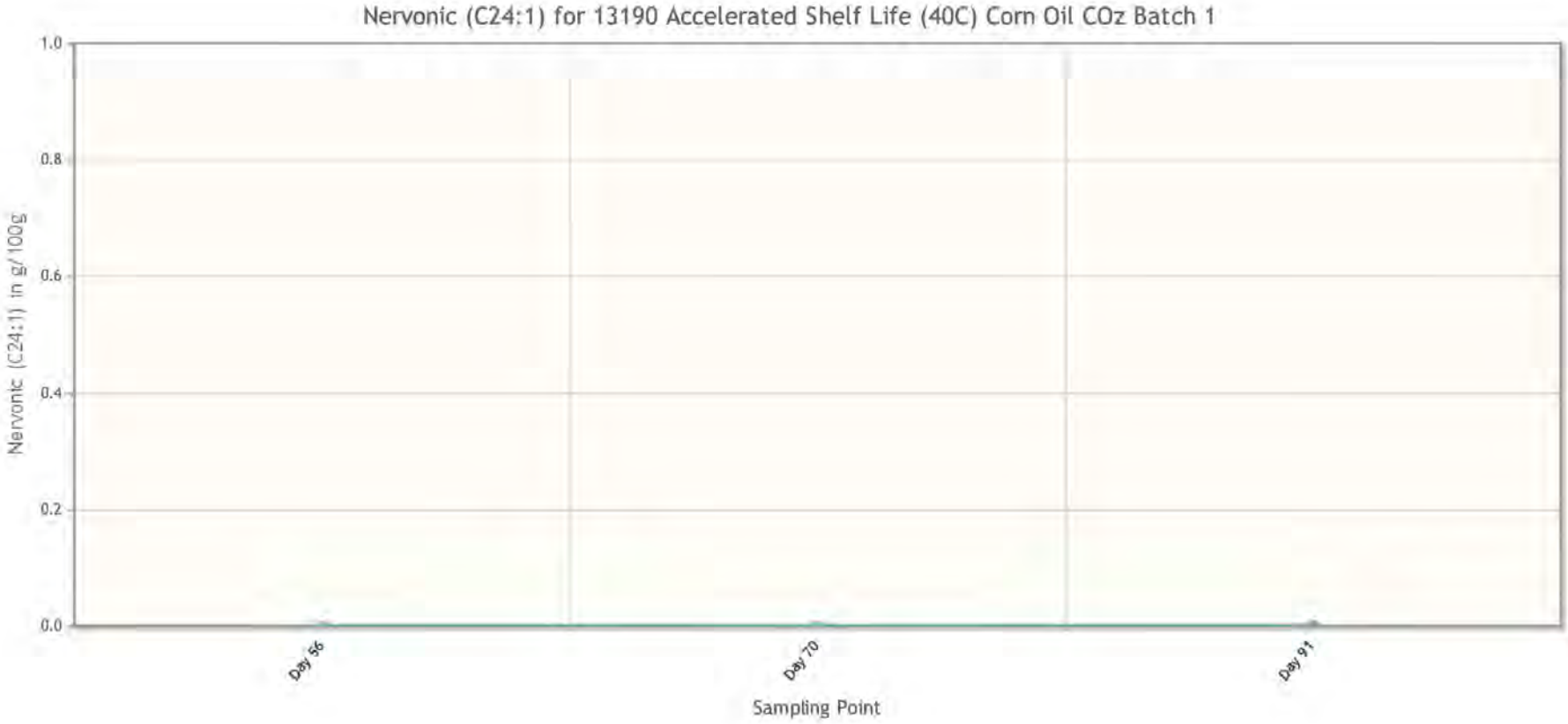

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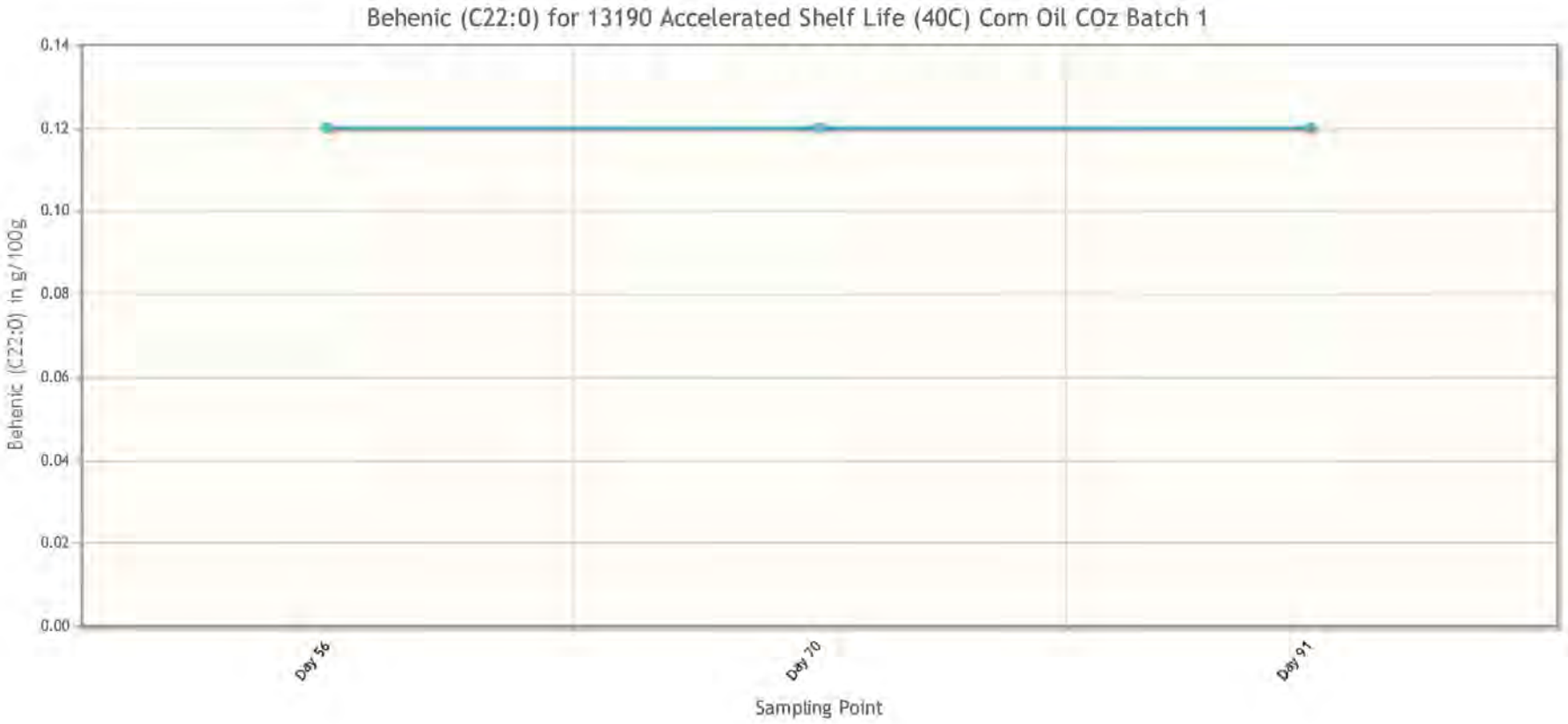

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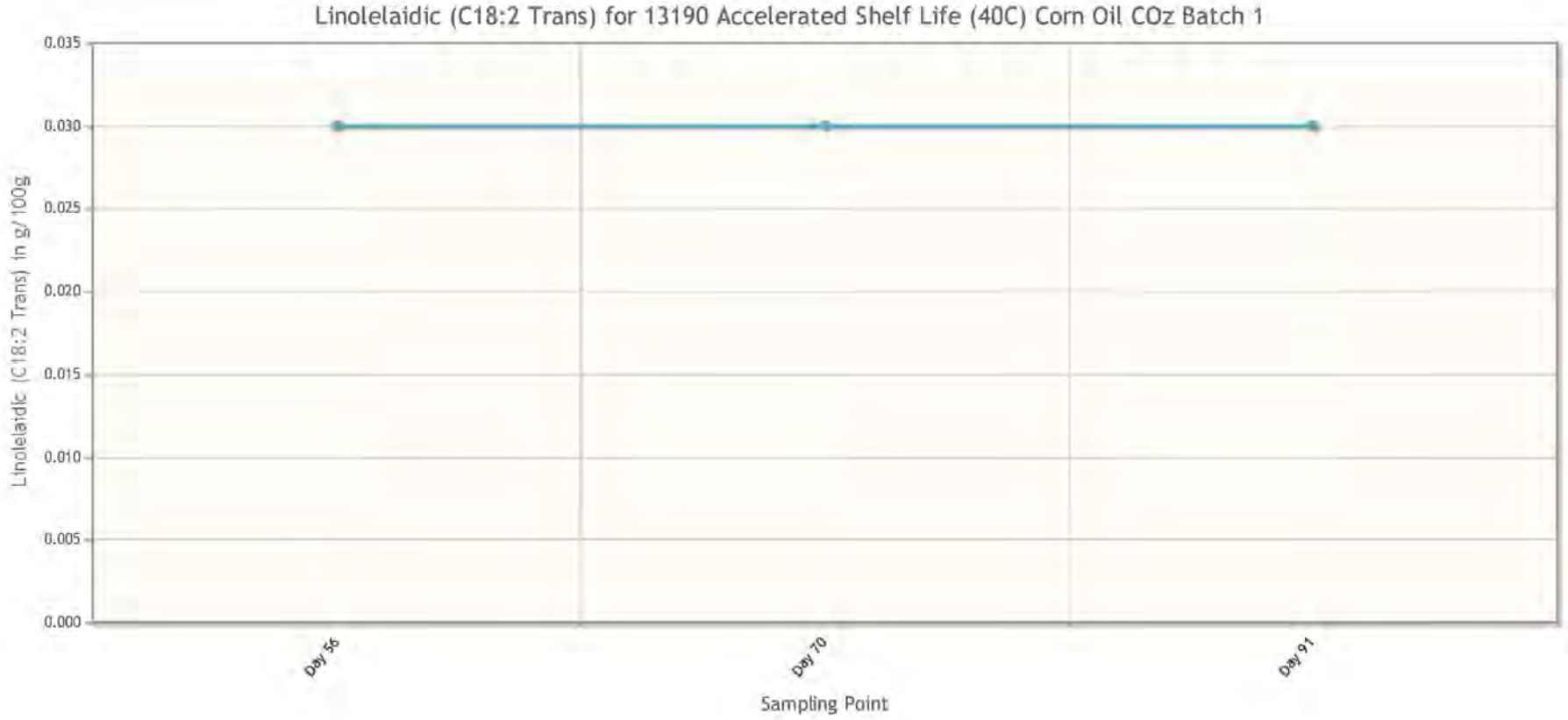

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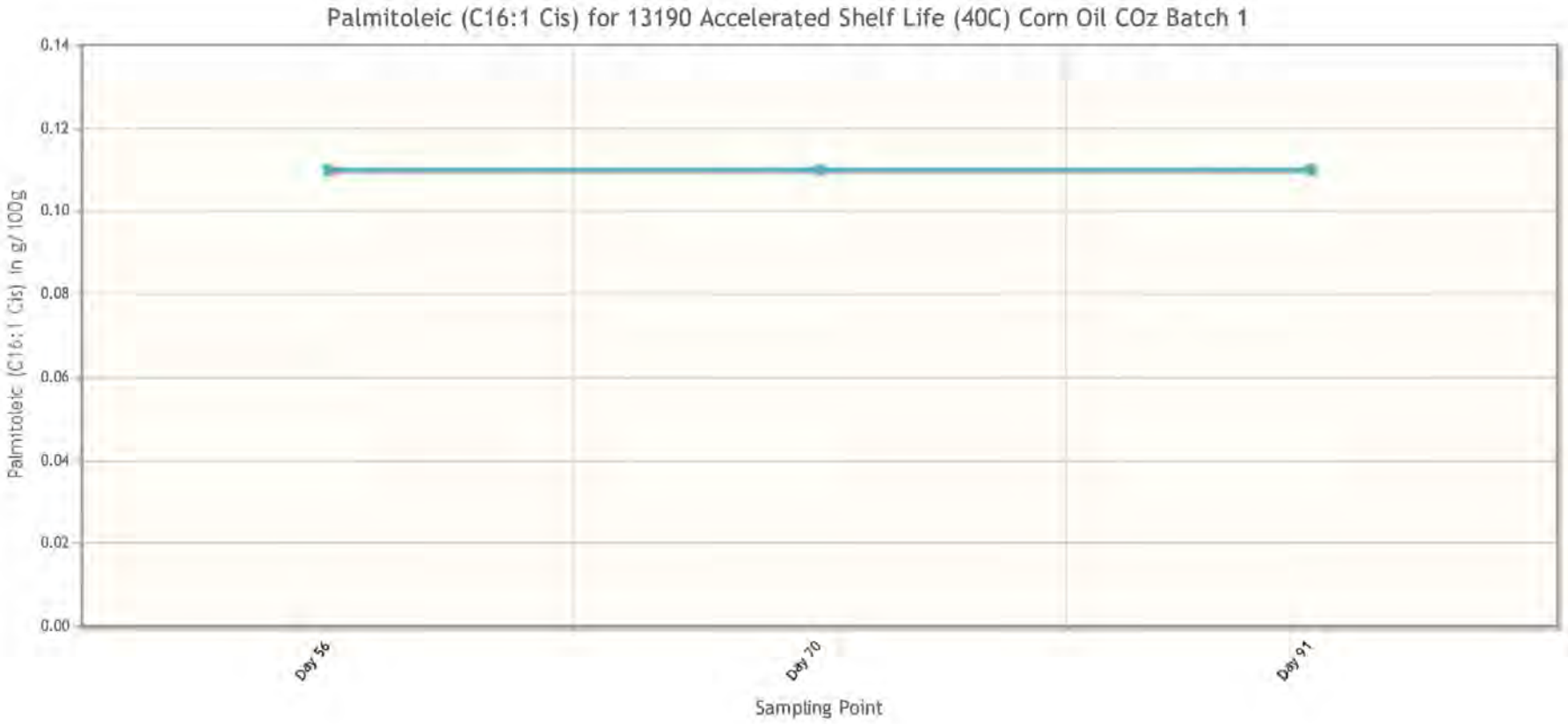

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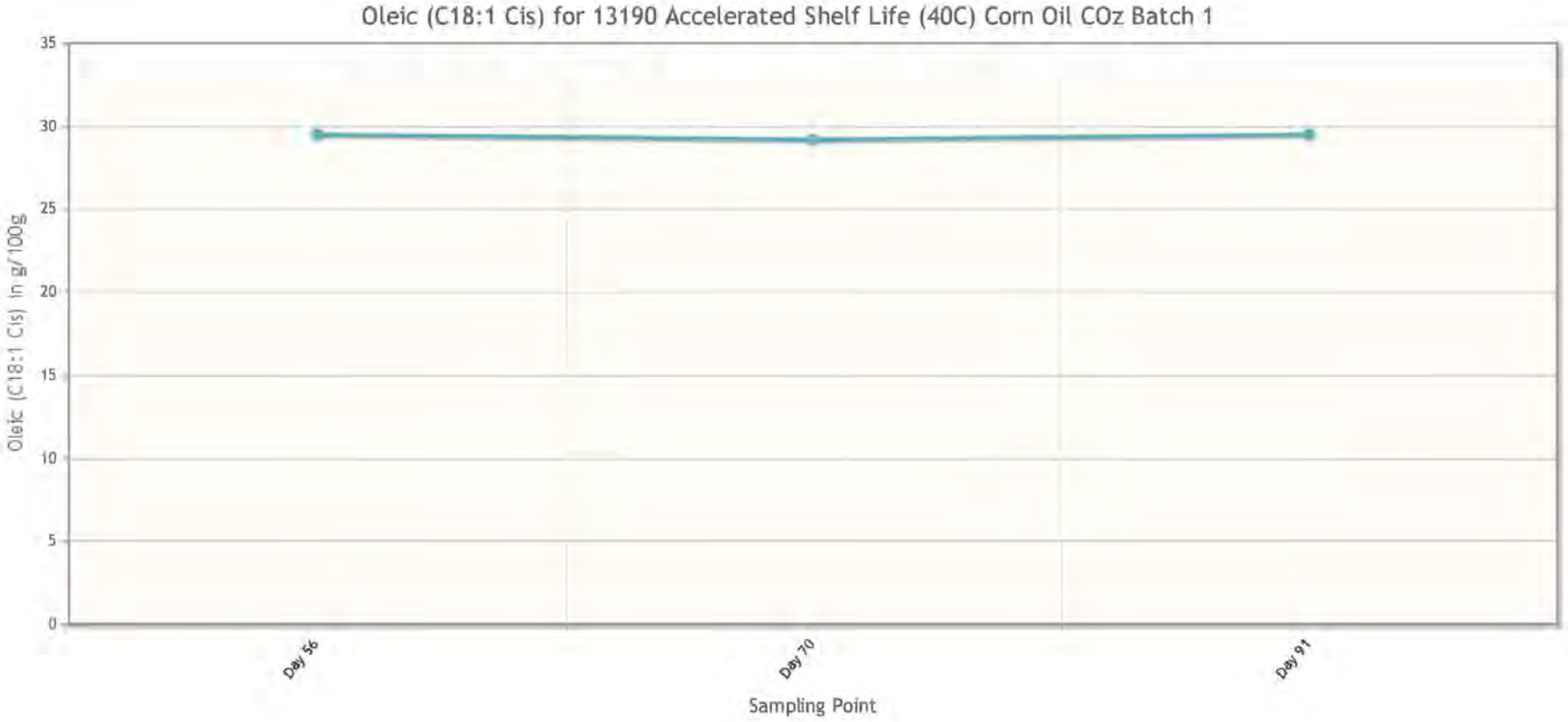

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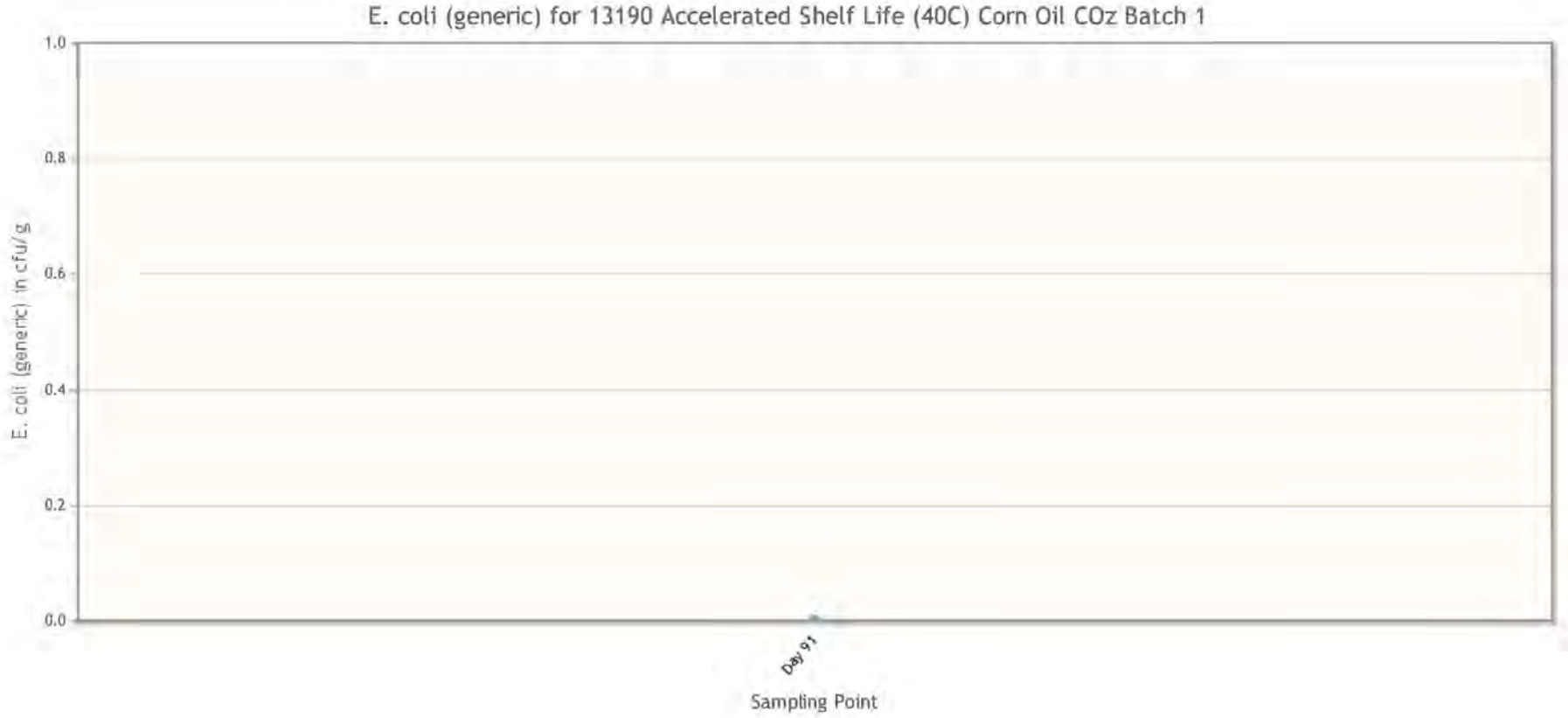

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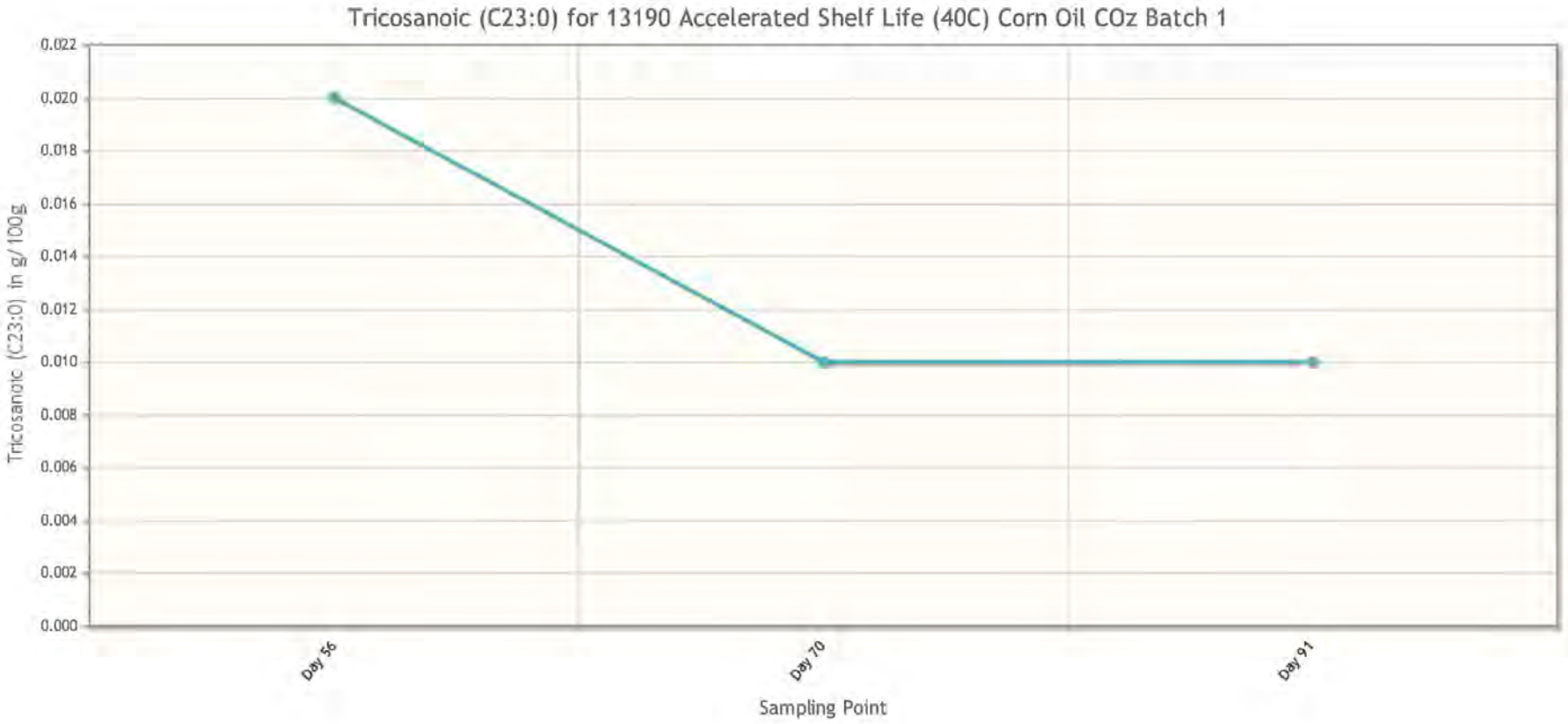

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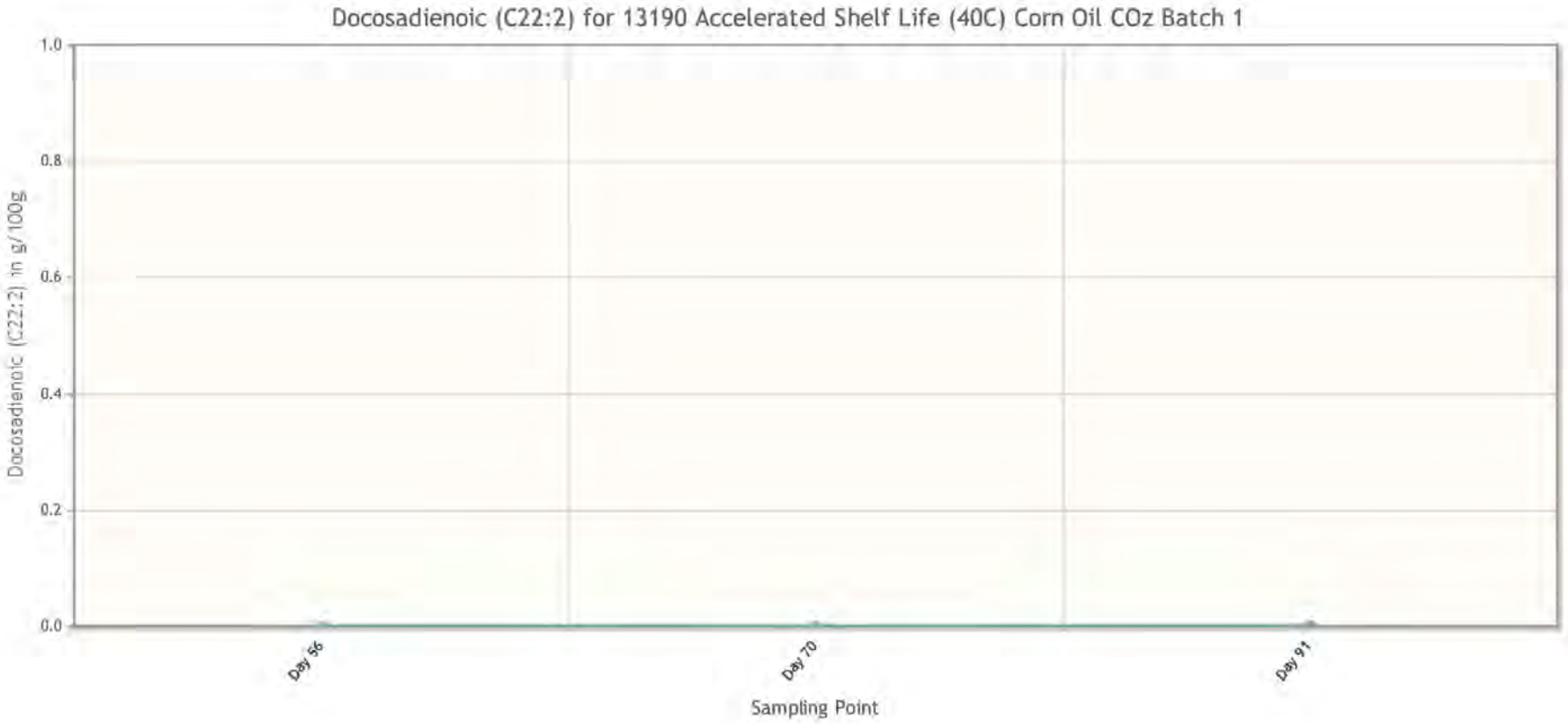

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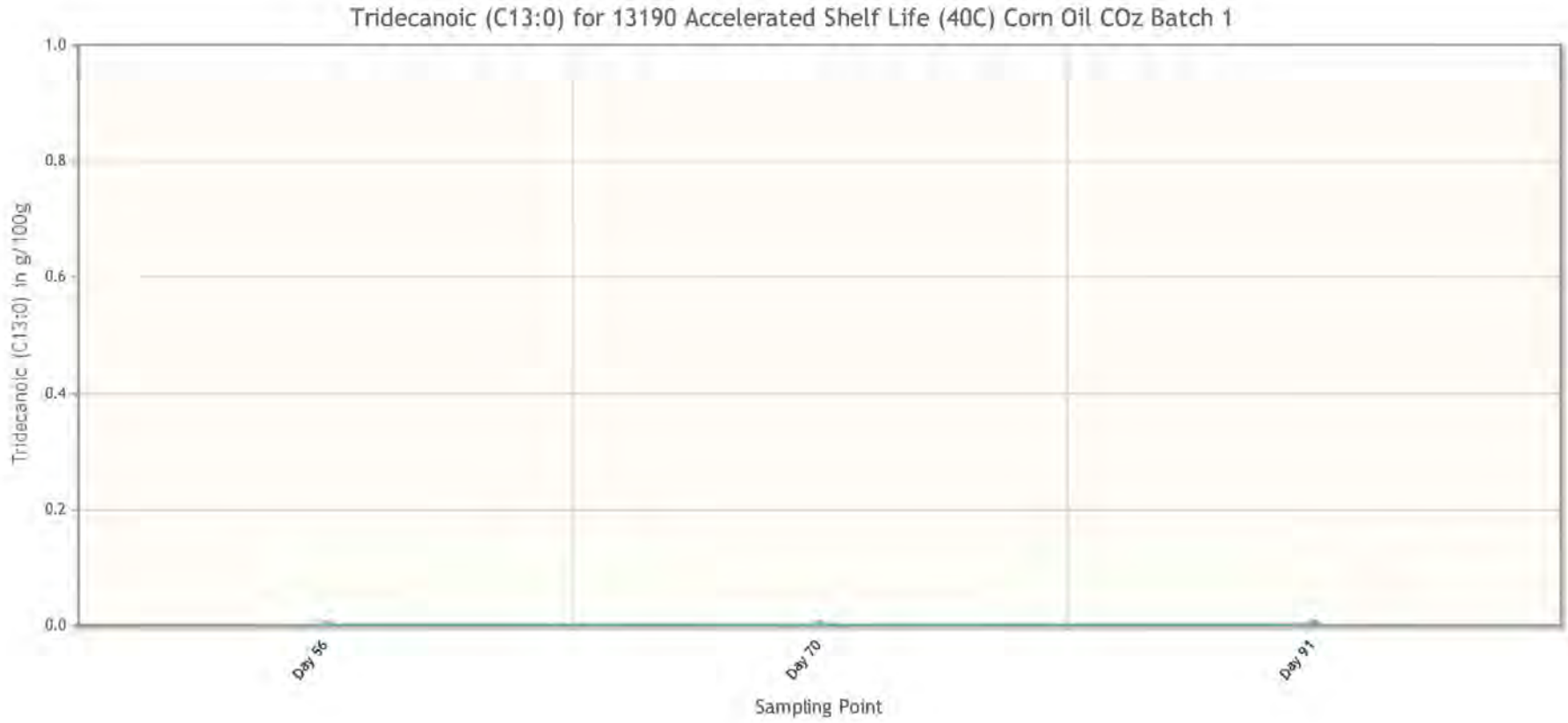

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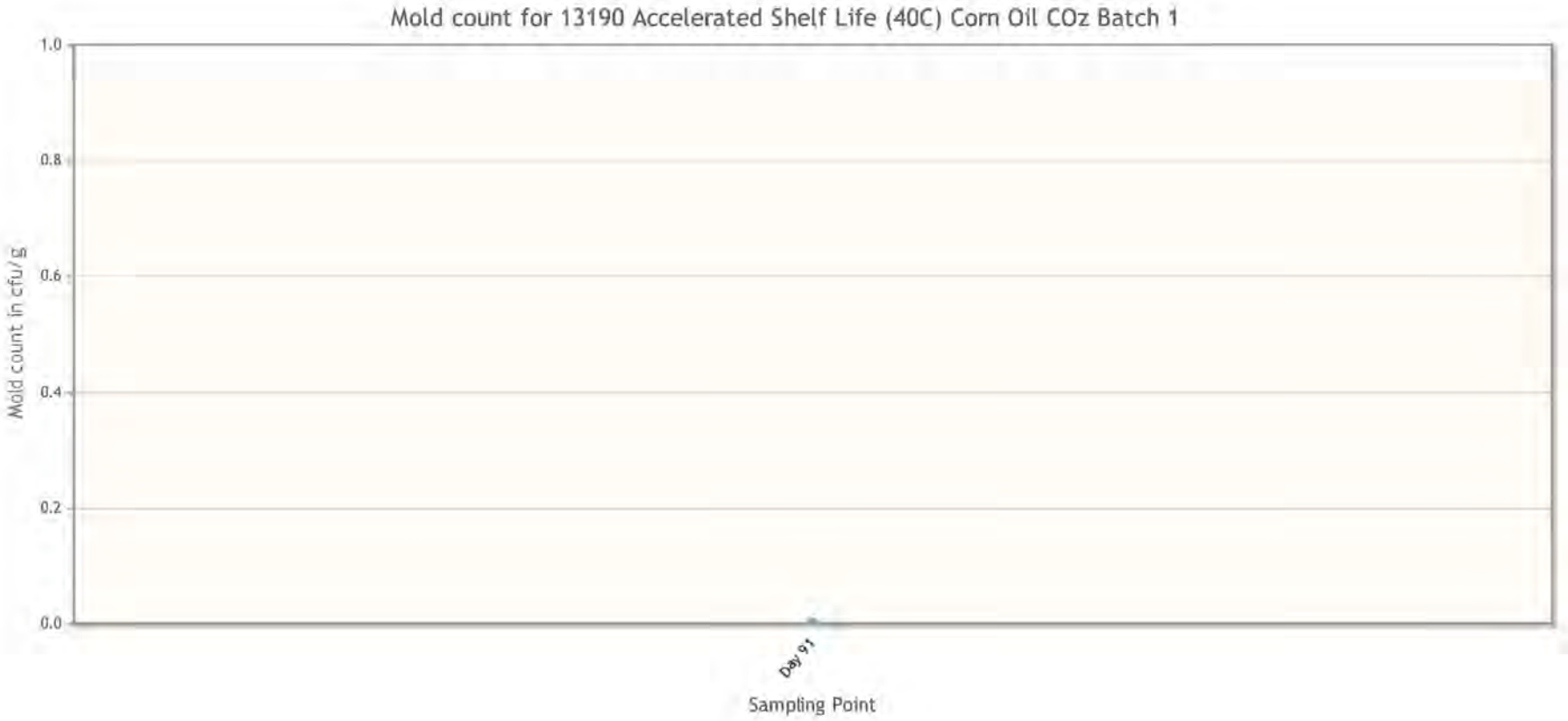

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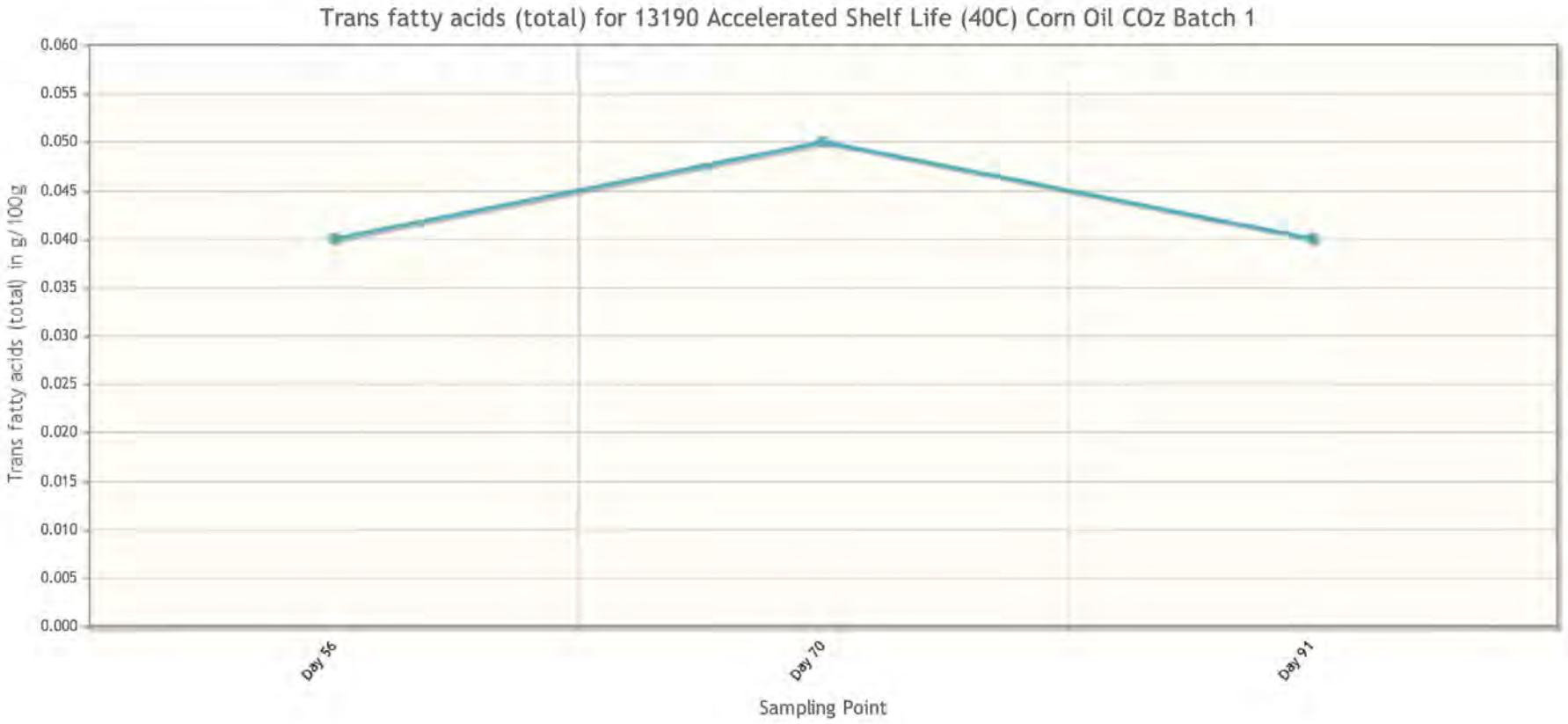

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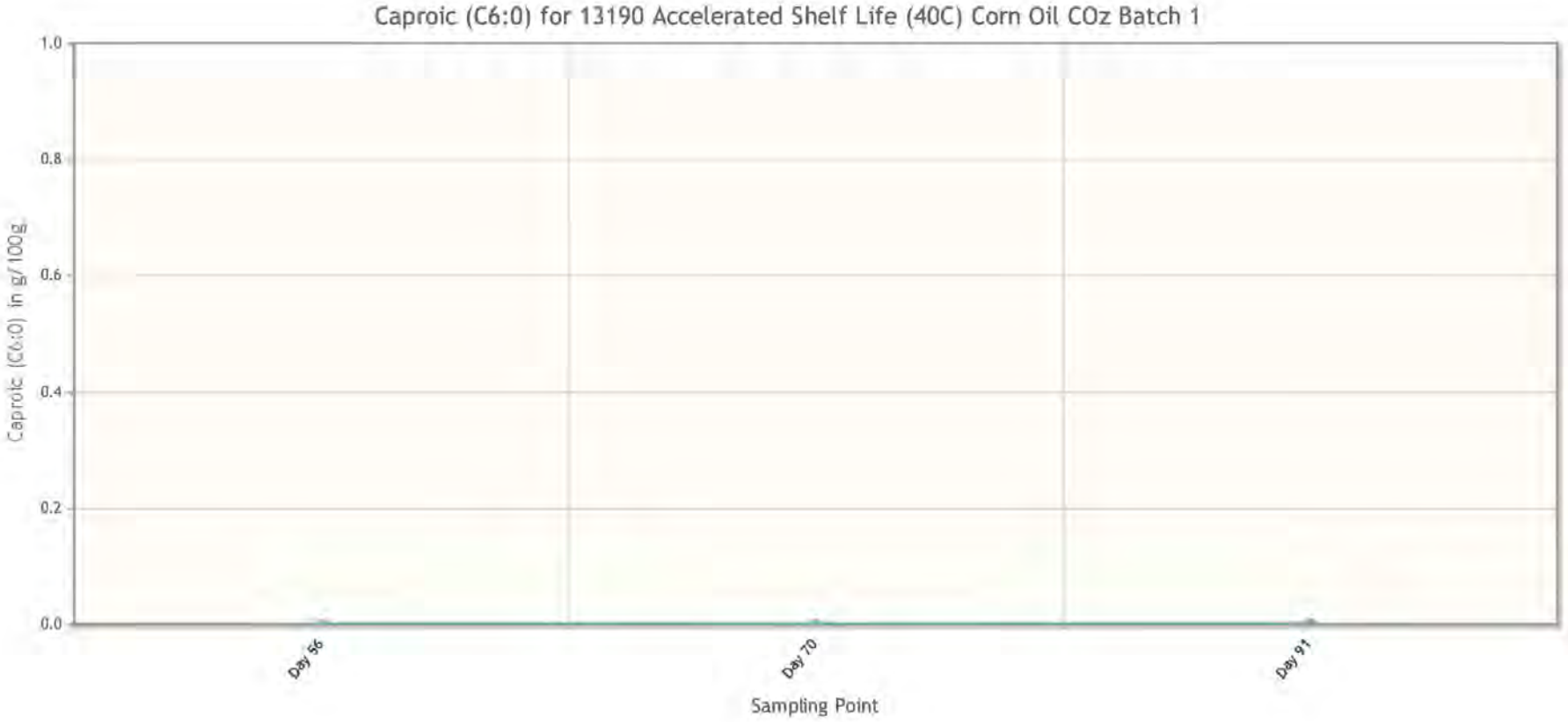

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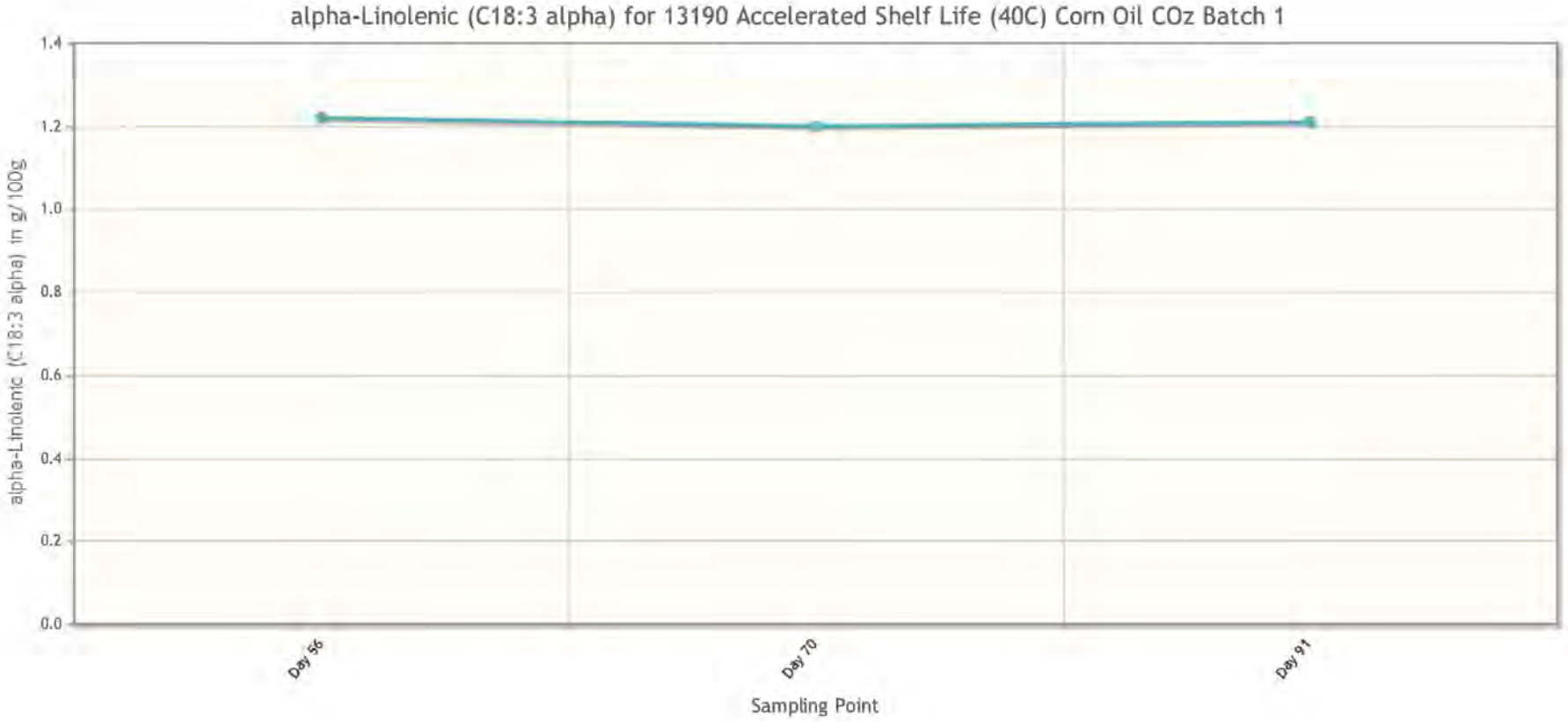

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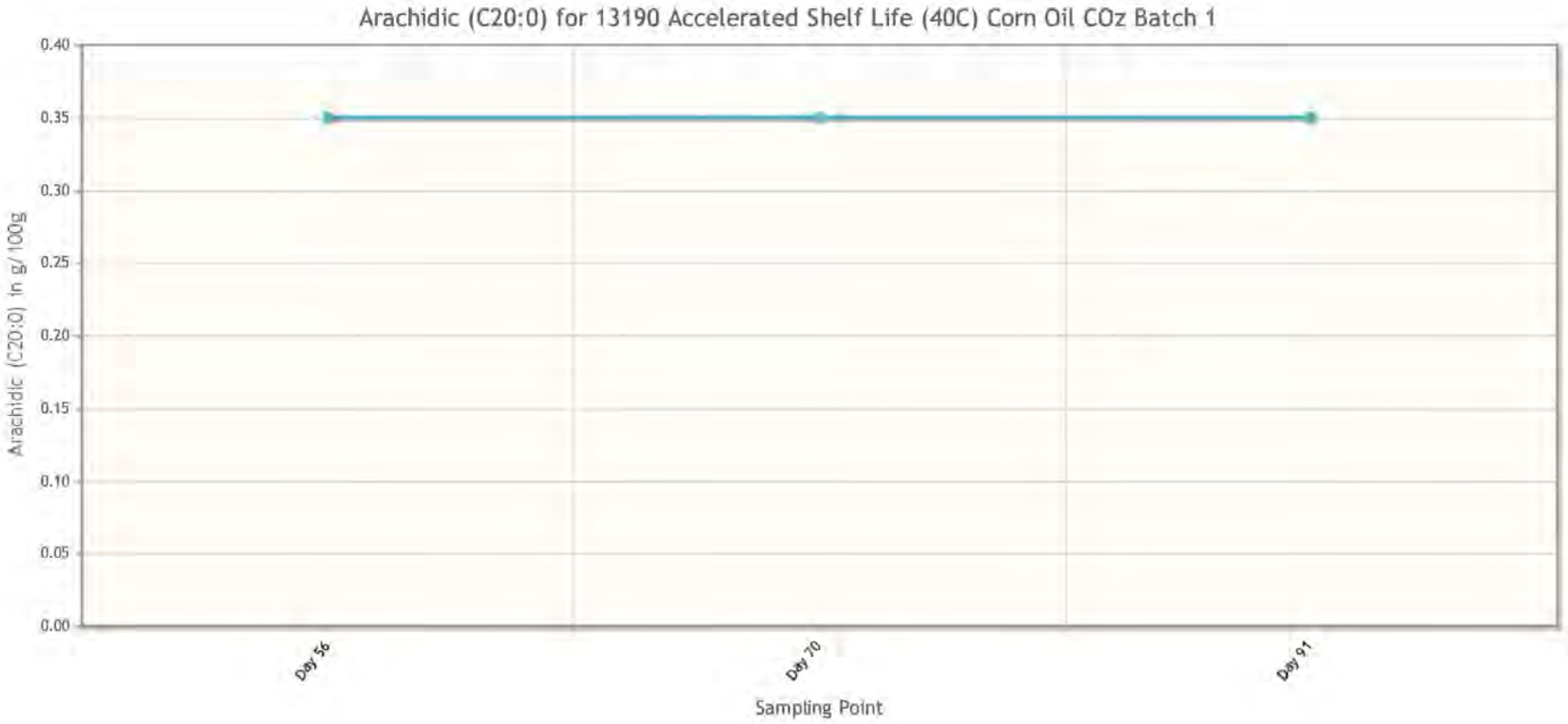

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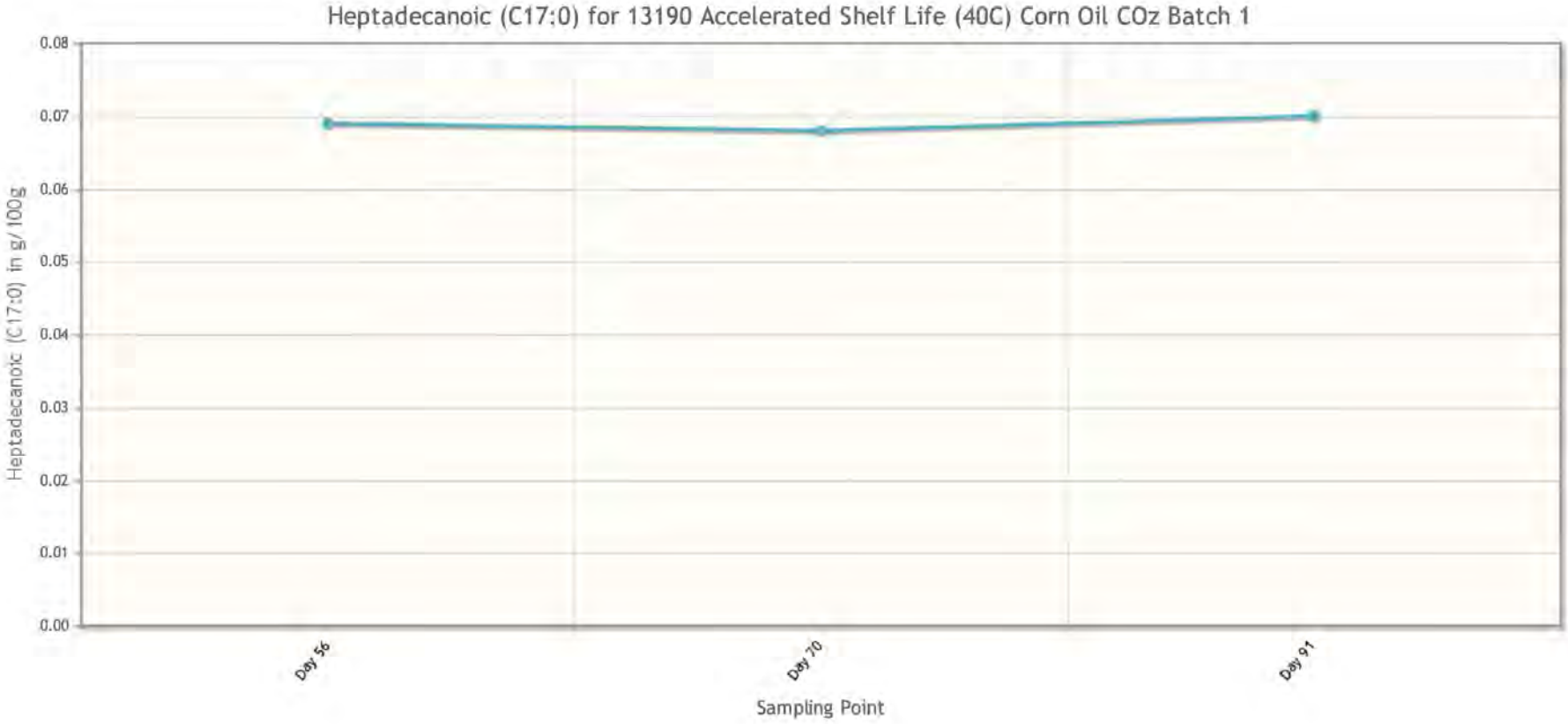

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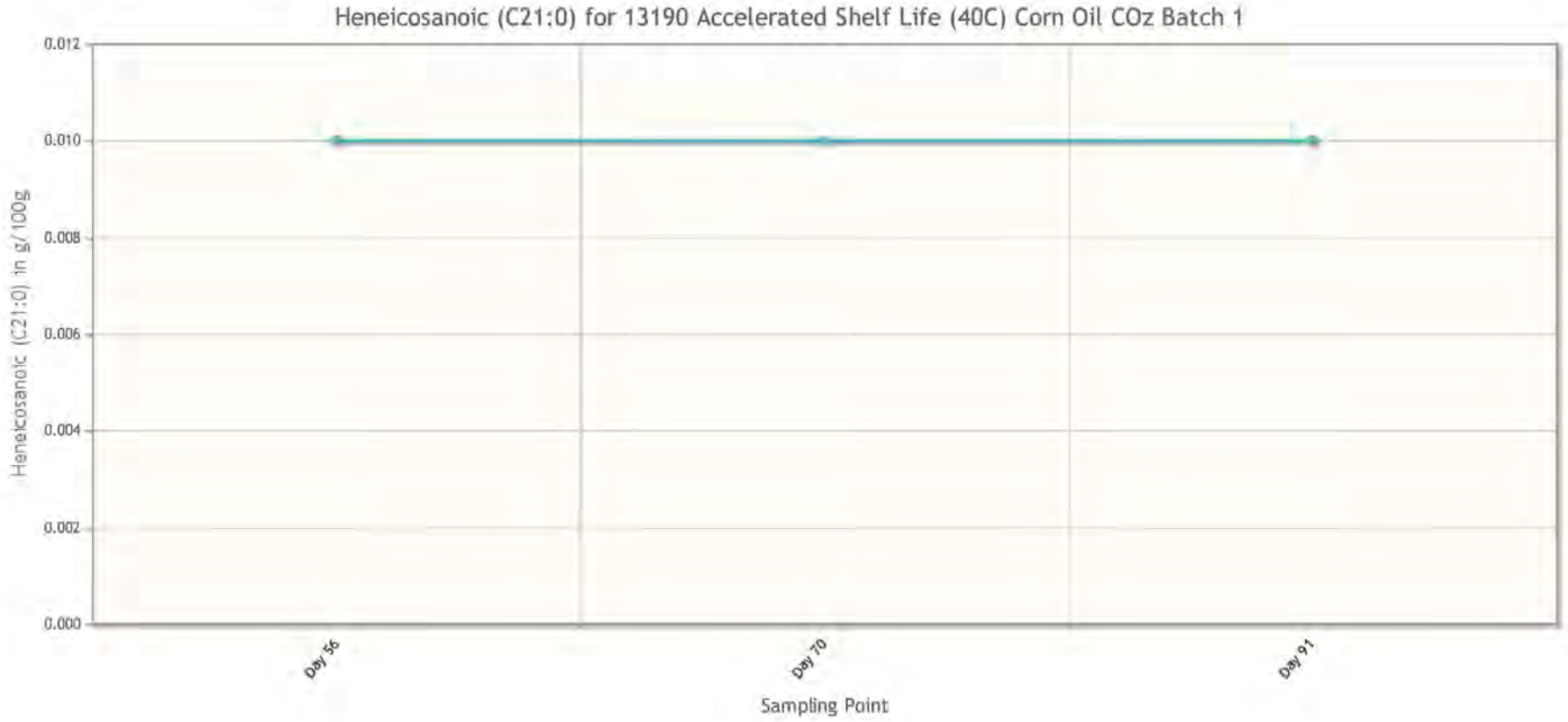

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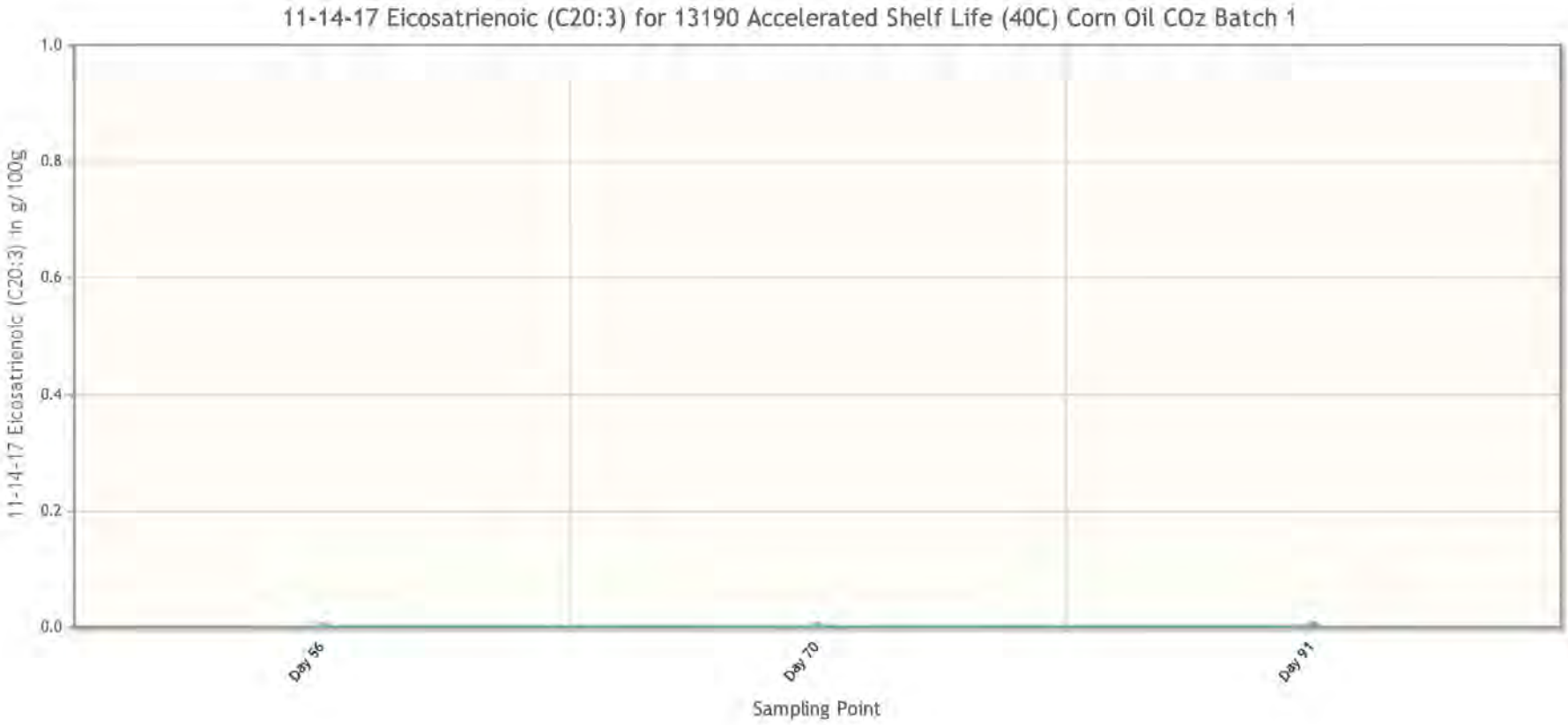

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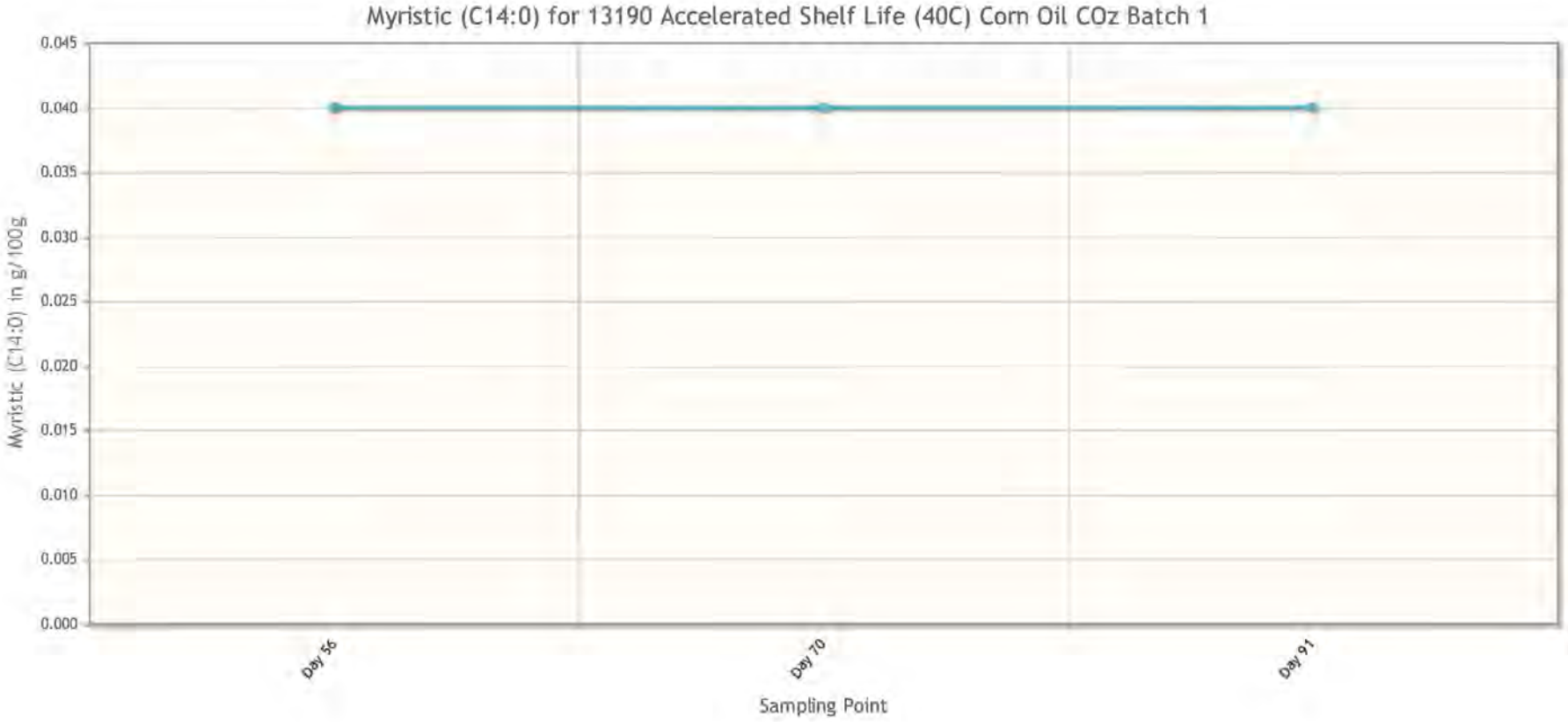

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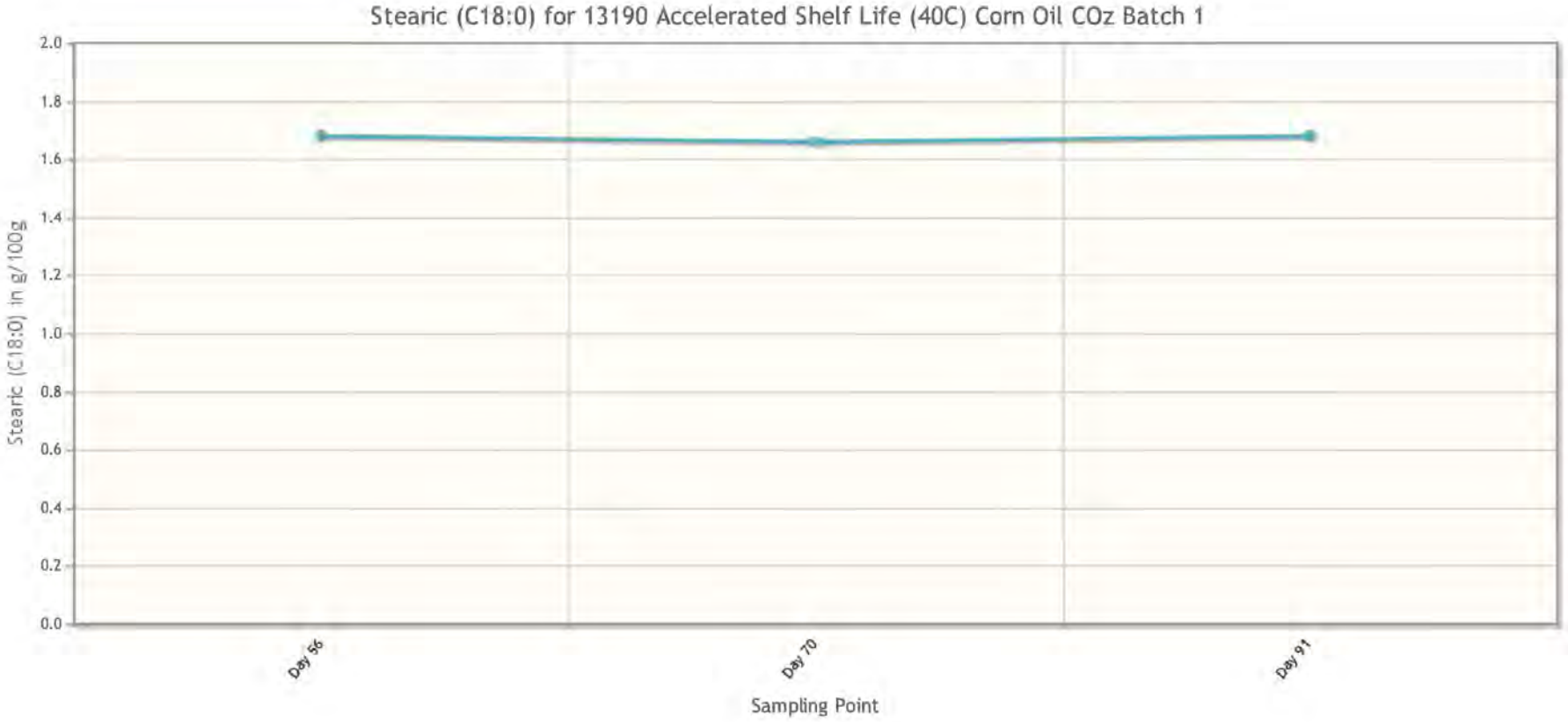

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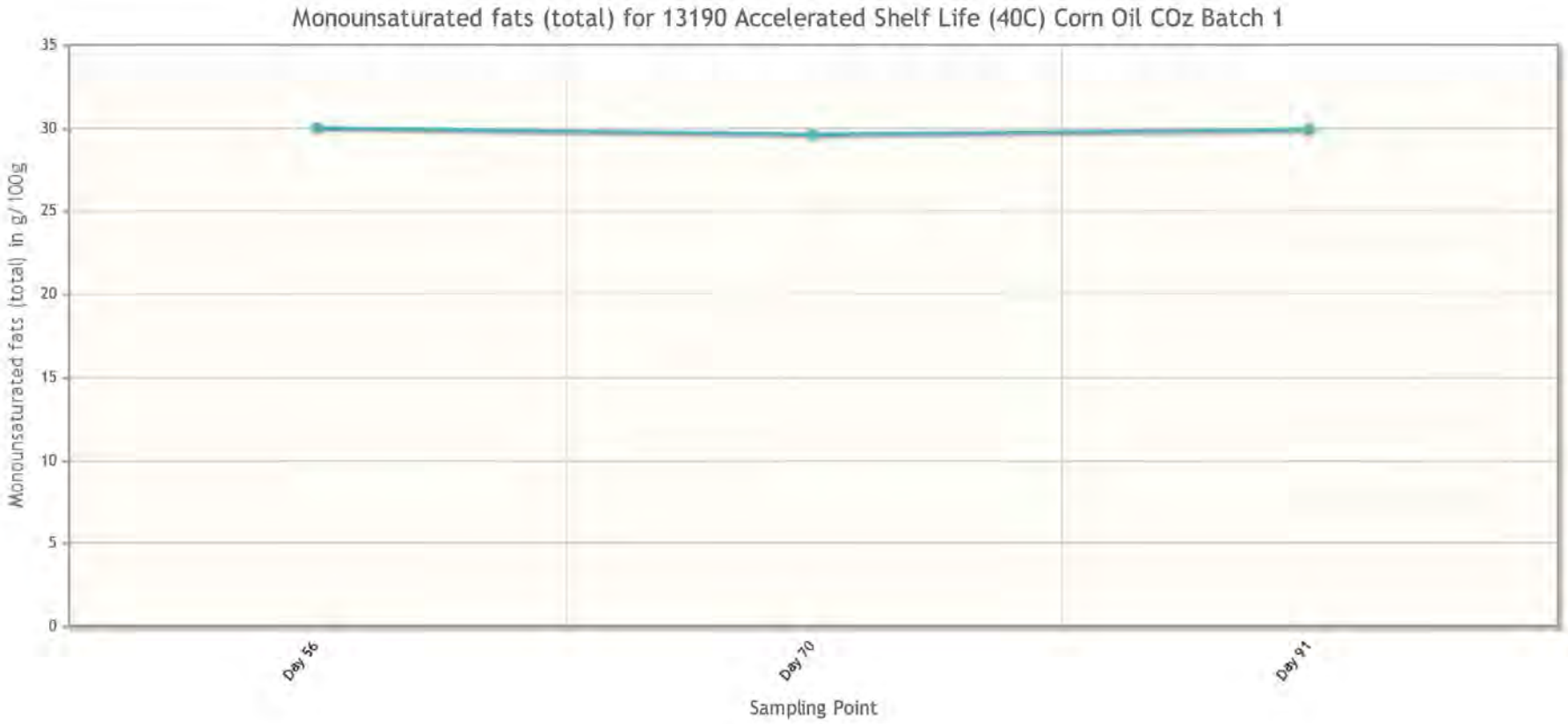

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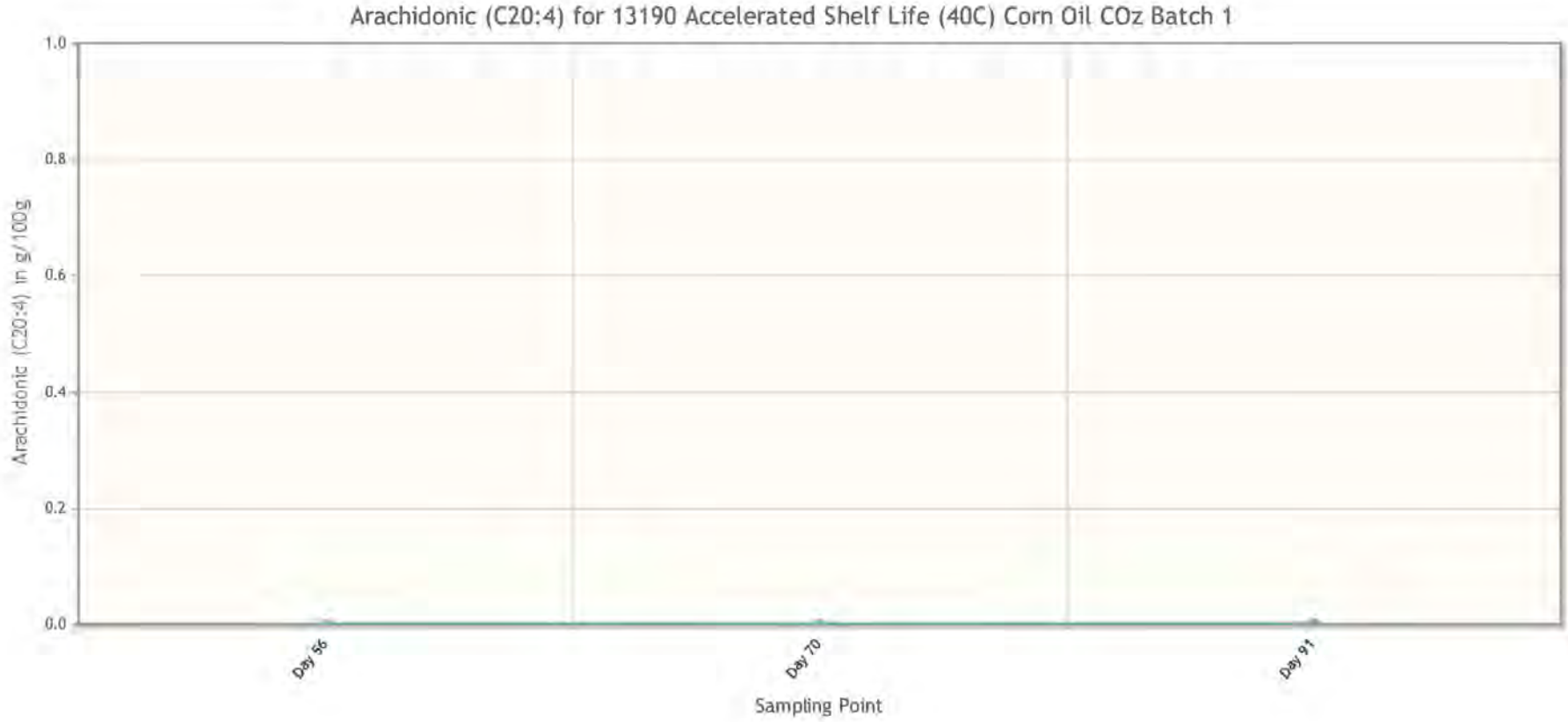

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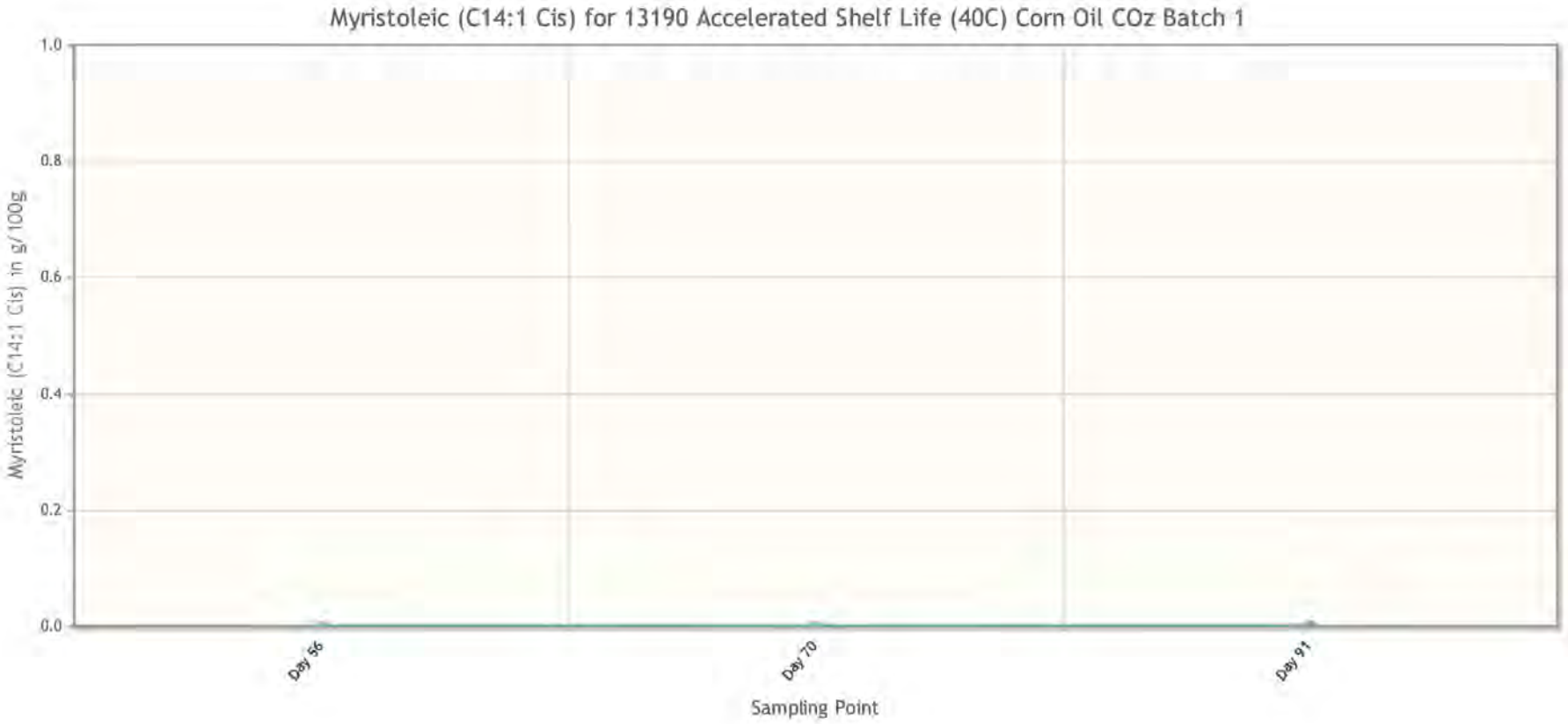

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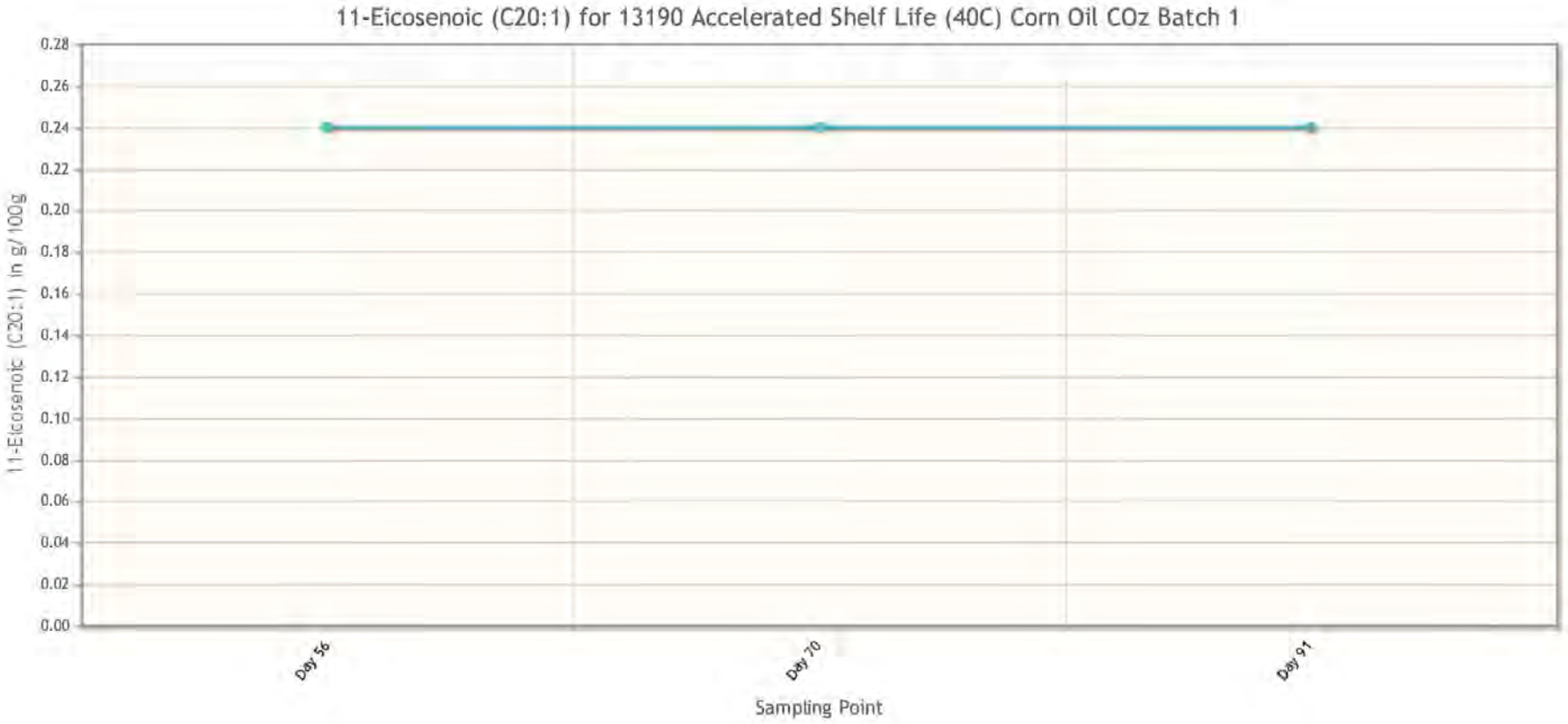

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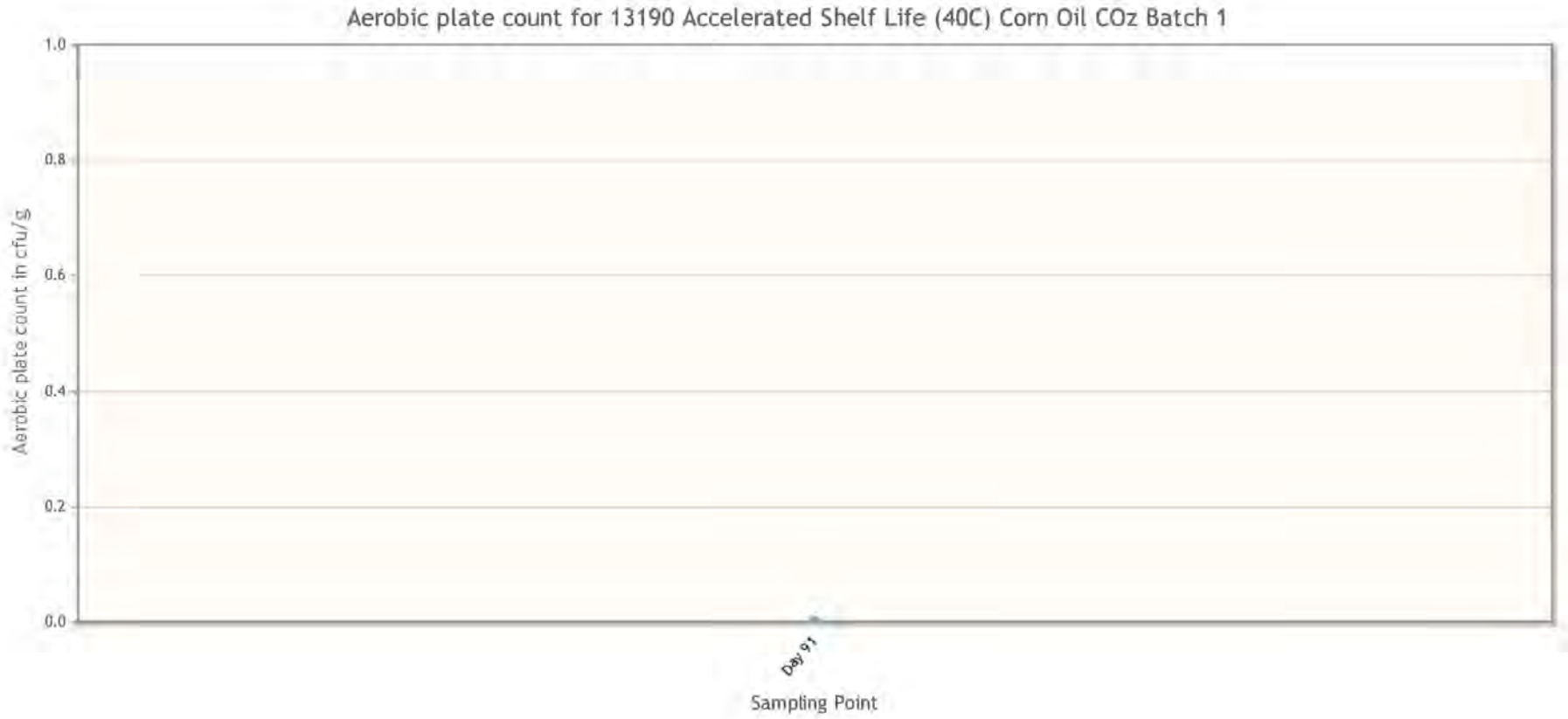

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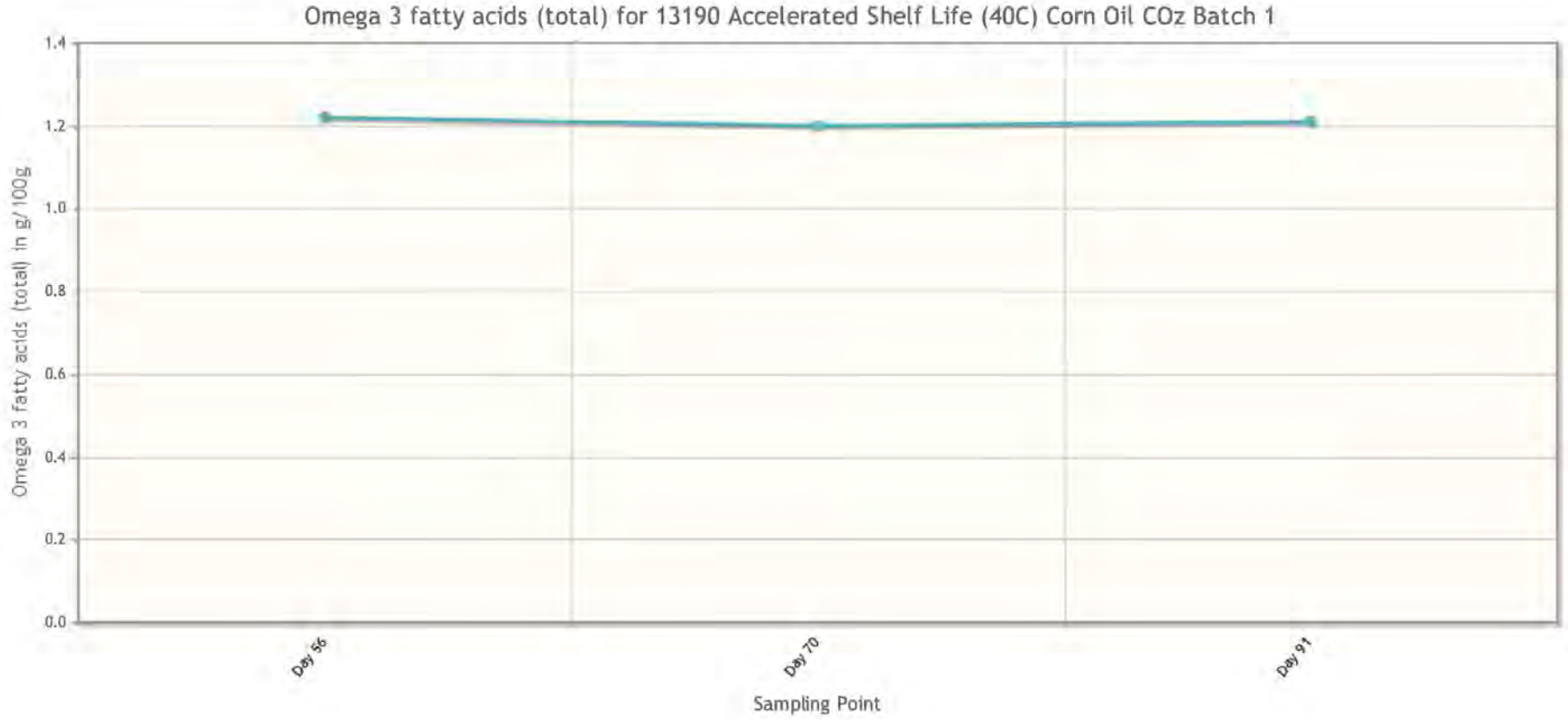

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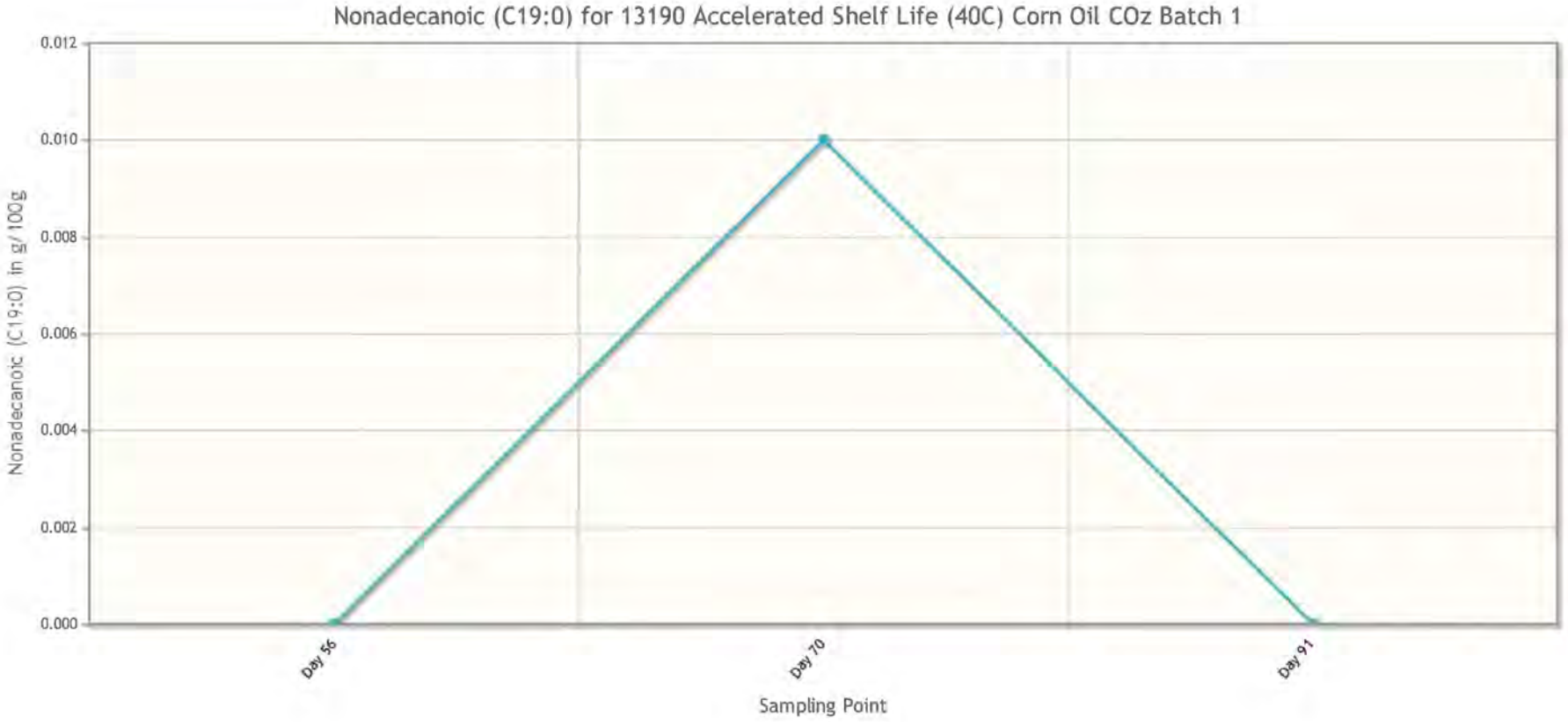

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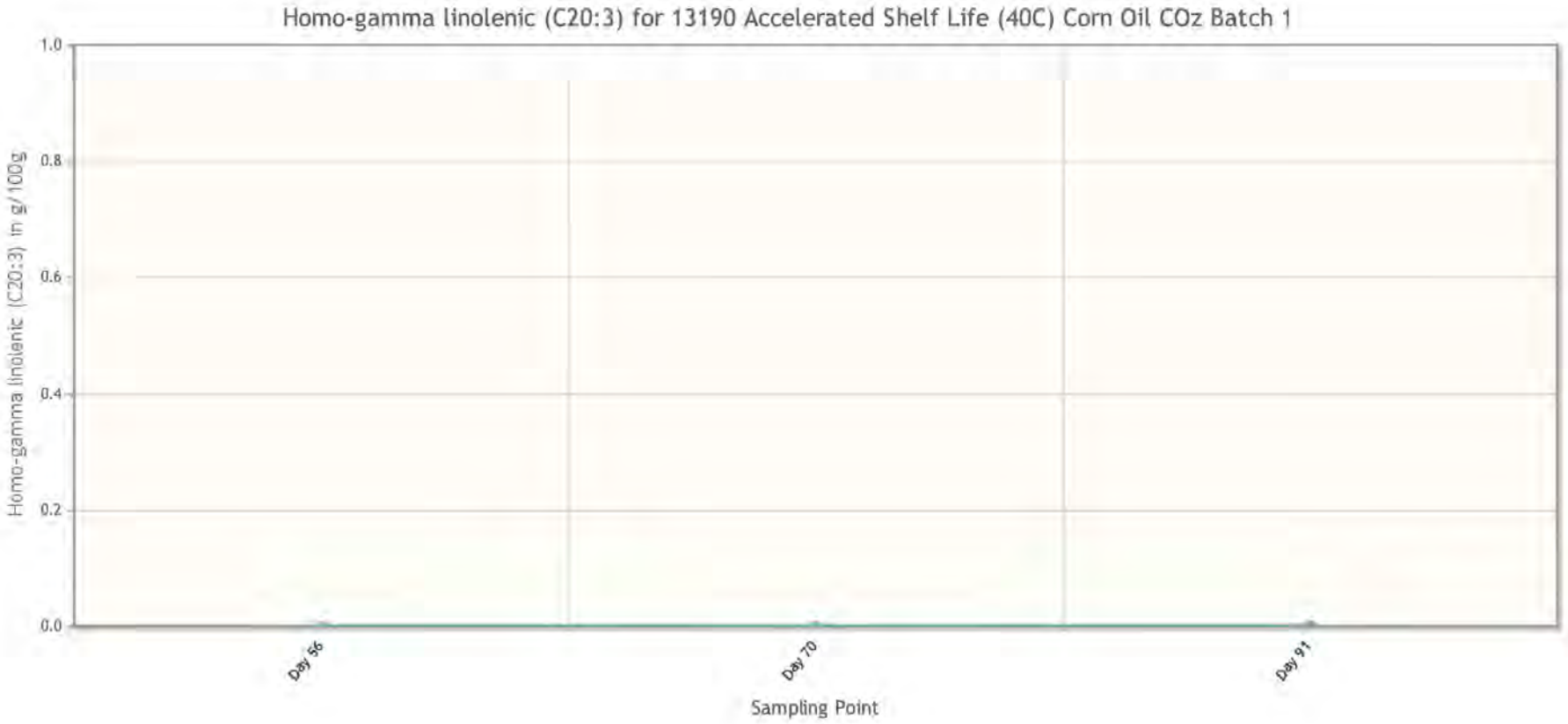

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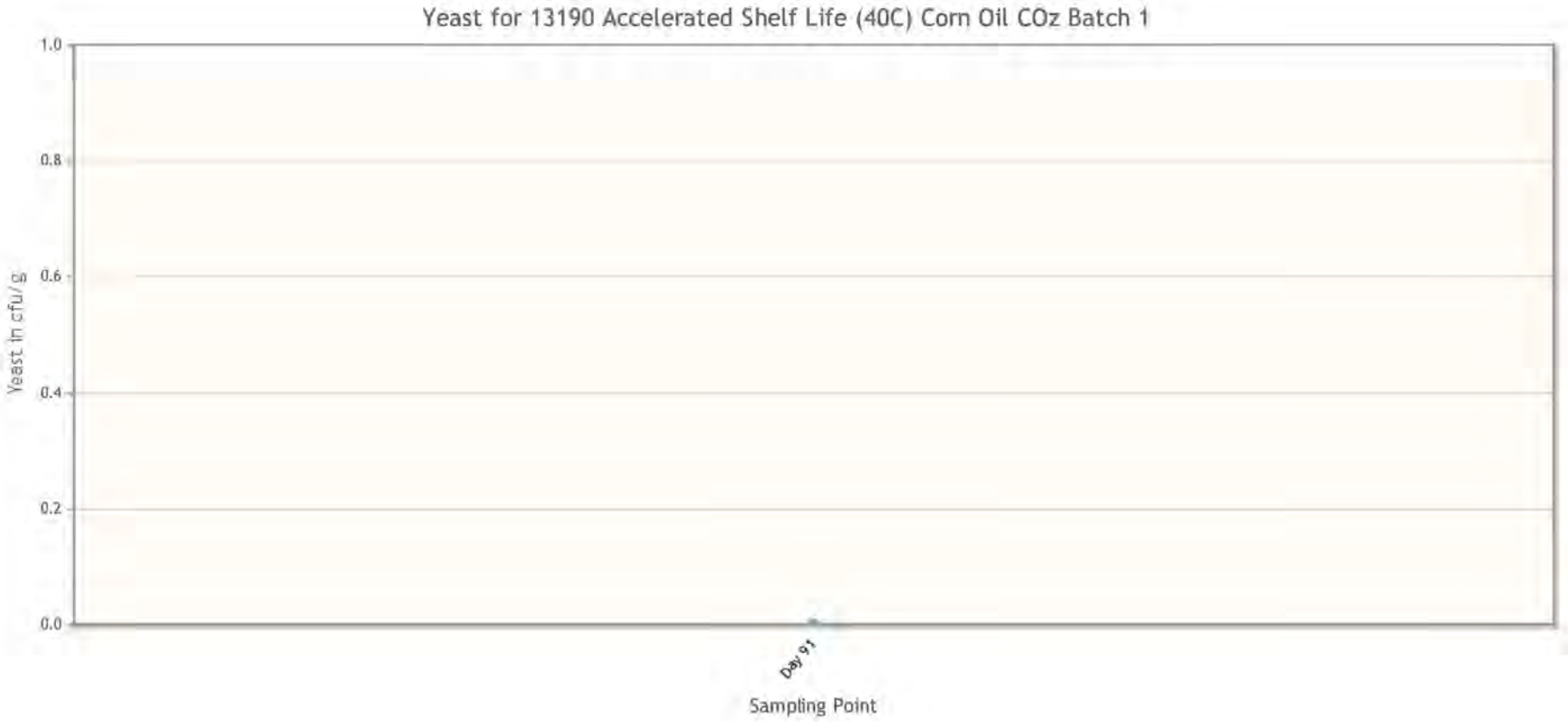

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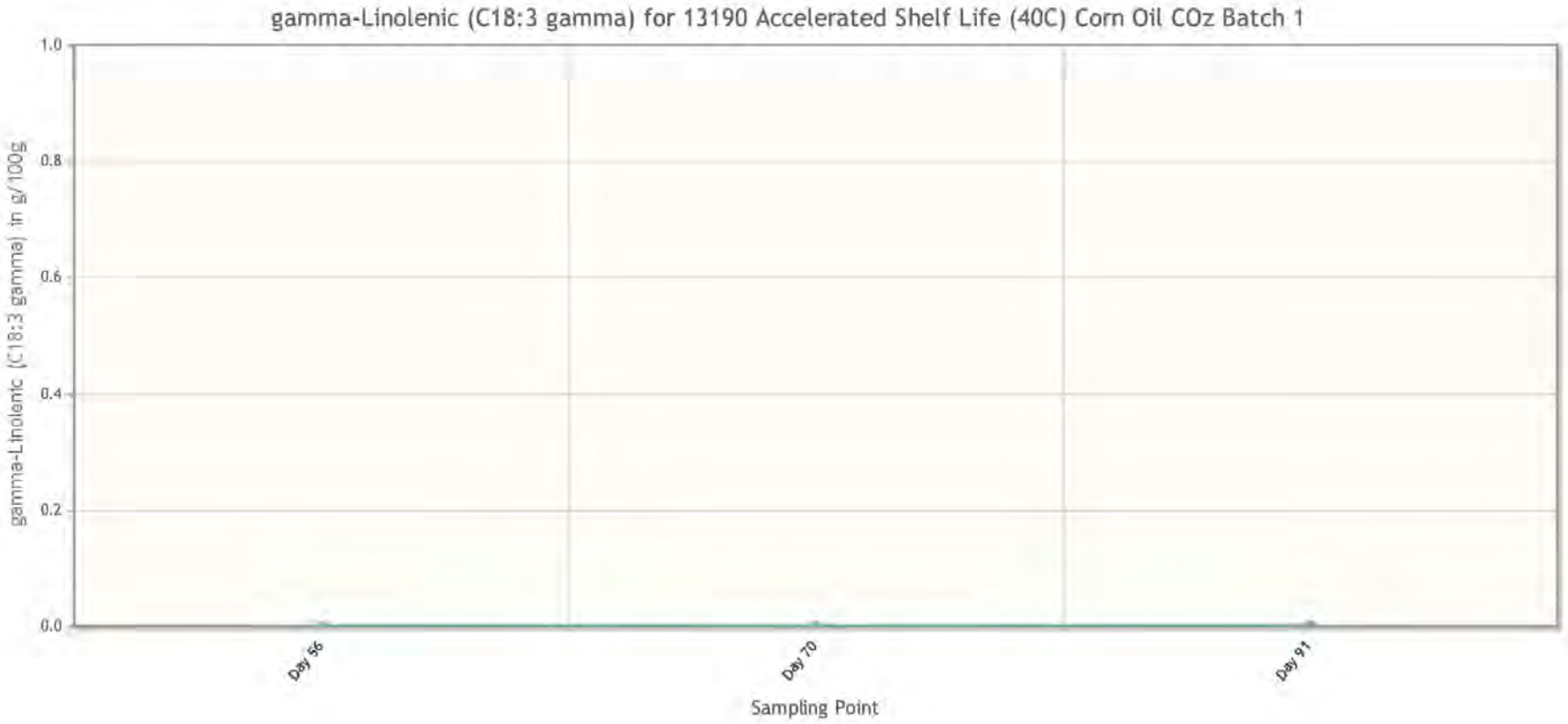

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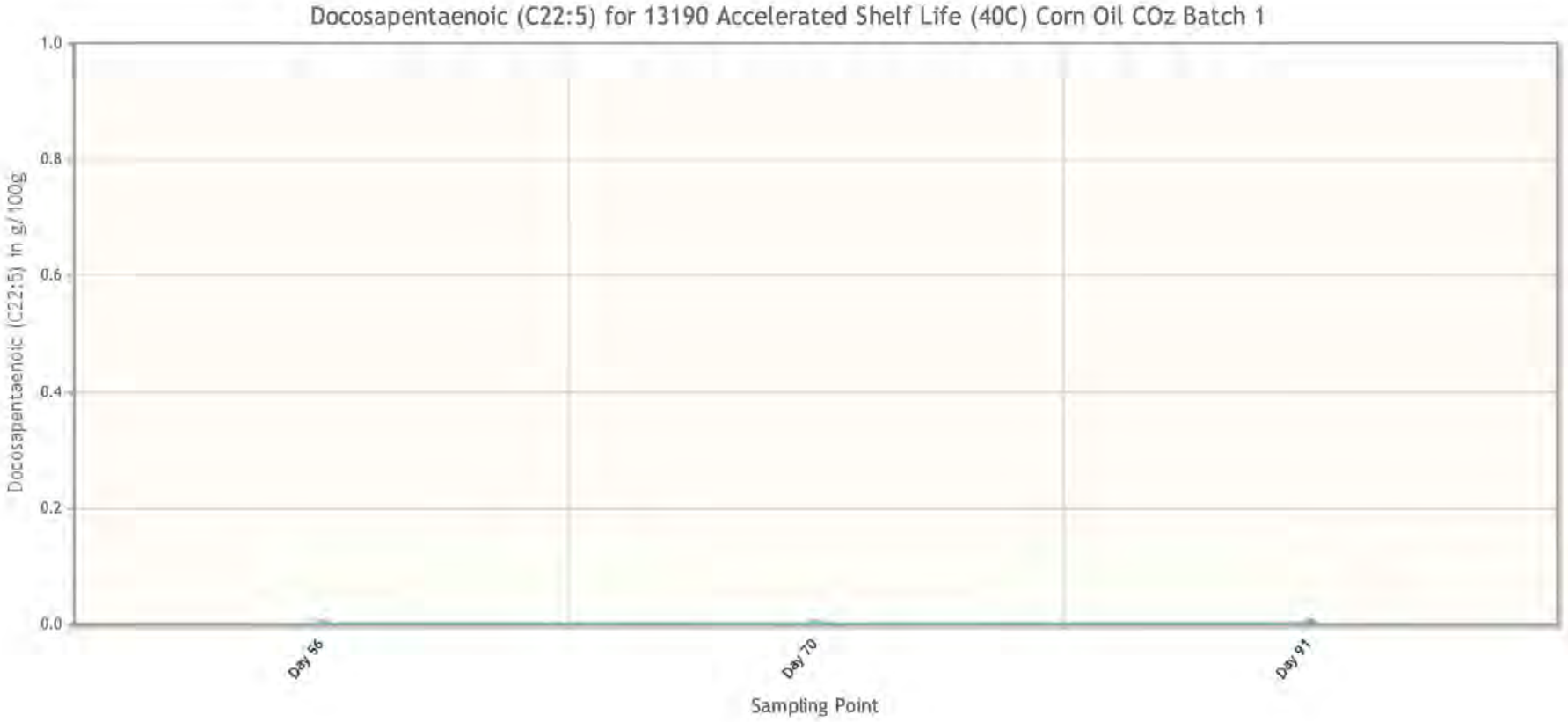

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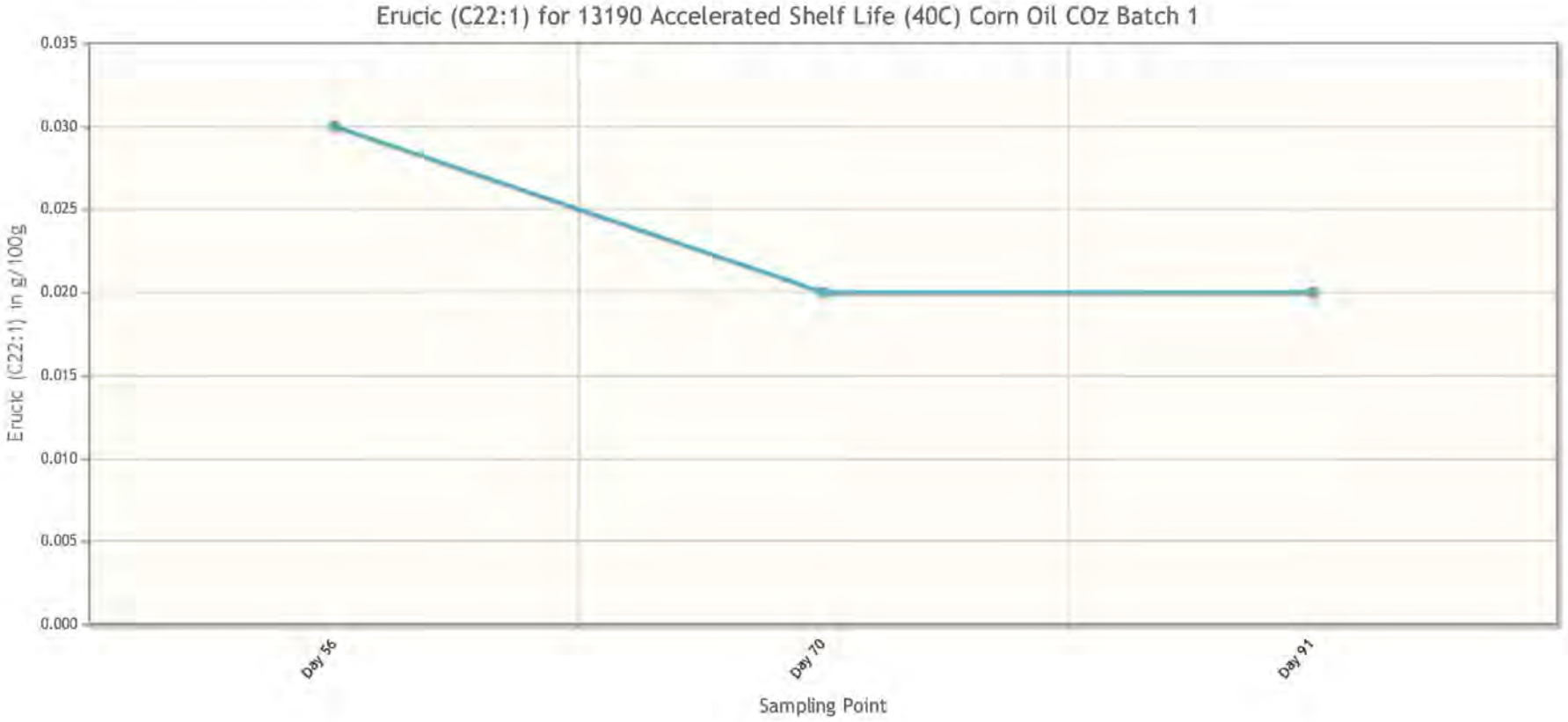

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PLEASANT HILL IA 50327

GRAPH OF ANALYSIS

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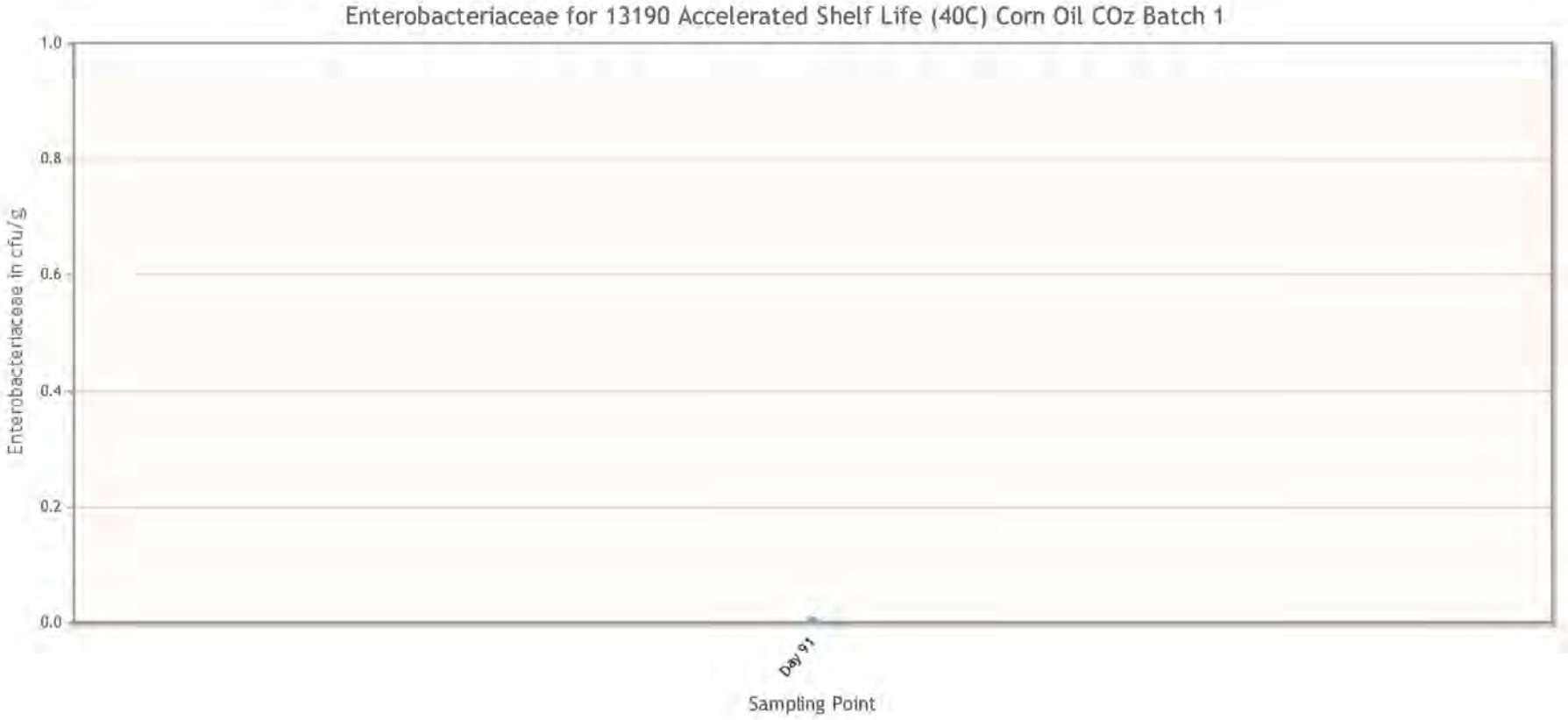
Accelerated Shelf Life (40C)
Corn Oil COz Batch 1



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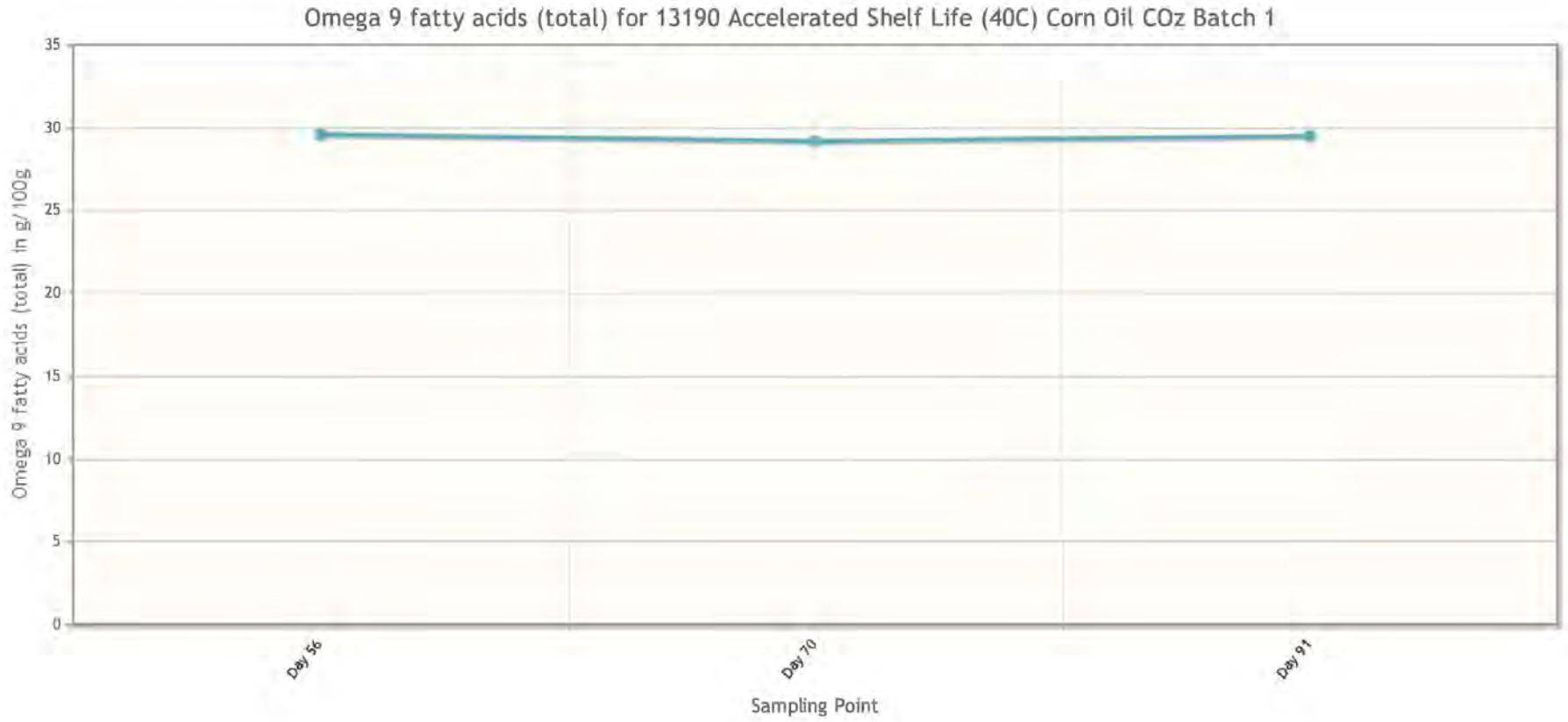

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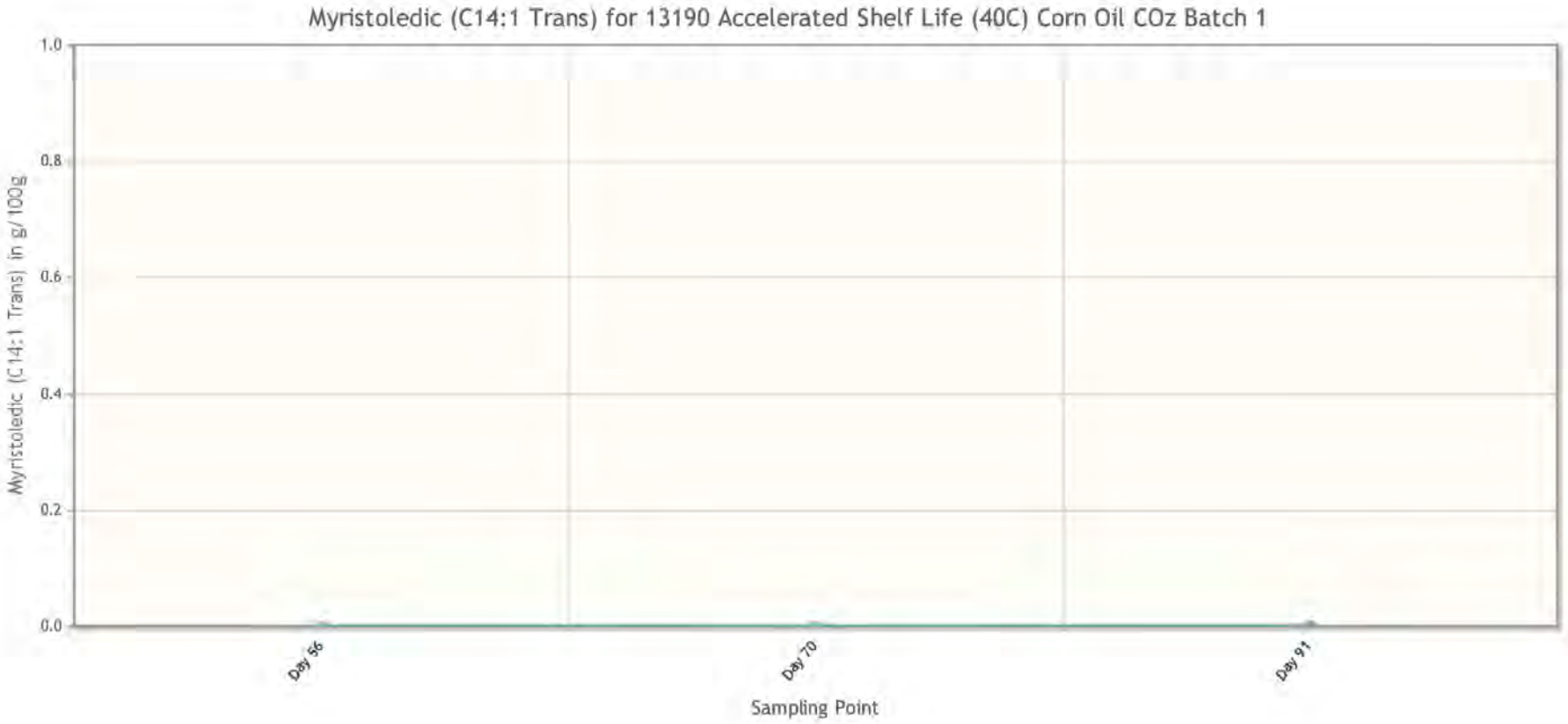

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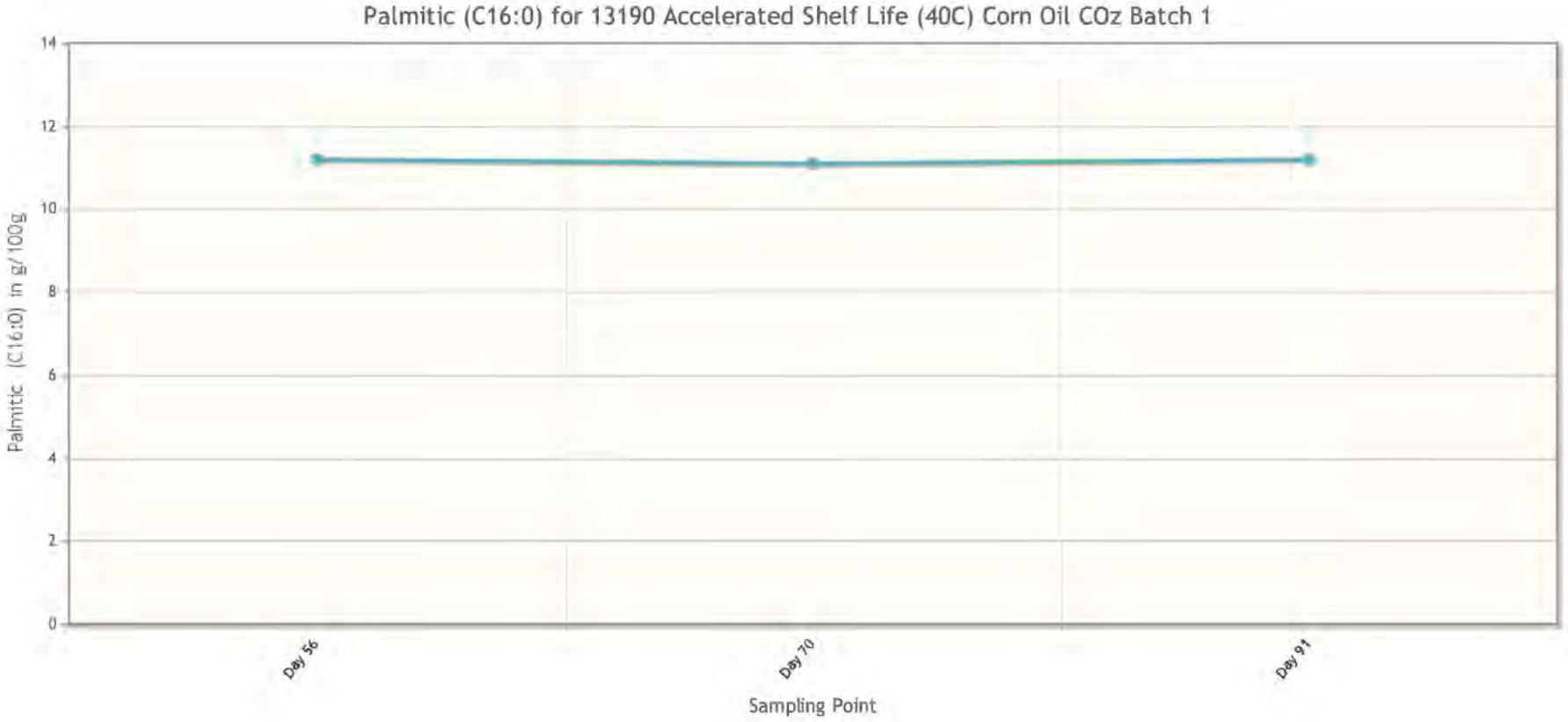

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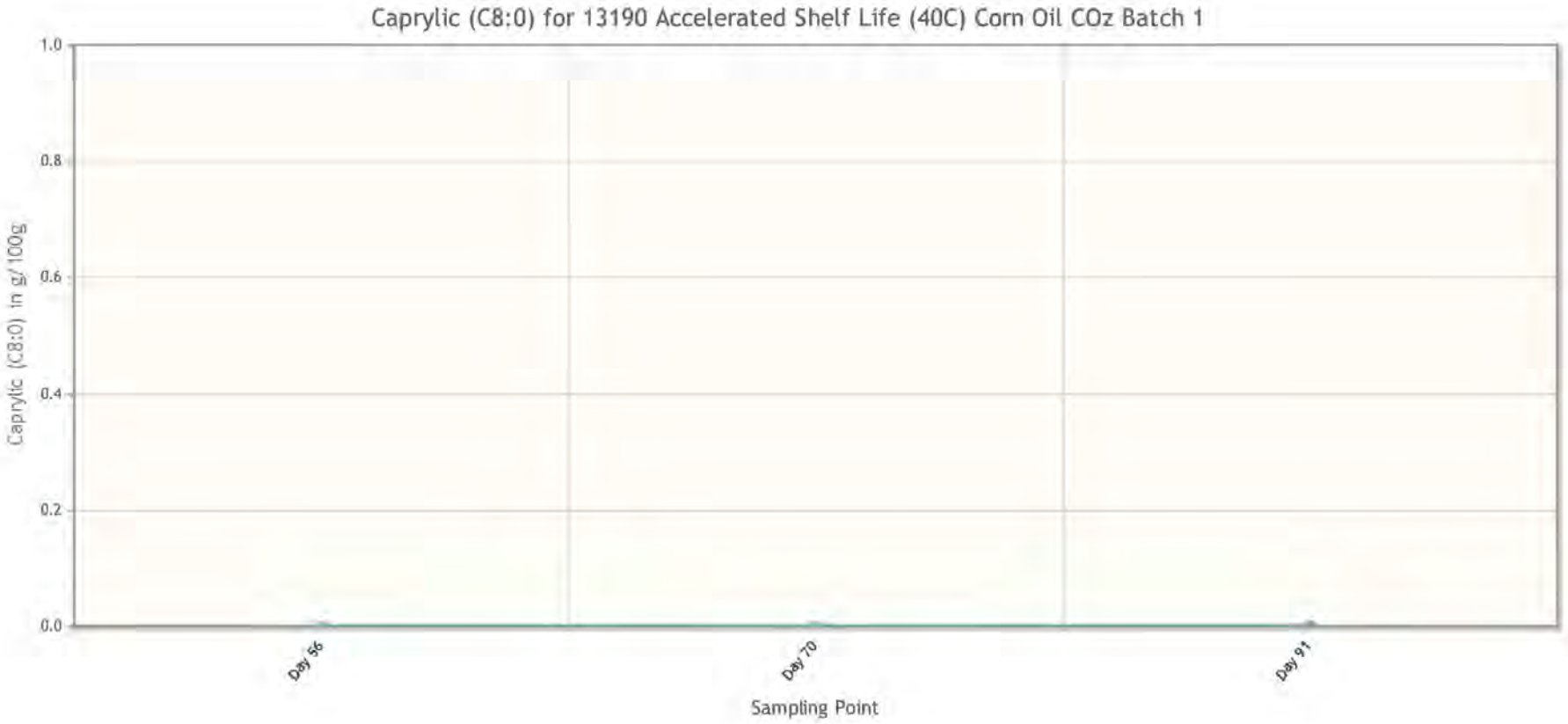

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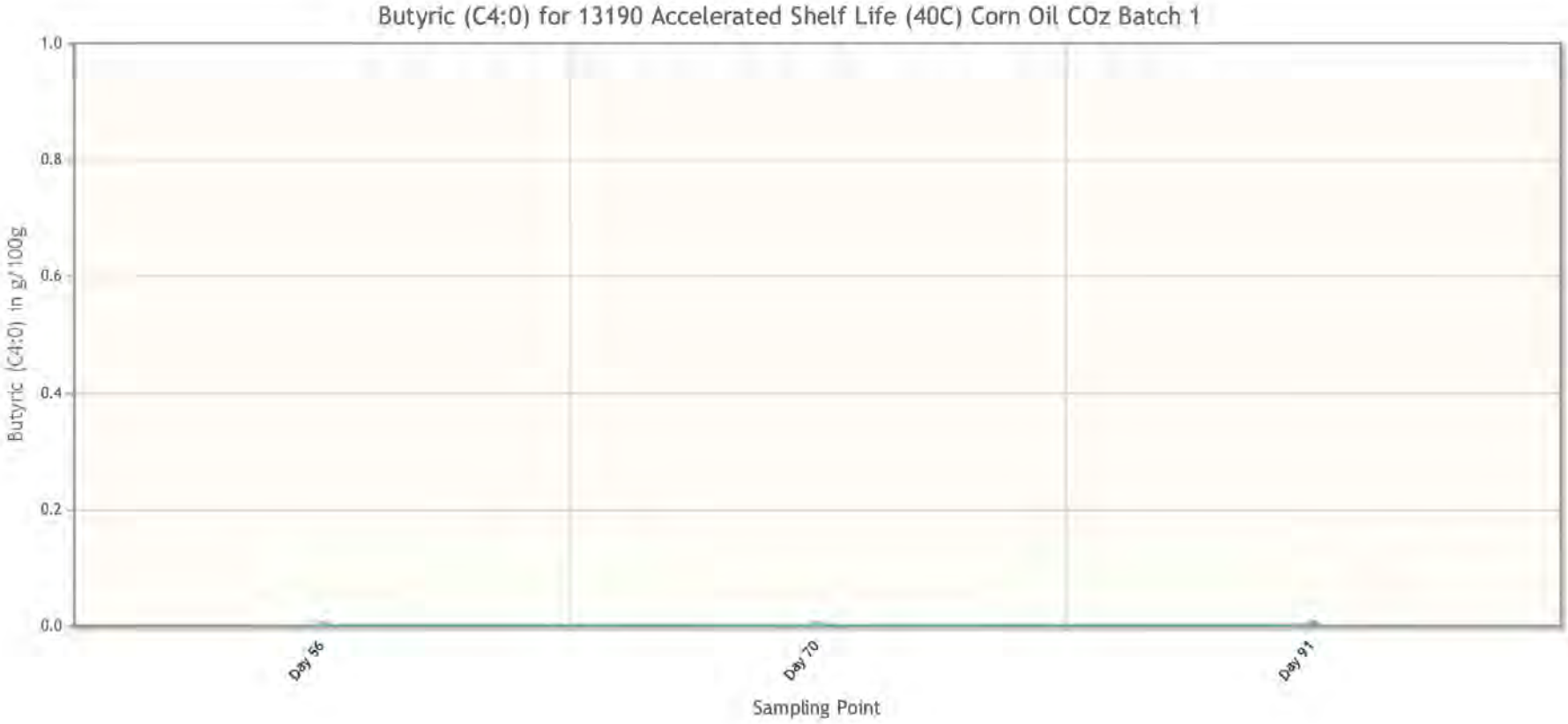

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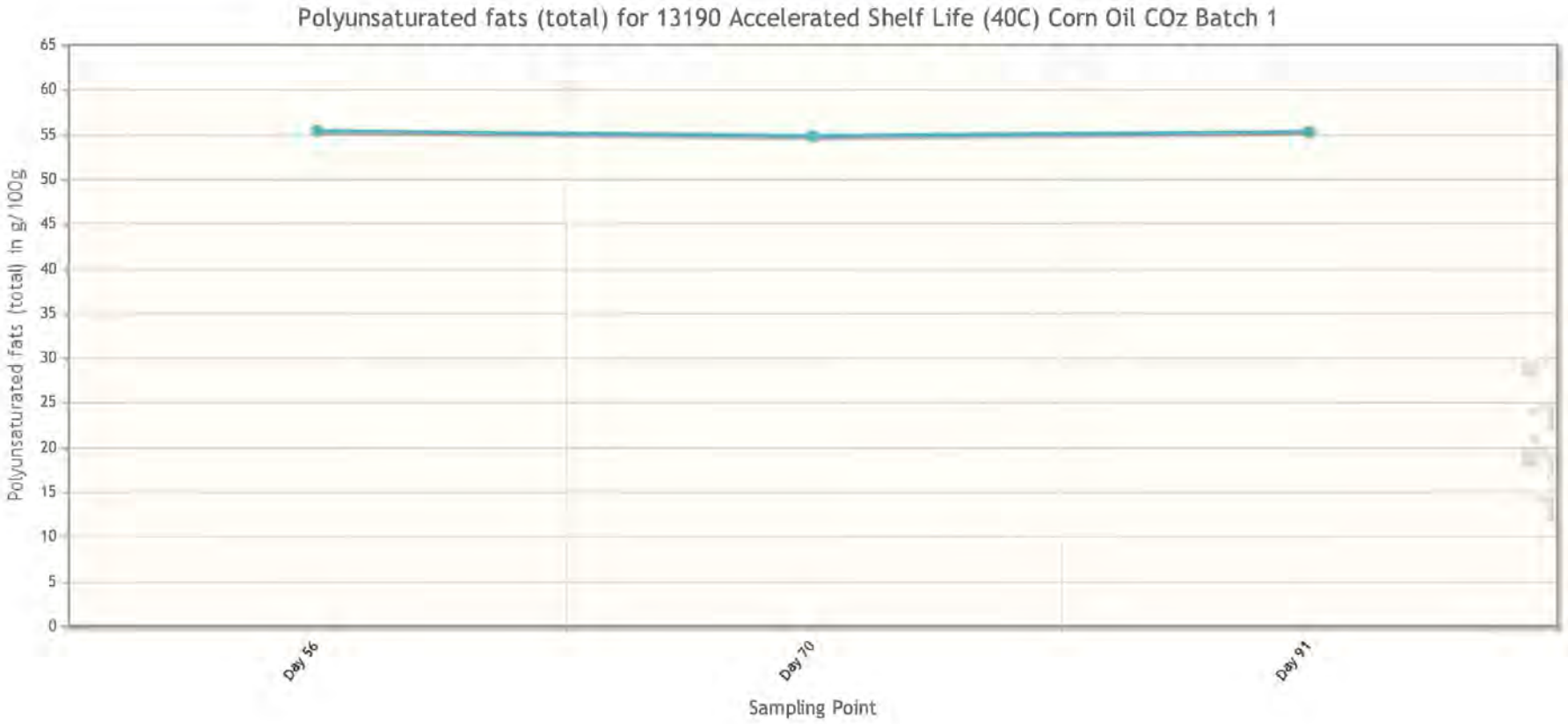

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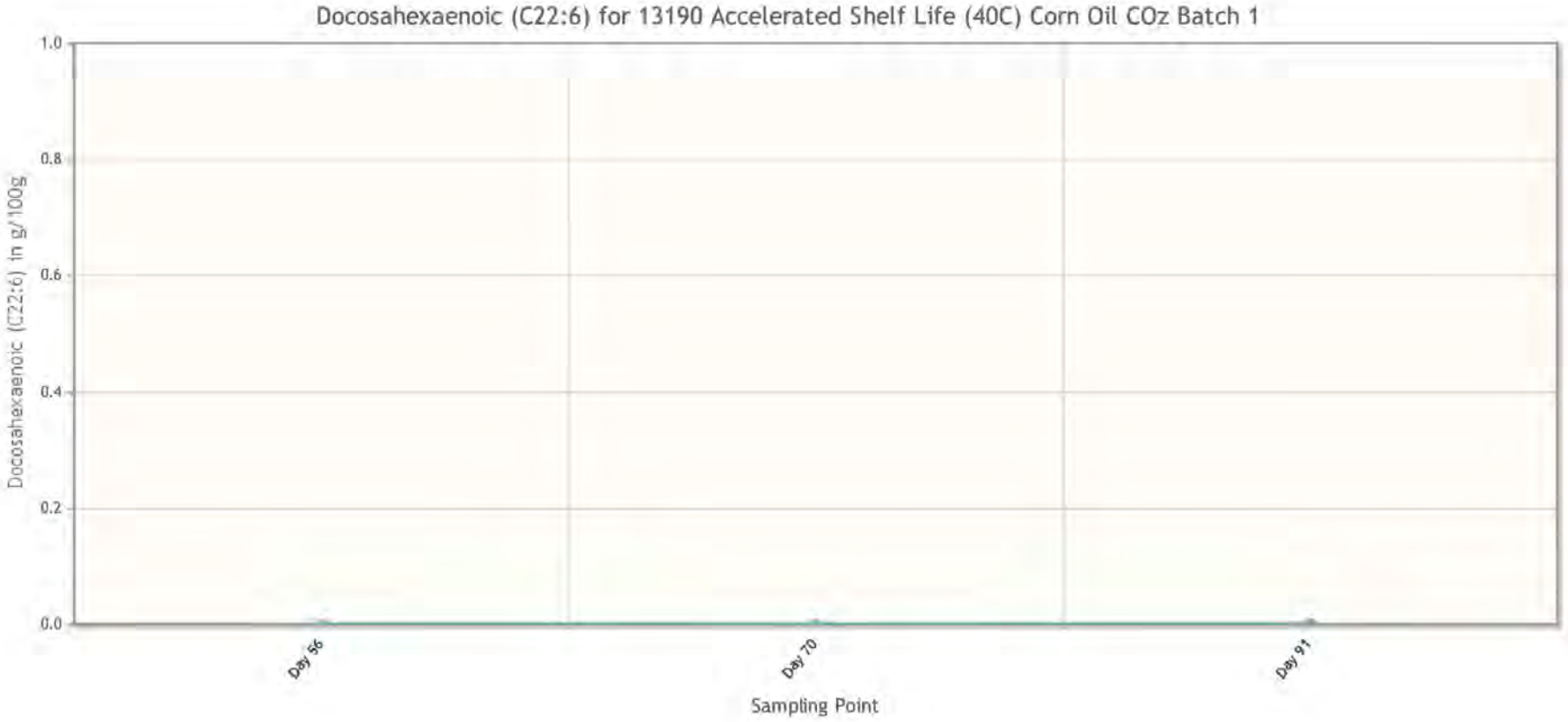

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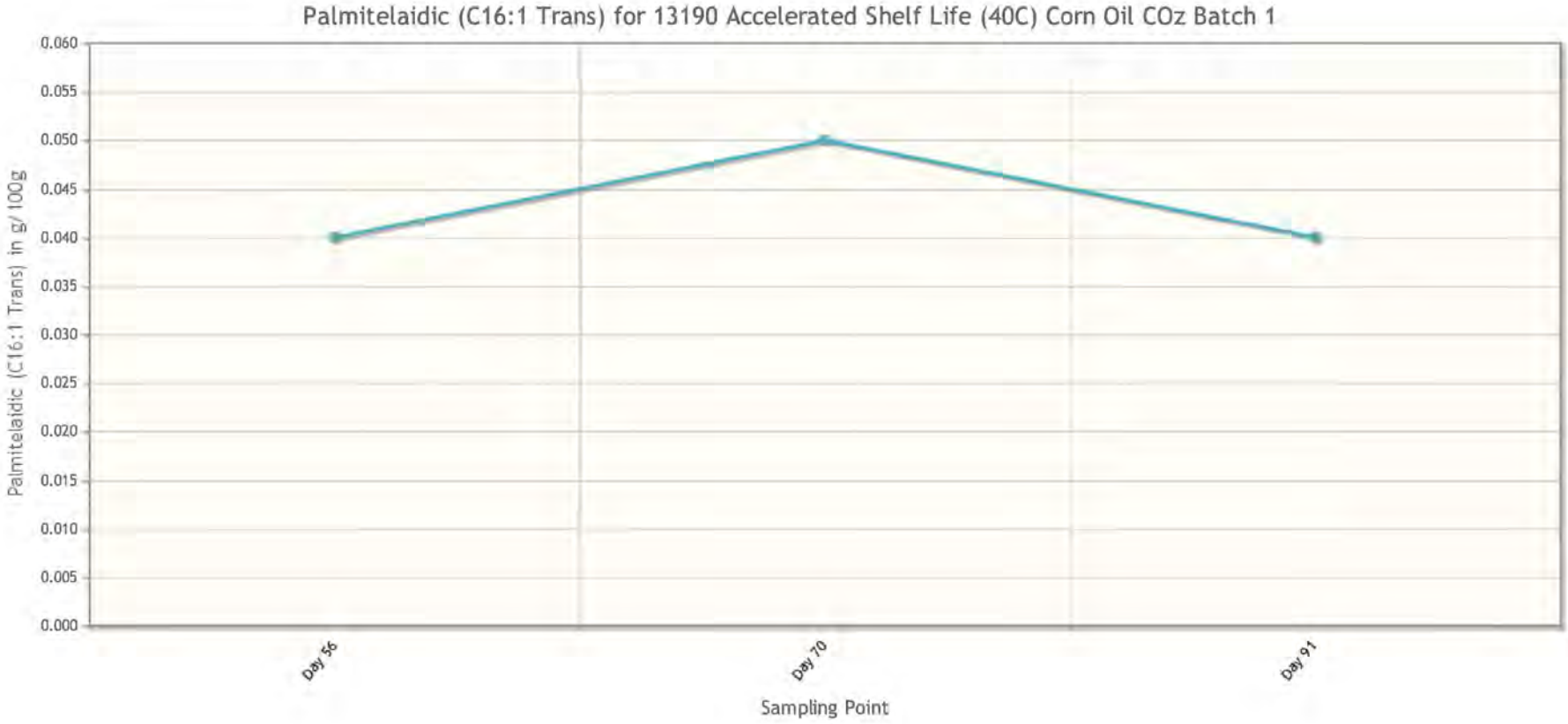

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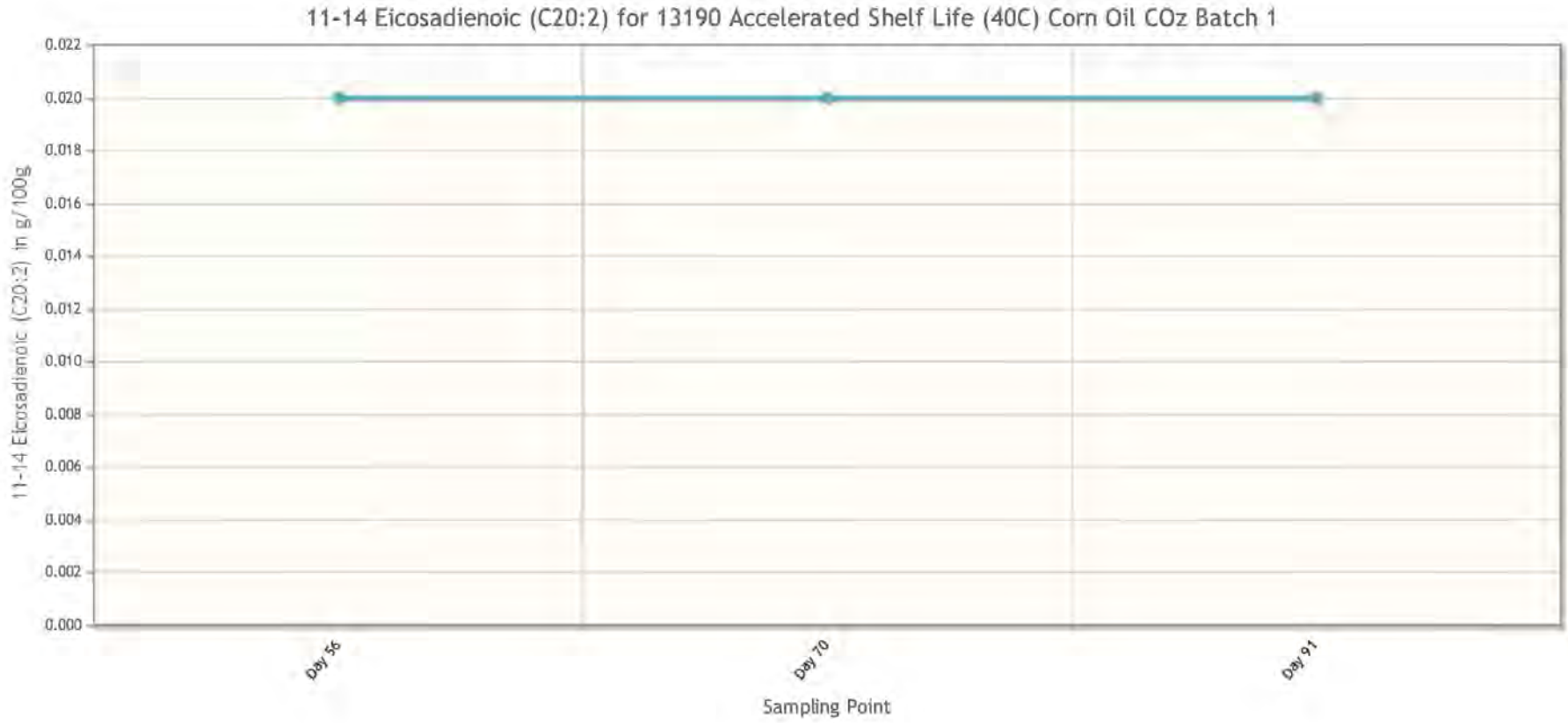

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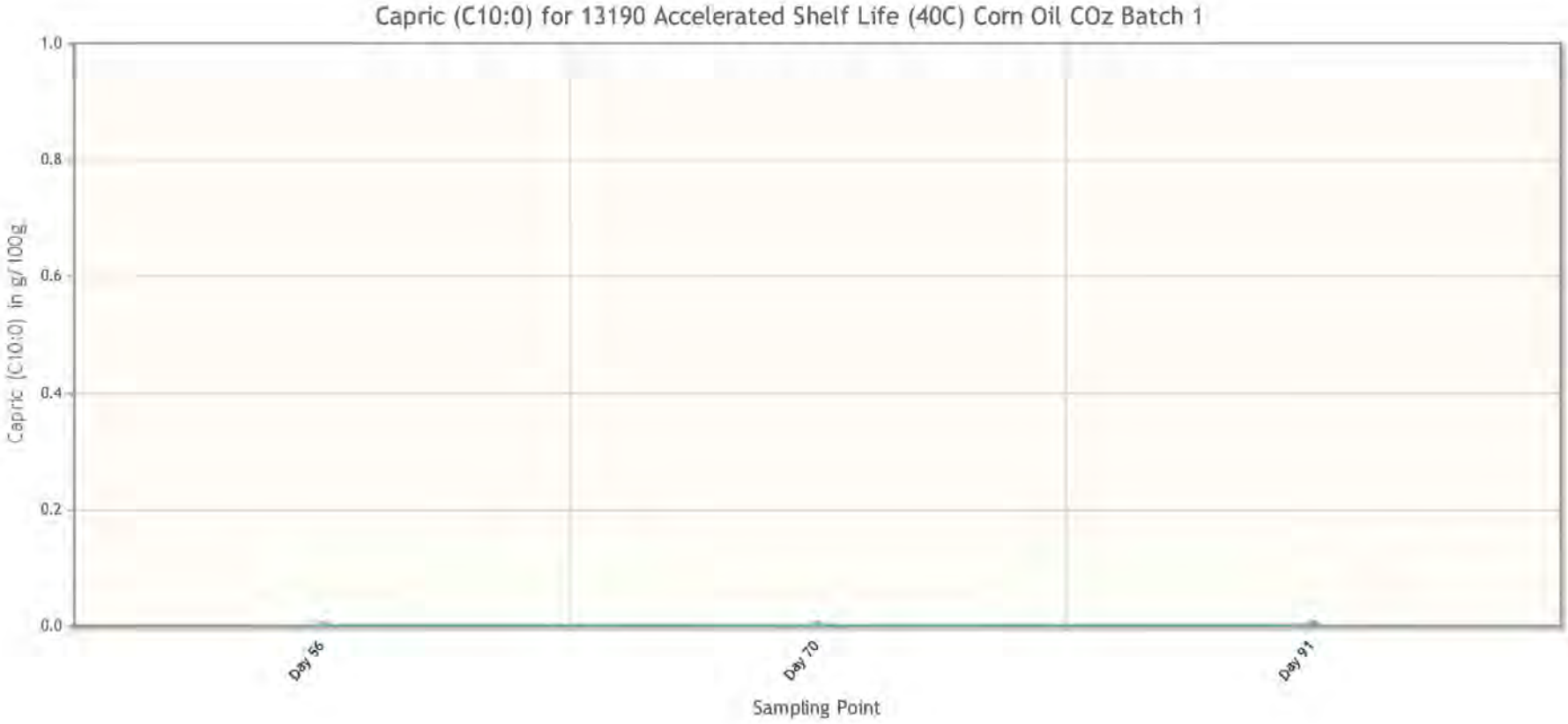

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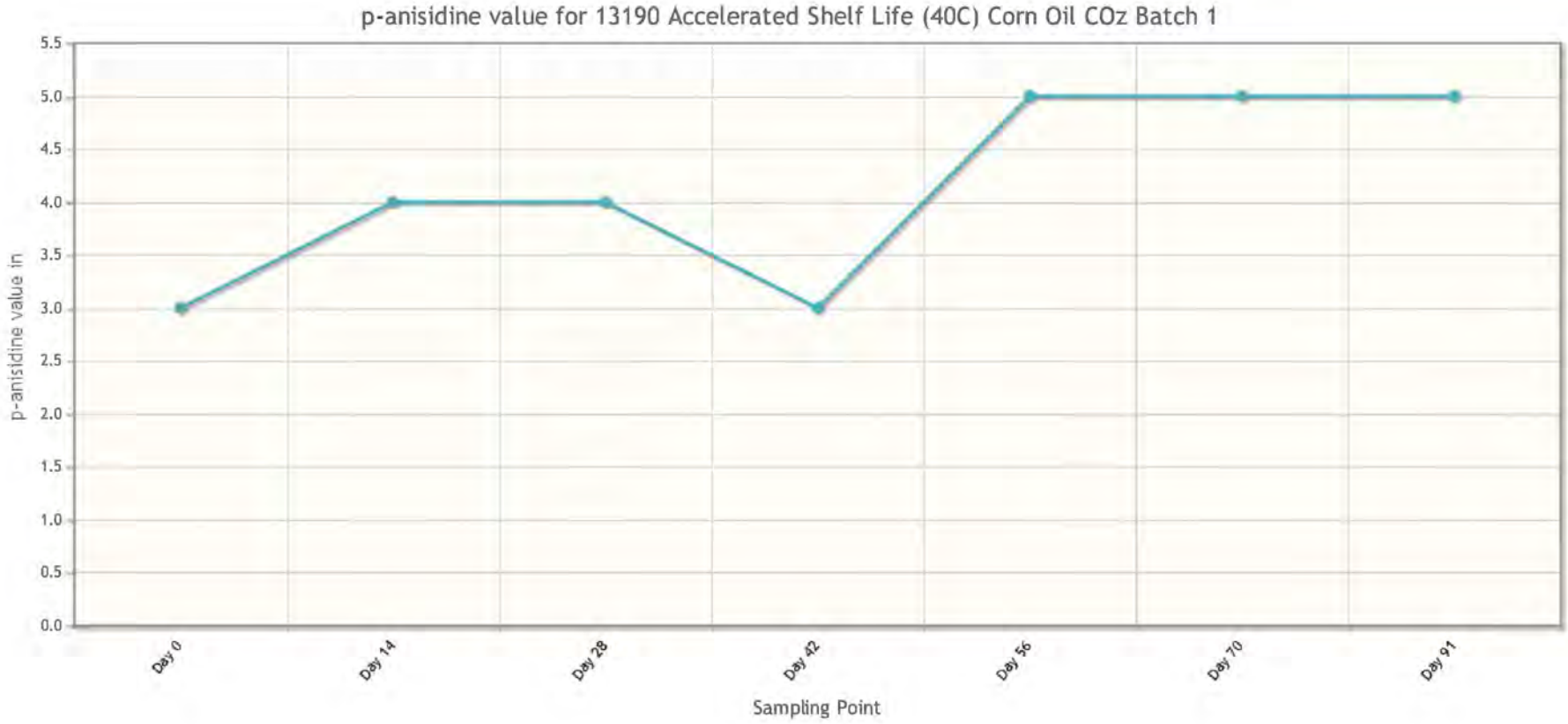

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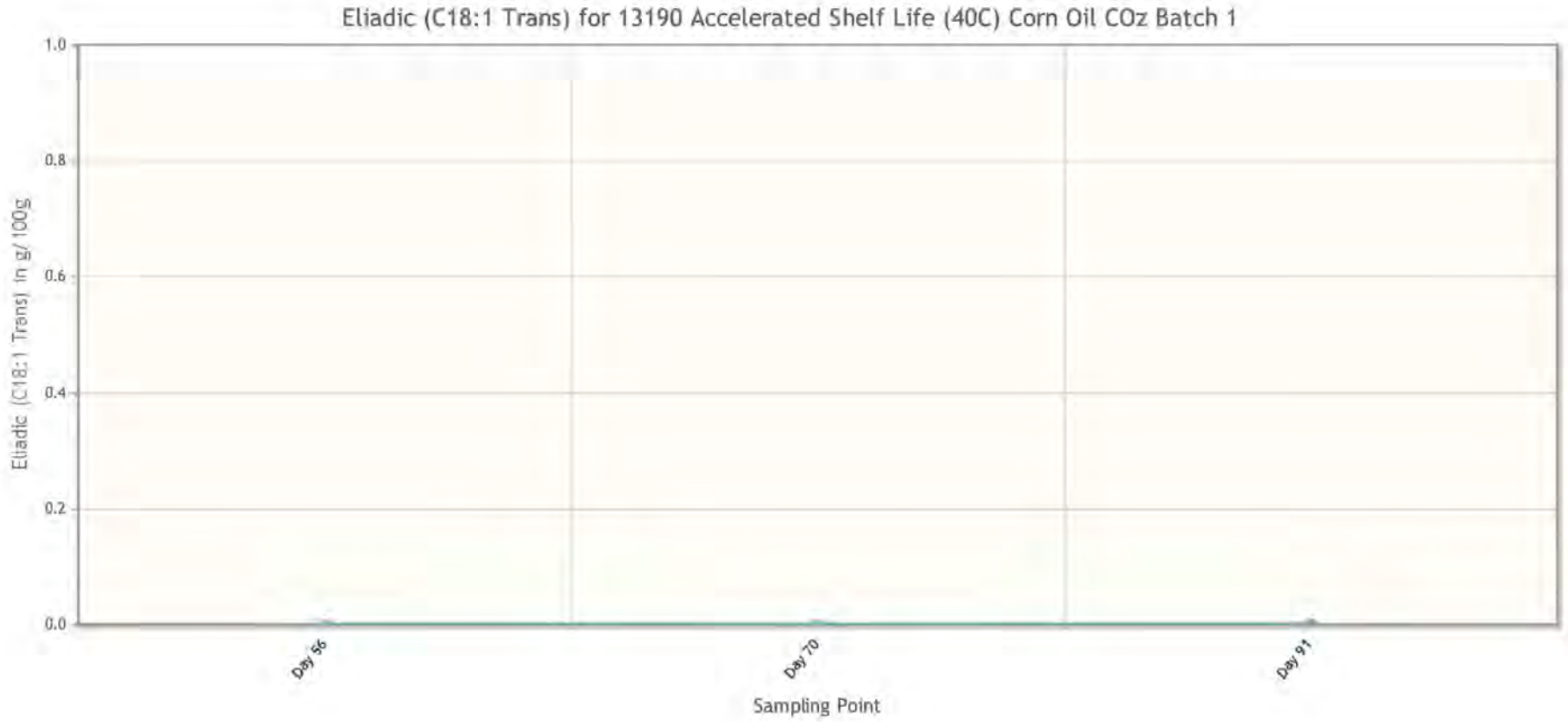

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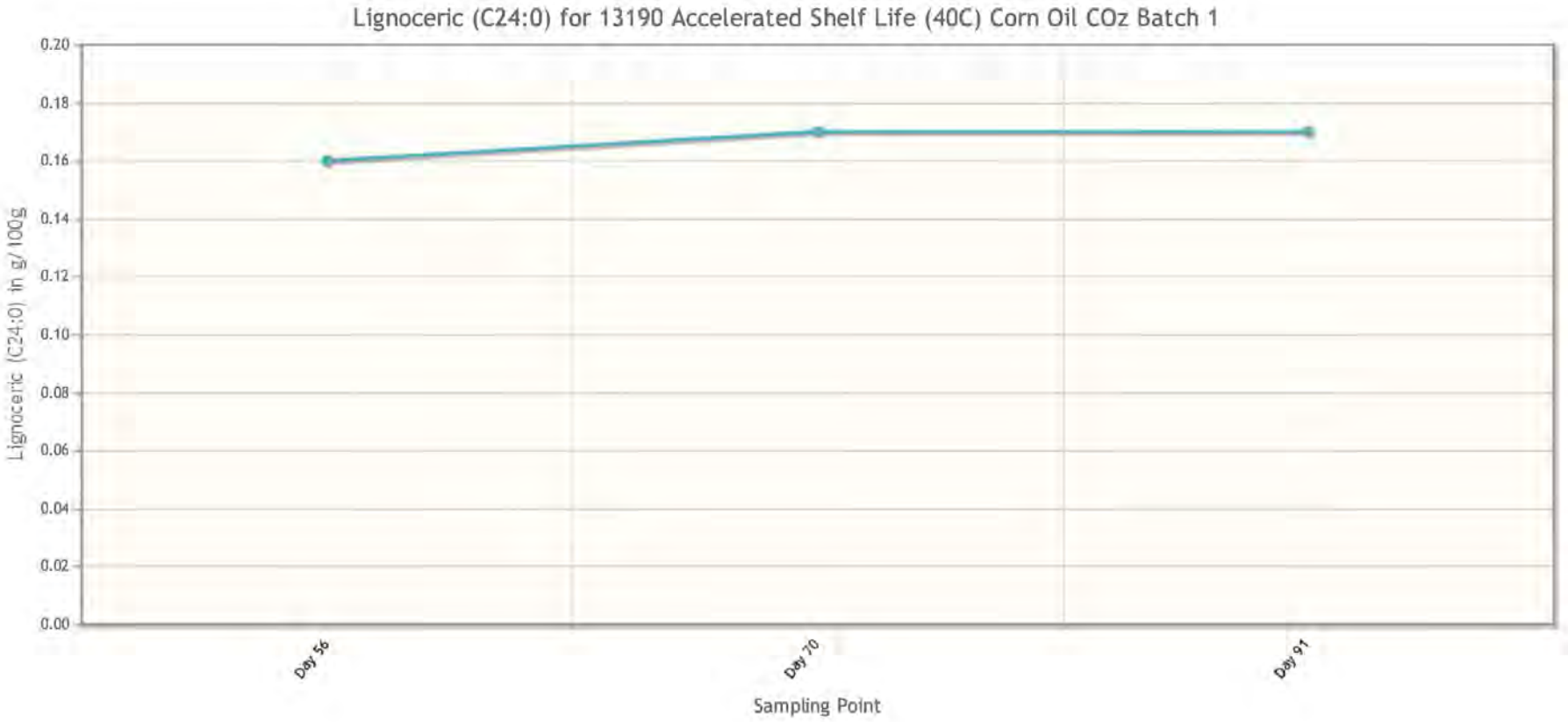

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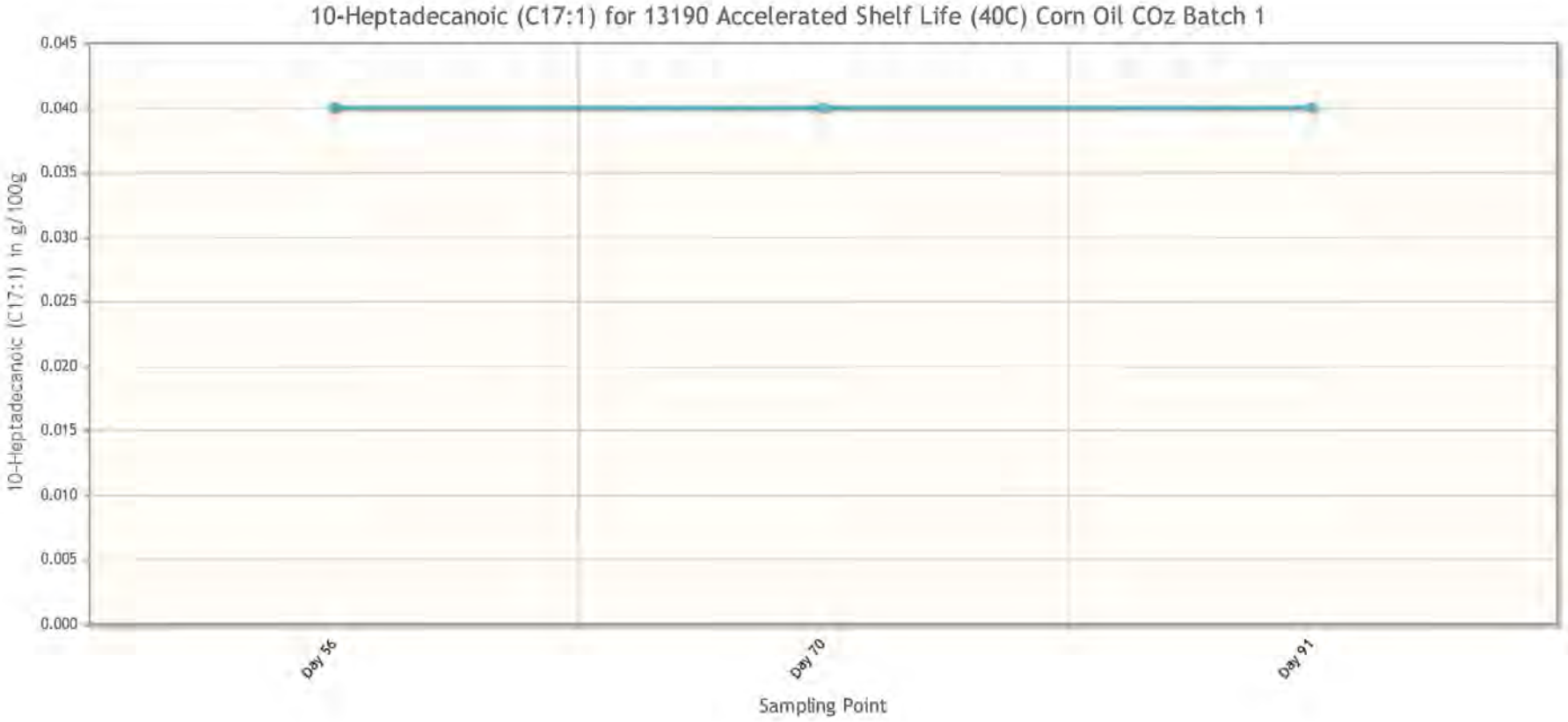

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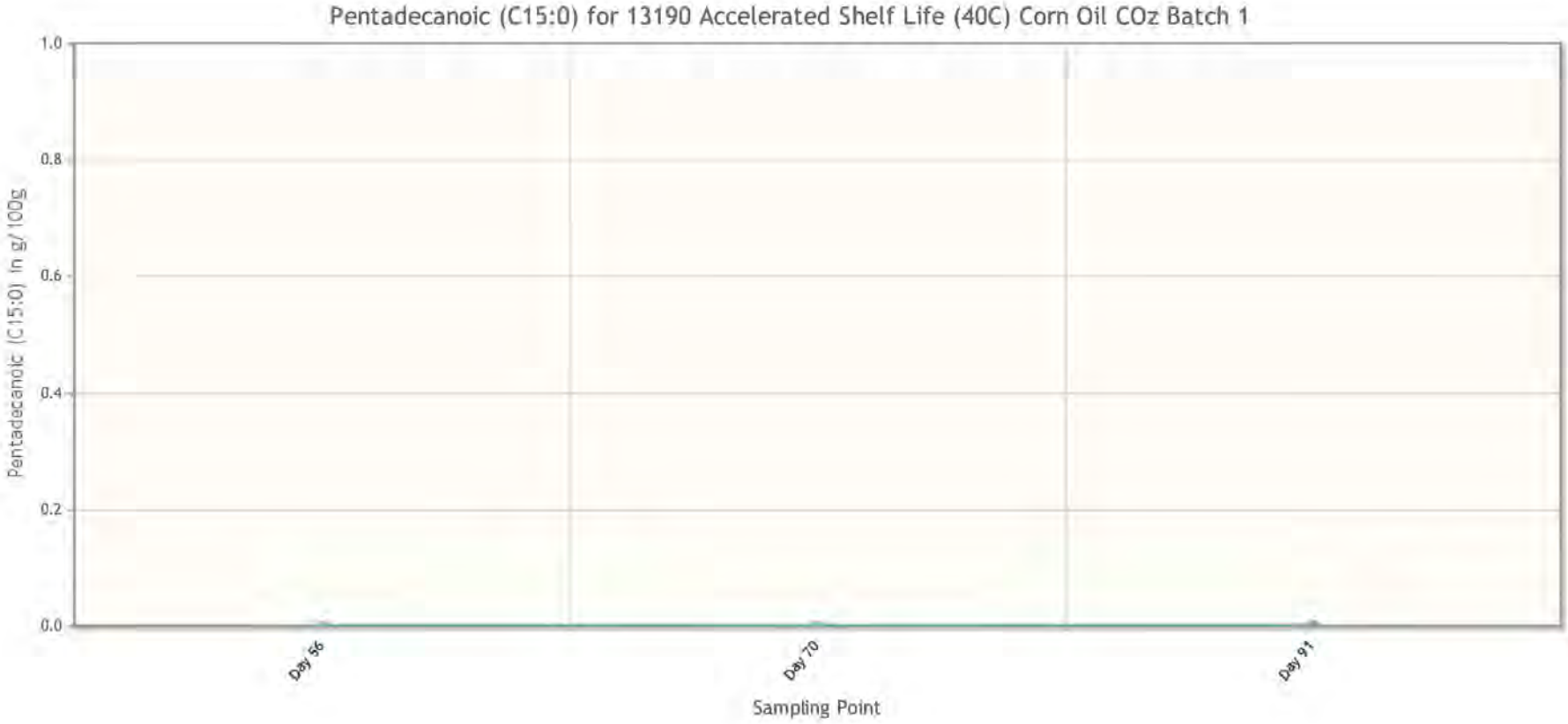

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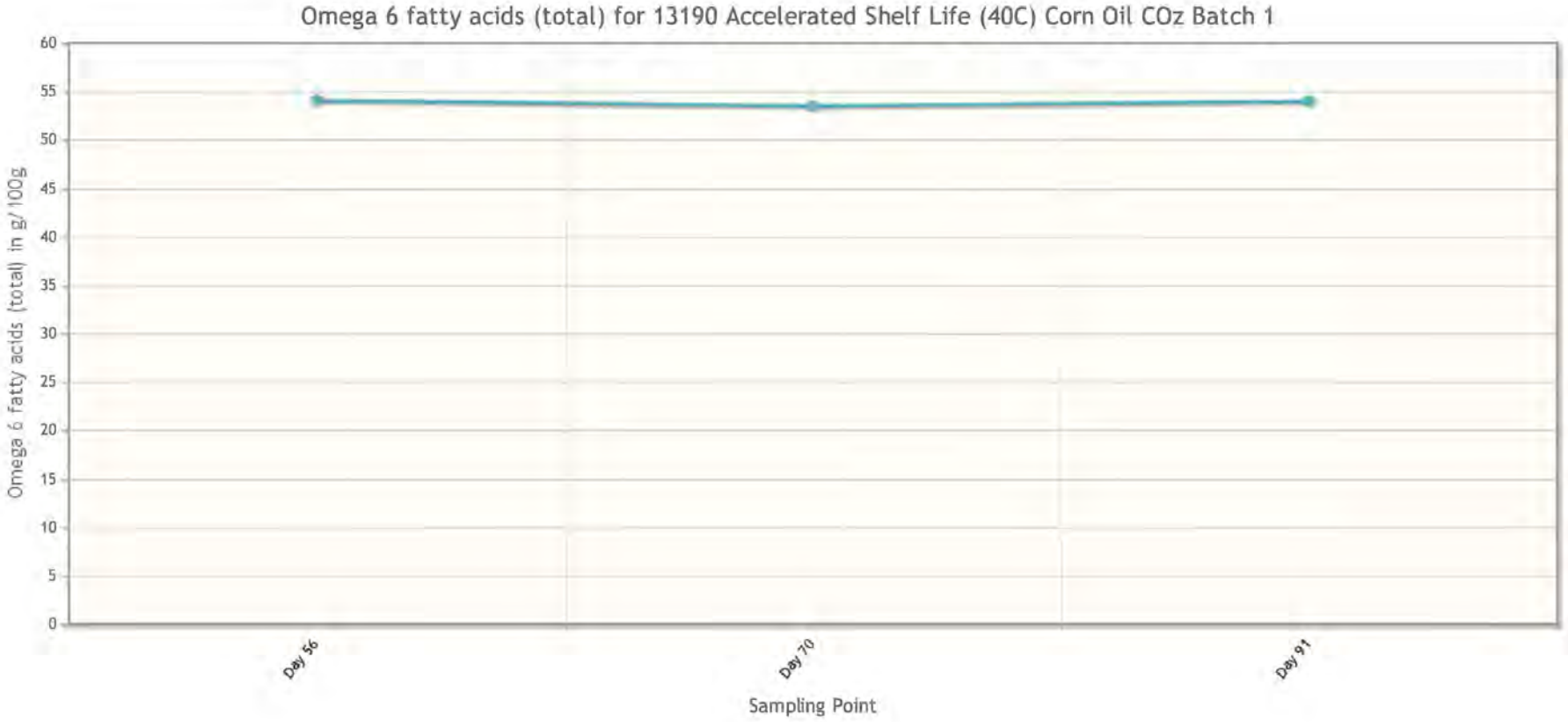

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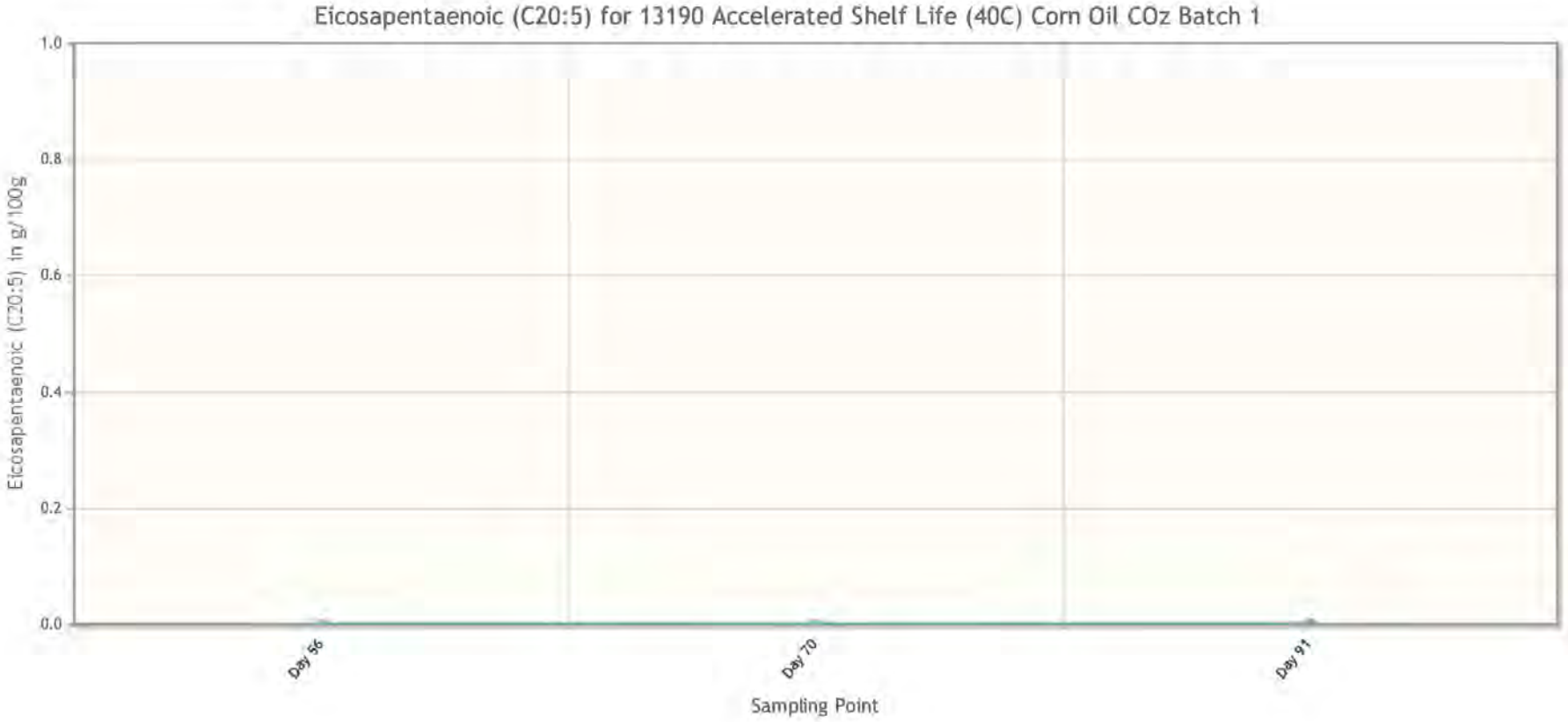

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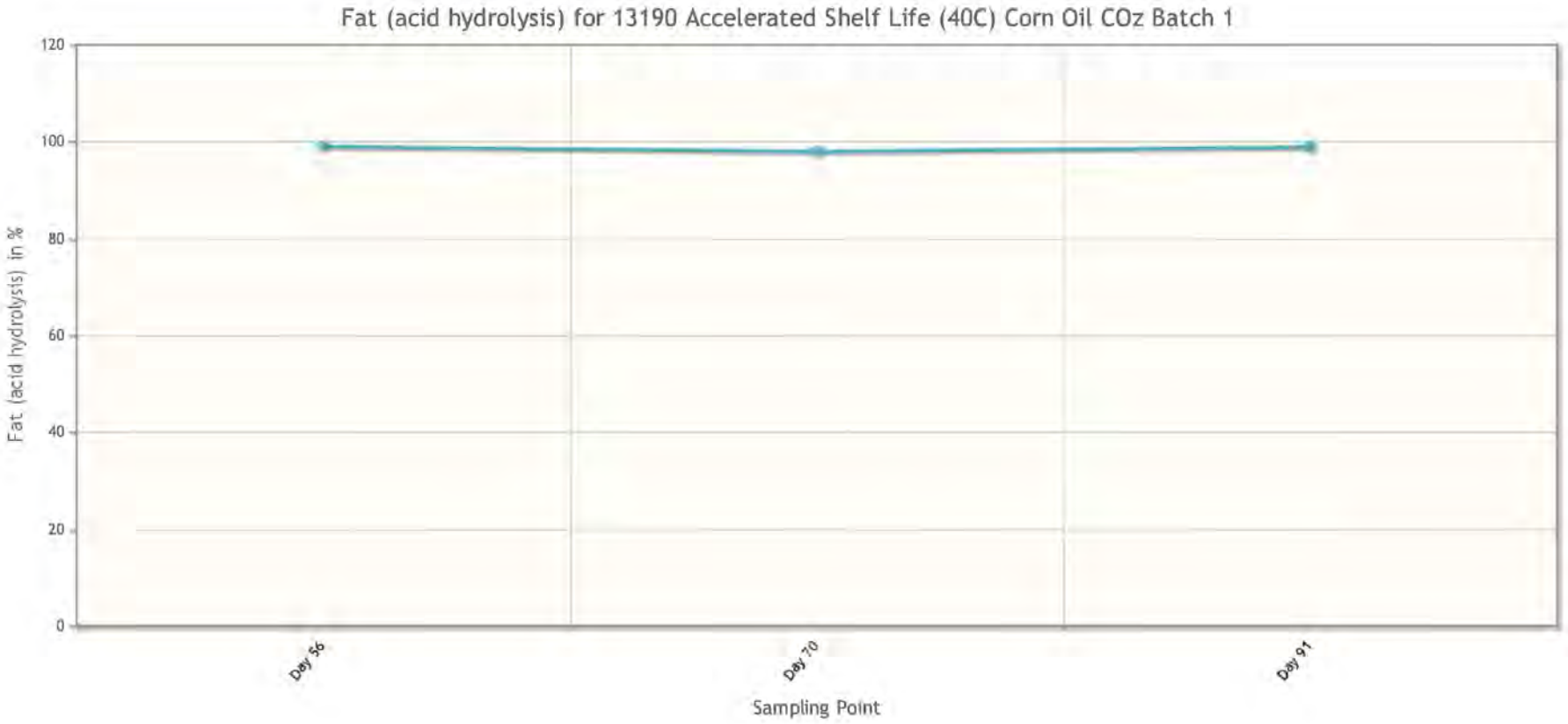

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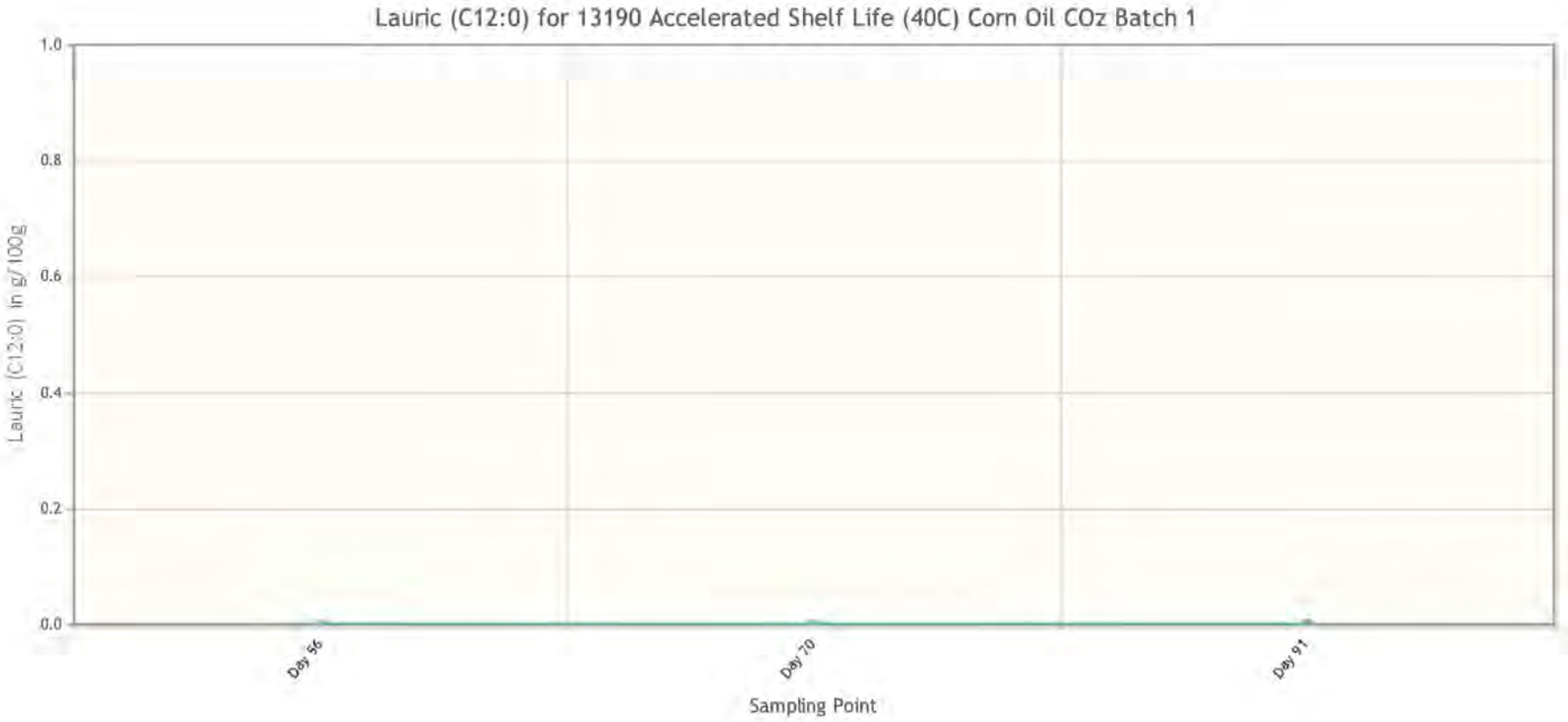

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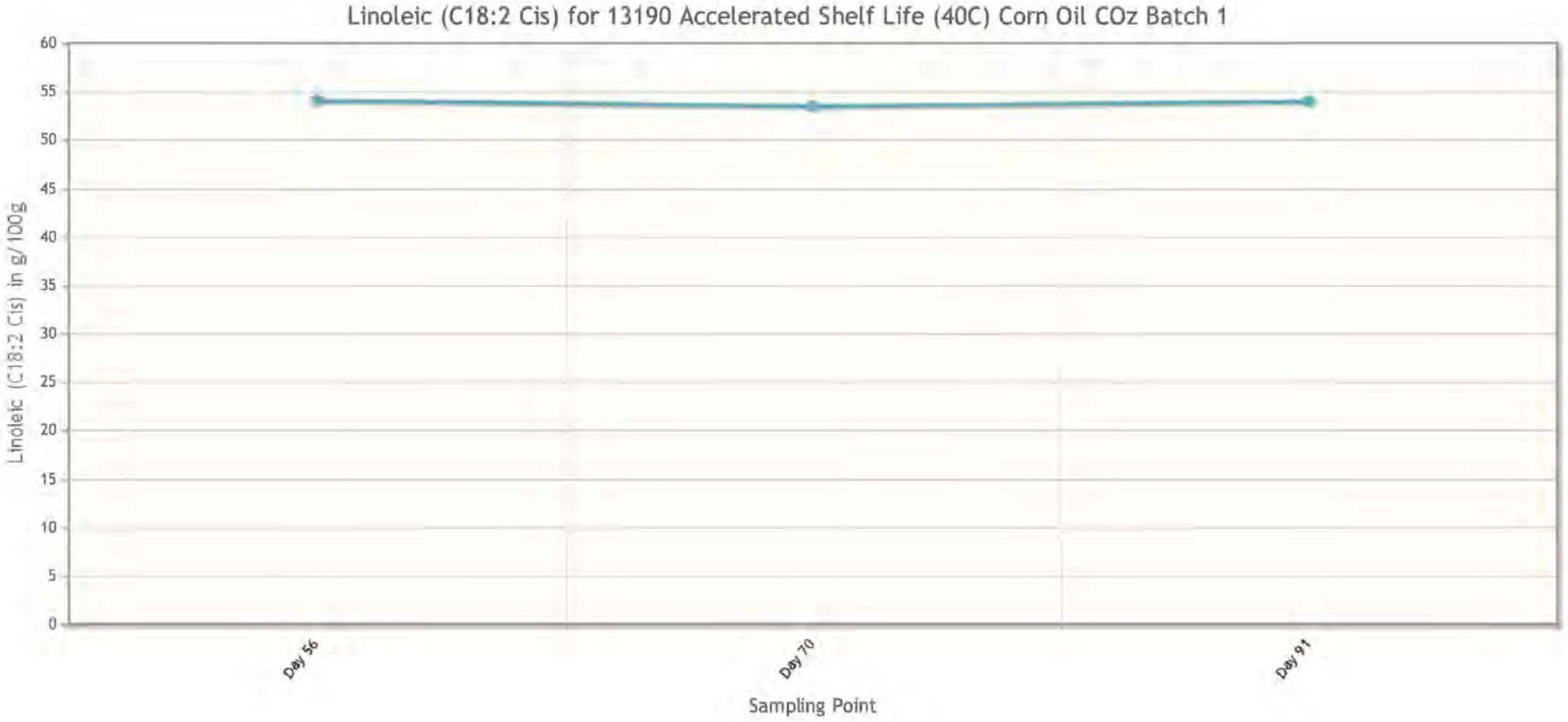

Ambient Shelf-life Study

REPORT NUMBER
18-047-9535 v4

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REPORT OF ANALYSIS

For: (36293) CORN OIL ONE
13188
Ambient Shelf Life
Corn Oil COz Batch 1

Analysis	Level Found As Received	Units	Reporting Limit	Method	Analyst-Date	Verified-Date
Sample ID: **Day 0** Lab Number: **60037314** Date Sampled: **2018-02-15**						
Sensory evaluation of foods	See Comments	None	None	VARIABLE *	jps0-2018/02/16	bch0-2018/02/16
p-anisidine value	4		2	AOCS Cd 18-90	ees0-2018/02/16	bch0-2018/02/16
Totox number	11.4	n/a	1.0	Calculation	Auto-2018/02/16	Auto-2018/02/16
Peroxide value	3.7	meq/kg fat	2.0	AOAC 965.33	kap7-2018/02/16	cmw4-2018/02/16
Sample ID: **Day 89** Lab Number: **60037315** Date Sampled: **2018-05-15**						
Sensory evaluation of foods	See Comments	None	None	VARIABLE *	jps0-2018/05/17	srp3-2018/05/17
p-anisidine value	4		2	AOCS Cd 18-90	alq6-2018/05/18	srp3-2018/05/18
Totox number	15.6	n/a	1.0	Calculation	Auto-2018/05/18	Auto-2018/05/21
Peroxide value	5.8	meq/kg fat	2.0	AOAC 965.33	kap7-2018/05/17	cmw4-2018/05/21
Sample ID: **Day 181** Lab Number: **60037316** Date Sampled: **2018-08-15**						
Sensory evaluation of foods	See Comments	None	None	VARIABLE *	jps0-2018/08/17	srp3-2018/08/17
p-anisidine value	4		2	AOCS Cd 18-90	lkd8-2018/08/16	srp3-2018/08/16
Totox number	15.6	n/a	1.0	Calculation	Auto-2018/08/23	Auto-2018/08/28
Peroxide value	5.8	meq/kg fat	2.0	AOAC 965.33	kap7-2018/08/23	cmw4-2018/08/28
Sample ID: **Day 273** Lab Number: **60037317** Date Sampled: **2018-11-15**						
Sensory evaluation of foods	See Comments	None	None	VARIABLE *	jps0-2018/11/16	srp3-2018/11/16
p-anisidine value	4		2	AOCS Cd 18-90	lkd8-2018/11/20	srp3-2018/11/20
Totox number	12.2	n/a	1.0	Calculation	Auto-2018/11/20	Auto-2018/11/21
Peroxide value	4.1	meq/kg fat	2.0	AOAC 965.33	kap7-2018/11/20	cmw4-2018/11/21

The result(s) issued on this report only reflect the analysis of the sample(s) submitted.

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REPORT OF ANALYSIS

For: (36293) CORN OIL ONE
13188
Ambient Shelf Life
Corn Oil COz Batch 1

Analysis	Level Found As Received	Units	Reporting Limit	Method	Analyst-Date	Verified-Date

Sensory Evaluation: Golden to Dark yellow viscous oily liquid that is translucent. When opening bottle there is a faint corn/grain aroma that fades quickly.
Day 89: Unchanged.
Day 181: Unchanged.
Day 273: Slight decline in aroma overall, otherwise, unchanged.
This report was reissued on 2018-11-21 10:02:41 by cmw4 for the following reason:
shelf life.
All results are reported on an AS RECEIVED basis.

For questions please contact:

Craig Ebel
Feed Coordinator
cebel@midwestlabs.com (402)590-2962

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REPORT OF ANALYSIS

For: (36293) CORN OIL ONE
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Ambient Shelf Life
Corn Oil COz Batch 1

Detailed Method Description(s)

Anisidine value

Anal;ysis follows MWL FO 063 which is based on modified AOCS Cd 18-90. The fat in a sample is extracted and then dissolved into iso-octane. The p-anisidine reagent is added and the resultant solution read at 350 nm.

Calculation

Analytical results are entered into applicable formulas to provide a calculated result which is reported.

Peroxide Value

Peroxide value is used as a measurement of the rancidity of a material. If a fat or oil has a large amount of double bonds (unsaturated), the oils can undergo a process of autooxidation where peroxides are formed as intermediate chemicals. The testing procedure involves adding a chloroform/acetic acid mixture. The chloroform functions to dissolve the fats. Potassium iodide is added to provide levels of iodine in the solution. As the level of peroxide increase, more iodide is liberated. The level of iodide is determined using sodium thiosulfate as a titrant and starch as an indicator.

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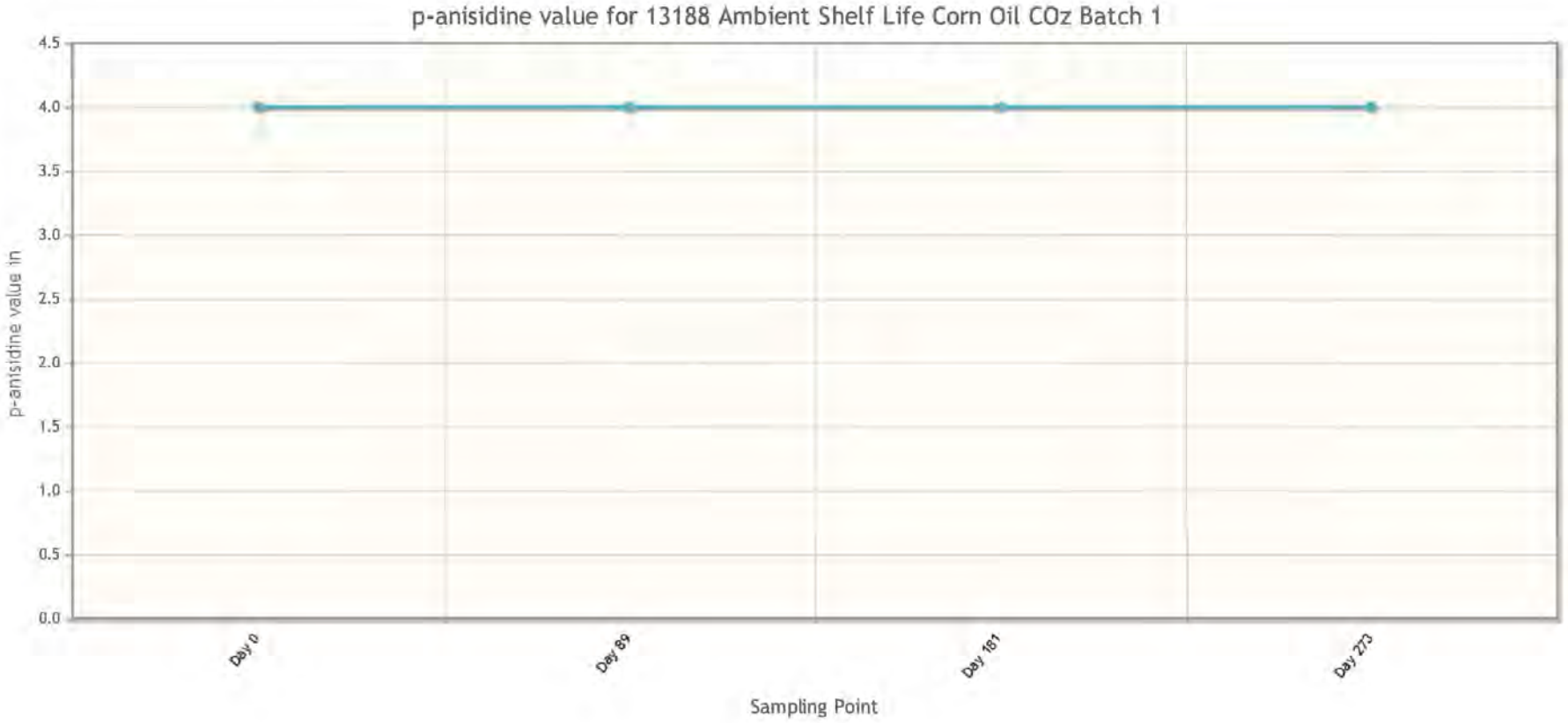

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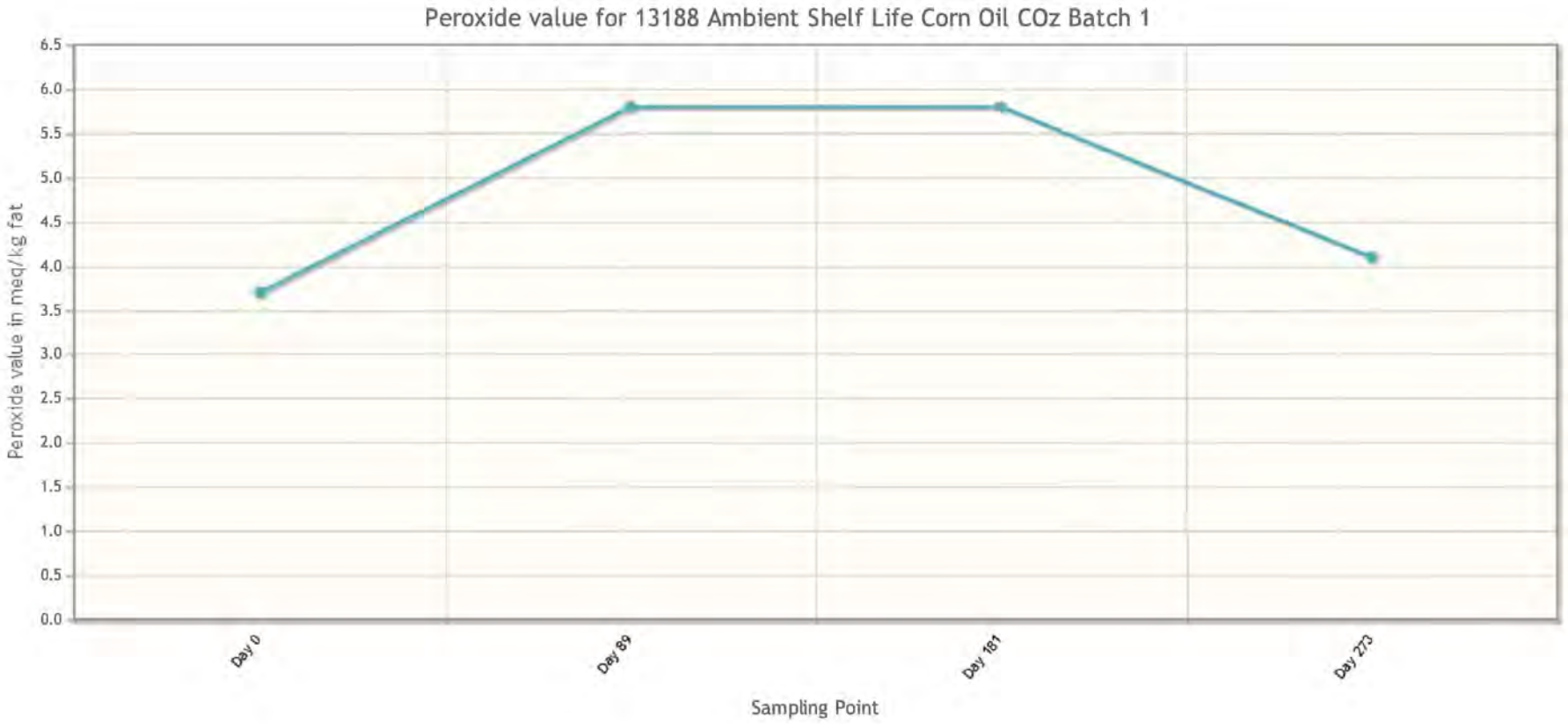

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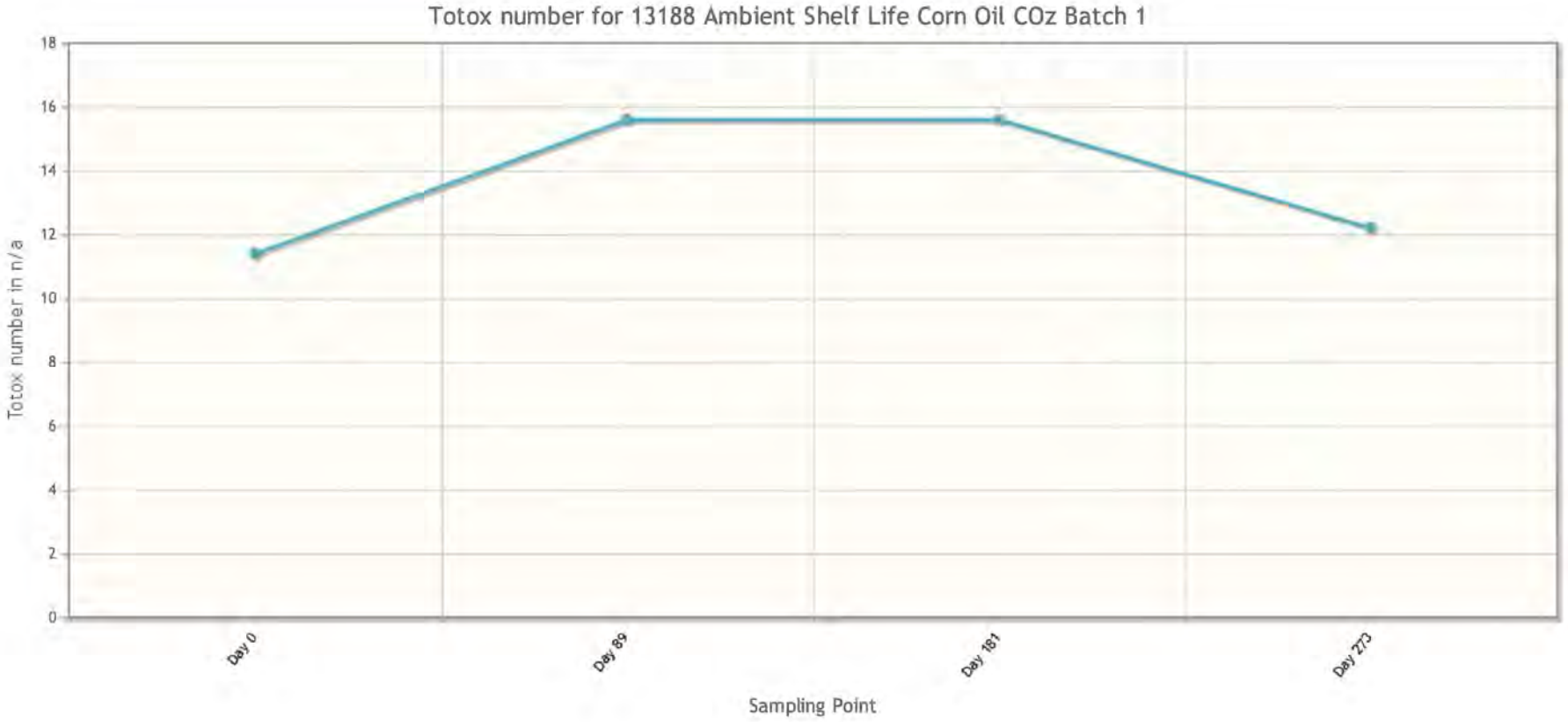

The result(s) issued on this report only reflect the analysis of the sample(s) submitted.

Appendix J. GRAS Panel Consensus Statement on the Generally Recognized as Safe (GRAS) Determination Supporting the Intended Use of COZ Corn Oil Derived from Distillers Corn Oil as Edible Corn Oil in Conventional Foods

GRAS Panel Consensus Statement on the Generally Recognized as Safe (GRAS) Determination Supporting the Intended Use of COZ Corn Oil Derived from Distillers Corn Oil as Edible Corn Oil in Conventional Foods

Introduction

The undersigned, an independent panel of experts, qualified by their scientific training and national and international experience to evaluate the safety of food and food ingredients (the "GRAS Panel"), was specially convened to evaluate the safety and "generally recognized as safe" ("GRAS") status of the intended use of purified corn oil derived from distillers corn oil, referred to as COZ Corn Oil, for its intended use as edible corn oil in conventional foods. For purposes of this review, "safe" or "safety" means that there is "a reasonable certainty in the minds of competent scientists that the substance is not harmful under the intended conditions of use in foods, as stated in 21 CFR §170.3(i) (U.S. FDA, 2018).[1] Exponent, Inc. ("Exponent") performed a comprehensive search of the scientific literature related to the safety of corn oil with respect to the proposed use of COZ Corn Oil for its intended use as edible corn oil in conventional foods. Exponent summarized the results of the literature search and prepared a safety dossier, "Documentation Supporting the "Generally Recognized as Safe" (GRAS) Status of COZ Corn Oil Derived from Distillers Corn Oil" for consideration by the GRAS Panel.

The GRAS Panel consisted of the following individuals: Richard W. Lane, Ph.D., DABT (Lane Consulting), Nadine R. Sahyoun, Ph.D. (Professor, Nutrition and Food Science, University of Maryland), and Stanley M. Tarka, Jr., Ph.D., FATS (The Tarka Group, Inc. and Adjunct Associate Professor, The Pennsylvania State University College of Medicine). The GRAS Panel critically evaluated Exponent's safety documentation (the dossier) and other available data and information that the members of the GRAS Panel believed to be pertinent to the safety of the proposed use of COZ Corn Oil.

On April 25, 2019, the GRAS Panel convened via teleconference and independently, jointly, and unanimously concluded that COZ Corn Oil, produced consistent with current good manufacturing practice (cGMP) and meeting the specifications as presented in the supporting dossier described above, is safe for use as edible corn oil in conventional foods. The GRAS Panel further concluded unanimously that the intended use of COZ Corn Oil as edible corn oil in conventional foods is GRAS based on scientific procedures. It is also the unanimous consensus opinion of this GRAS Panel that other qualified experts would concur with these conclusions.

[1] https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm

Summarized below are the data, information, and interpretive analysis supporting the GRAS Panel's conclusions.

Description

COZ corn oil is an edible corn oil derived from distillers corn oil (a co-product of making ethanol) using both a patented CO1™ process and conventional oil refining processes. For the purpose of this GRAS document, the distillers corn oil input material is referred to as crude corn oil feed stock (or crude corn oil). The incoming crude corn oil is first subjected to the patented CO1™ process that removes most of the free fatty acids (FFA). After the CO1™ process, the oil is further refined using conventional oil refining processes to produce COZ corn oil. Similar to any edible corn oil, COZ corn oil is a mixture of triglycerides, of which the major fatty acid components are linoleic, oleic, and palmitic. Specifications for COZ corn oil meet the Food Chemicals Codex specifications for corn oil (unhydrogenated) (FCC Vol 11).

Intended Use and Estimated Daily Intake

COZ corn oil derived from distillers corn oil by the CO1™ process followed by conventional refining processes is intended to be used as edible corn oil in conventional foods. Its use will be substitutional to other edible corn oil products in the US market. Estimates of corn oil intake in the US using multiple approaches resulted in estimates at the 90th percentile of intake of up to 5.4 g/day. For the purpose of this safety evaluation, corn oil intake is assumed to be no more than 6 g/day.

Assessment of Safety

The safety of COZ corn oil is established based on the following evaluation:

a) Crude corn oil feedstock is suitable for further processing into edible corn oil
b) CO1™ and conventional oil refining steps ensuring removal of impurities that may be present in the crude corn oil, and
c) Corn oil is a food; humans and animals consume corn oil as a component of the diet and it is safe. COZ corn oil is equivalent to edible corn oil and thus also safe.

Corn Oil One, the manufacturer of COZ corn oil, has established acceptance criteria for the incoming crude corn oil, i.e., the distillers corn oil and starting material in the production of COZ corn oil. The unsaponifiables, insolubles, iodine value, and moisture acceptance criteria are consistent with characteristics of crude corn oil derived from conventional corn refineries. The FFA acceptance limit is higher than for crude corn oil from conventional corn refineries, but the CO1™ process is able to remove the majority of the FFA. In order to ensure that the crude corn oil is suitable for further processing, Corn Oil One has established strict acceptance limits for

antibiotics, mycotoxins, metals and pesticides, as well as other chemical impurities for the incoming crude corn oil. The acceptance criteria rationale is based on exposure limits set by JECFA, FDA and FCC to ensure suitability for food use. The acceptance criterion for other potential chemical impurities was derived based on a Threshold of Regulation (TOR) approach (calculated to be below 250 ppb), which provides an appropriate assurance for food safety. To assure compliance with all acceptance criteria, a standard operating procedure (SOP) for new supplier certification and periodic testing of crude corn oil are also implemented. Overall, the series of acceptance criteria in conjunction with compliance SOPs ensure the suitability of the incoming crude corn oil.

Removal of impurities in the crude oil is further ensured by the CO1™ process followed by conventional oil refining (i.e., the refining, bleaching and deodorizing (RBD) process) steps. The CO1™ process, and the steps prior to the conventional RBD process, remove the majority of FFA. Also, during the neutralization step of the CO1™ process, antibiotics and mycotoxins, if present, are unstable and will be removed. Given Corn Oil One's strict acceptance limit for incoming crude corn oil, the presence of chemical impurities are not expected. However, in the unlikely event that impurities are present in the crude corn oil, they will be completely removed from corn oil due to their thermophysical and chemical properties during the conventional RBD process. The removal of these potential impurities during the specified processing steps provides added assurance that the finished COZ corn oil would be free of unwanted contaminants and safe. All processing aids used in the CO1™ processing step and all processing aids used in conventional oil RBD steps have regulatory approvals for use in food.

Corn oil is a food with a long history of use in the U.S. food supply (Corn Refiners Association, 2006). Nearly all of the corn oil produced is refined for the food industry and direct use by consumers. The available literature also indicates that corn oil was commonly used in infant formulas in the U.S. as recently as the late 1990s. Corn oil-based diets have been shown to significantly lower elevated blood pressure, corn oil is GRAS because of its long history of widespread use, and FDA concluded that there is sufficient scientific support for a qualified health claim for corn oil (Corn Oil and Corn Oil-Containing Products and a Reduced Risk of Heart Diseases; Docket No. 2006P-0243). Corn oil is a component of the rodent's diet in toxicology testing studies (NTP, 1994) and used as an ingredient in animal feed (AFFCO 33.10).

The finished COZ corn oil derived from distillers corn oil by the CO1™ and conventional RBD processes is equivalent to conventional corn oil. COZ corn oil meets FCC specifications for color, water, free fatty acids, iodine value, peroxide value, unsaponifiable matter, and fatty acids. In addition to having a fatty acid profile consistent with conventional corn oil, the phytosterol and fat-soluble vitamin concentrations are comparable. COZ corn oil therefore is nutritionally equivalent to conventional corn oil.

Thus, the proposed use of COZ corn oil as edible corn oil, substitutional to other edible corn oil in the US market, is safe within the meaning of the FD&C Act, i.e., meets the standard of reasonable certainty of no harm.

Summary

COZ corn oil is an edible corn oil derived from distillers corn oil by the CO1™ and conventional oil refining processes. Acceptance criteria for the incoming crude corn oil have been established based on recognized safe levels of intake of any potential contaminants and established safety evaluation approaches. SOPs are in place to ensure that incoming crude oil is in compliance with the established acceptance criteria. The resulting oil is equivalent to conventional corn oil. Therefore, COZ corn oil derived from distillers corn oil by the CO1™ and conventional oil refining processes can be concluded to be safe for its intended use in conventional foods.

General recognition of safety through scientific procedures requires common knowledge throughout the scientific community knowledgeable about the safety of food ingredients, and that there is a reasonable certainty that a substance is not harmful under the intended conditions of use in foods. The aforementioned regulatory and scientific reviews related to the consumption and safety of corn oil has been published in the scientific literature and, therefore, are generally available and generally known among the community of qualified food ingredient safety experts. There is broad-based and widely disseminated knowledge concerning corn oil. The chemical, physical and stability comparability of COZ corn oil to edible corn oil allows for the bridging of scientific data of edible corn oil to support the safety of COZ corn oil. The data and publicly available information supporting the safety of edible corn oil are not only widely known and disseminated, but are also commonly accepted among qualified food safety experts. The data provided in the dossier clearly demonstrate the comparability of COZ corn oil to edible corn oil allowing bridging of safety data on edible corn oil to COZ corn oil, and thus support the proposed use of COZ corn oil, for its intended use as edible corn oil in conventional foods. The proposed use of COZ corn oil for its intended use as edible corn oil can therefore be concluded to be safe and generally recognized as safe (GRAS) based on scientific procedures.

Conclusion

We, the undersigned independent qualified members of the GRAS Panel, have individually and collectively, critically evaluated the published and unpublished data and information summarized above that is pertinent to the safety of the proposed use of COZ corn oil as edible corn oil in conventional foods. We unanimously conclude that the intended use of COZ corn oil as edible corn oil, produced consistent with current Good Manufacturing Practice (cGMP) and meeting appropriate food-grade specifications as presented in the supporting dossier ["Documentation Supporting the "Generally Recognized as Safe" (GRAS) Status of COZ Corn Oil Derived from Distillers Corn Oil"], is safe.

We, the members of the GRAS Panel, further conclude that the intended use of COZ corn oil as edible corn oil, produced consistent with current Good Manufacturing Practice (cGMP) and meeting appropriate food-grade specifications as presented in the supporting dossier, is "Generally Recognized as Safe" (GRAS) based on scientific procedures under the conditions of intended use in conventional foods specified herein.

It is our professional opinion that other qualified experts would also concur with this conclusion.

Richard W. Lane, Ph.D., DABT
Lane Consulting

13 June 2019
Date

Nadine Sahyoun, PhD, RD
Professor, Department of Nutrition and Food Science
University of Maryland

6/9/2019
Date

Stanley M. Tarka, Jr., Ph.D.
Fellow, ATS
The Tarka Group, Inc. and Adjunct Associate Professor,
The Pennsylvania State University College of Medicine

Date

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Nadine Sahyoun, PhD, RD
Professor, Department of Nutrition and Food Science
University of Maryland

Date

Stanley M. Tarka, Jr., Ph.D.
Fellow, ATS
The Tarka Group, Inc. and Adjunct Associate Professor,
The Pennsylvania State University College of Medicine

12 June 2019
Date