Wastewater Characterization of Craft Beverage Industries in Michigan, 2024

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Abstract

A variety of producers through the craft beverage industry were selected to have their wastewater sampled throughout the grant period and compiled into a database for use by other craft beverage processors. Data is available for winery, brewery, cidery, and distillery facilities, however a limited number of facilities in each category. The database demonstrates the variability in craft beverage wastewater between the type of industries. It also highlights that site specific data is necessary as many differences exist.

Original Goals and Objectives of the Project

The Michigan craft beverage industry produces a variety in quantity and quality of wastewater, much of which is from small-medium scale operations. With the varying process sizes and seasons in the Michigan craft beverage industry, as well as the limited data available for this industry in general demonstrated a significant need for this information. Therefore, the aim of this study is to characterize Michigan craft beverage industry wastewater for a variety of small-medium scale operations. Specifically, wineries, breweries, distilleries, and cideries were targeted across multiple seasons to characterize Michigan craft beverage wastewater. With this data, new and established facilities can have a benchmark to better manage or understand their wastewater.

Period of time research was conducted

Surveys were distributed in June 2023 via email contact and through the newsletters from the Michigan Craft Beverage Council (MCBC).

Sampling activities were collected from November 2023 through July 2024.

Work accomplished during period, including methods

Through distribution of a confidential survey, Michigan craft beverage producer specific information was acquired and used to select six craft beverage producers throughout the Michigan. The six craft beverage producers selected are as follows: two wineries (Winery A and Winery B), two breweries (Brewery A and Brewery B), one cidery (Cidery A), and one distillery (Distillery A). The location and size of producers characterize a variety of the Michigan craft beverage industry. The amount of equalization varied as well as other pretreatment processes. A brief summary of the systems is also provided in **Table 1** for comparison.

Sampling of each facility's effluent wastewater was conducted throughout the remainder of the grant period. The specific sampling method varied based on the facility but primarily involved use of a wastewater sampling bailer to dip into a tank, pipe, or wastewater pond to collect a sample. Most facilities (except Brewery B) had equalization (such as tanks or ponds) prior to the sampling location. Brewery B was sampled directly from discharge during cleaning operations.

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Wastewater samples were then placed in appropriate bottles, and on ice, for delivery to a certified analytical laboratory for analysis of the following standard wastewater parameters:

- Phosphorus, Total
- Sodium, Chloride
- Total Inorganic Nitrogen (NO2, NO3, NH4)
- Total Kjeldahl Nitrogen
- Chemical Oxygen Demand (COD)
- Biochemical Oxygen Demand (BOD)
- Carbonaceous Biochemical Oxygen Demand (CBOD)
- Total Suspended Solids (TSS)
- Total Dissolved Solids (TDS)
- Alkalinity
- pH (measured using calibrated field meter, as available)

Distillery A was also analyzed for the following:

- Arsenic
- Barium
- Cadmium
- Chromium
- Copper
- Lead
- Selenium
- Silver
- Zinc
- Mercury

Data was reviewed and combined into a database and organized by facility type. A summary of the average and standards deviation of each parameter is provided in this report, while all available data has been compiled and can be available upon request from LEI.

Communication activities, accomplishment, and impacts

The initial survey distributed to constituents of the Michigan Craft Beverage Council as a part of this study communicated the importance of this work and future impact on the industry. This summary report and the resulting database may be made available to MCBC members and others within the industry as additional data for evaluation of their own wastewater discharge and/or wastewater treatment requirements.

Discussion of results and conclusions, indicating objectives

Overall, LEI collected a total of 89 wastewater samples at the six craft beverage production locations across the state of Michigan. A standard set of wastewater constituents was analyzed (see summary above) and the average and standard deviation were calculated for publication within this report (**Table 2** and **Table 3**).

The resulting database is representative of the variability in wastewater produced by the Michigan Craft Beverage Industry, as well as the need for appropriate treatment and stabilization prior to discharge.

This database can be utilized as developed but should continue to be expanded upon through additional evaluation of available data from existing permits and/or additional sample collection from other facilities within the industry. Additionally, due to equalization, the product specific differences (such as white or red wine processing, type of spirits, etc.) were not attainable because all facilities had a variety of processing occurring between the sampling events. Sampling from specific processes within each facility may be beneficial rather than looking at overall wastewater effluent in order to optimize wastewater management.

In addition to the analytical data compiled in the database, general facility information such as size and the amount of treatment or storage prior to the associated sampling point has been characterized. This should be considered an integral part of the database and an important aspect of future database development.

The project was conducted consistent with the budget originally posed by LEI and approved by the MCBC of the State of Michigan which was $64,446.

Table 1 – Summary of Facilities, Survey Response Information; November 2023

	Type of Beverage Processed	Daily Water Use, estimate (gal/day)	Daily Water Discharge, estimate (gal/day)	Holding Prior to Sampling Point, estimate	Additional Wastewater Treatment prior to Sampling Point
Winery A	Wine	2,000	2,000	2,500	--
Winery B	Wine	2,000	2,000	14,000	--
Brewery A	Beer	40,000	25,000	30,000	pH adjustment
Brewery B	Beer	250	250	0	--
Cidery A	Hard Cider	25,000	18,000	5,000	--
Distillery A	Spirits	200 - 1200	100 - 350	2,000	--

Notes: Based on information provided in initial questionnaire and generally verified through site visits.

Table 2 – Summary of Data, Average Effluent Wastewater Characterization, November 2023 – July 2024

	number	Phosphorus, Total	Sodium	Chloride	Nitrate, as N	Nitrite, as N	Ammonia, as N	Total Inorganic Nitrogen (TIN)	Total Kjeldahl Nitrogen	Alkalinity	Chemical Oxygen Demand (COD)	Biochemical Oxygen Demand (BOD)	Carbonaceous Biochemical Oxygen Demand (CBOD)	Total Suspended Solids (TSS)	Total Dissolved Solids (TDS)	pH (S.U.)
Winery A	17	19.3	497	1042	8.1	1.3	13.9	19.8	169	472	7847	4163	4459	5791	2906	5.9
Winery B	17	22.1	96	17	2.3	0.30	41.0	44.0	83	370	5531	3611	3341	577	1386	5.7
Brewery A	18	17.3	672	58	0.44	2.2	5.6	6.9	71	862	6008	4488	4194	617	3178	7.2
Brewery B	5	73.7	1004	32	1.1	5.4	2.3	6.4	121	1752	15636	2697	11343	58	5540	9.4
Cidery A	15	4.5	286	243	0.12	0.0	0.18	0.61	27	399	2337	1511	1541	651	1319	7.6
Distillery A	15	8.6	403	663	0.17	0.0	1.0	1.5	12	194	1996	1285	1274	39	1373	7.7
ALL	**87**	24.2	493	342	2.0	1.5	10.6	13.2	80	675	6559	2959	4359	1289	2617	7.23

Notes: All results reported as averages from 2023 - 2024 in mg/l unless otherwise noted

Table 3 – Summary of Data, Standard Deviation for Effluent Wastewater Characterization, November 2023 – July 2024

	number	Phosphorus, Total	Sodium	Chloride	Nitrate, as N	Nitrite, as N	Ammonia, as N	Total Inorganic Nitrogen (TIN)	Total Kjeldahl Nitrogen	Alkalinity	Chemical Oxygen Demand (COD)	Biochemical Oxygen Demand (BOD)	Carbonaceous Biochemical Oxygen Demand (CBOD)	Total Suspended Solids (TSS)	Total Dissolved Solids (TDS)	pH (S.U.)
Winery A	17	22.6	1049	1991	8.9	0.9	15.7	16.4	206	388	6064	2457	2643	7668	3511	2.62
Winery B	18	12.5	198	13	1.6	0.1	38.9	38.6	56	257	3883	3044	2780	786	975	2.55
Brewery A	18	17.1	384	57	0.2	1.4	7.9	8.1	31	625	2380	2113	1678	588	1550	2.95
Brewery B	5	51.5	444	38	0.7	6.5	0.4	7.0	14	1047	3815	3397	3266	0	954	4.71
Cidery A	15	2.3	39	74	0.0	0.0	0.5	0.5	16	159	1290	866	920	580	341	3.93
Distillery A	16	18.5	338	657	0.0	0.0	1.1	1.1	17	56	2448	1368	1700	35	1130	3.68
ALL	**89**	16.6	346	784	3.5	2.5	15.1	14.3	75	364	1665	968	874	2985	1100	0.85

Notes: All results reported as averages from 2023 - 2024 in mg/l unless otherwise noted