Brewers' Wastewater Bulletin

THIS ISSUE

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RELATED ISSUES

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Wastewater Composition

Introduction – Why is brewery wastewater a concern?

For every gallon of beer produced, breweries typically generate between 5-8 gallons of wastewater from processing and clean-up operations. This wastewater is usually discharged into a municipal sewage treatment system that treats the wastewater to reduce pollutants before the clean water is discharged to nearby rivers or streams. Because of the ingredients used to produce beer and other beverages, large amounts of pollutants are in the wastewater, much higher than levels in domestic sewage that the municipal treatment plants were designed to treat. Typically, brewery wastewater has 10-20 times higher levels of pollutants (Oxygen demand and solids) than domestic sewage.

Although not the subject of this fact sheet, there are a number of sources of wastewater and pollutants from brewery operations. Even if most of the spent grains are captured and disposed elsewhere, the strength of the wastewater can be impacted by spills, cleaning and sanitizing operations. Any water that eventually finds its way to drains and eventually sewers is considered "wastewater" for the purposes of this discussion.

When one considers that a typical household generates between 100-200 gallons per day of wastewater with a BOD of about 200 mg/l the impact of brewery wastewater becomes more obvious. For example, a brewery that produces about 1,000 bbl of beer annually, will generate up to 1,000 gallons/day of wastewater. With a BOD (strength) of about 3,000 mg/l, this brewery discharge is equivalent to about 50 homes…

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1 Brewery = 50 Homes!

Sources of Wastewater

Main Areas Of Wastewater Generation

SOURCE	OPERATION	CHARACTERISTICS
Mash Tun	Rinsing	Cellulose, sugars, amino acids. ~3,000 ppm BOD
Lauter Tun	Rinsing	Cellulose, sugars, spent grain. SS ~3,000 ppm, BOD ~10,000 ppm
Spent Grain	Last running and washing	Cellulose, nitrogenous material. Very high in SS (~30,000 ppm). Up to 100,000 ppm BOD
Boil Kettle	Dewatering	Nitrogenous residue. BOD ~2,000 ppm
Whirlpool	Rinsing spent hops and hot trub	Proteins, sludge and wort. High in SS (~35,000 ppm). BOD ~85,000 ppm
Fermenters	Rinsing	Yeast SS ~6,000 ppm, BOD up to 100,000 ppm
Storage tanks	Rinsing	Beer, yeast, protein. High SS (~4,000 ppm). BOD ~80,000 ppm
Filtration	Cleaning, start up, end of filtration, leaks during filtration	Excessive SS (up to 60,000 ppm). Beer, yeast, proteins. BOD up to 135,000 ppm
Beer spills	Waste, flushing etc	1,000 ppm BOD
Bottle washer	Discharges from bottle washer operation	High pH due to chemical used. Also high SS and BOD, especially thru load of paper pulp.
Keg washer	Discharges from keg washing operations	Low in SS (~400 ppm). Higher BOD.
Miscellaneous	Discharged cleaning and sanitation materials. Floor washing, flushing water, boiler blow-down etc.	Relatively low on SS and BOD. Problem is pH due to chemicals being used.

Pollutants

There are any number of methods to classify groups of pollutants of concern in wastewater, but for the sake of simplicity and focus on brewing operations, there are generally two categories to be concerned with which are "Compatible" and "Incompatible" pollutants. Compatible pollutants can be accepted and largely treated by municipal treatment system while Incompatible Pollutants cannot. Typical Compatible Pollutants include: BOD, Suspended Solids, Ammonia, Phosphorus, pH. Incompatible pollutants include heavy metals, pesticides, organic chemicals, etc… and can cause significant problems at wastewater treatment plants.

BOD Measurement

Specific Pollutants of Concern

Biochemical Oxygen Demand (BOD) - Biological oxygen demand (**BOD**) refers to the amount of dissolved oxygen (DO) that aerobic organisms need in order to break down organic material in water over time.

Chemical Oxygen Demand (COD) - Chemical Oxygen Demand or ***COD*** is a measurement of the oxygen required to oxidize soluble and particulate organic matter in water.

Total Suspended Solids (TSS) - Total Suspended Solids (**TSS**) are solids in water that can be trapped by a filter. **TSS** can include a wide variety of material, such as silt, decaying plant and animal matter, industrial wastes, and sewage. High concentrations of suspended solids can cause many problems for stream health and aquatic life.


Suspended Solids

pH - **pH** measurement is used in a wide variety of applications: agriculture, wastewater treatment, industrial processes, environmental monitoring, and in research and development. **pH** is a measure of the acidity or alkalinity of a solution. ... In this relationship, **pH** is defined as the negative logarithm of hydrogen activity.

Nitrogen - Nitrogen is a naturally occurring element that is essential for growth and reproduction in both plants and animals. It is found in amino acids that make up proteins, in nucleic acids, that comprise the hereditary material and life's blueprint for all cells, and in many other organic and inorganic compounds. In addition, nitrogen comprises about 80% of the Earth's atmosphere.

Phosphorus - Phosphorus naturally occurs in all waters. Increased phosphorus concentrations due to human activities come from detergents and other cleaners (phosphoric acid) used in sanitation.

How do you determine what is in your wastewater?

Sample Collection involves the collection of wastewater samples from the point in the discharge where all process wastes come together. Sounds simple right? Not really. Access to the right sample point is often obscure and difficult or impossible to access. Should you take a grab sample, 12-hour composite sample, 24- hour composite sample or time proportional? Well, it depends… Some analysis requires grab samples while some requires composites.

Wastewater Sampling

Analysis of the samples is just as critical as the collection - weak link in the chain prospective… Knowing what to sample for (regulatory basis), type of sample to collect and the right laboratory to analyze the samples are all critical components to the sampling program. Once again, an error here can cause dramatic issues later. it is also critical to take a number of samples during a variety of production operations and products - understanding variability in wastewater is also important in designing system for its treatment.

Flow Monitoring is a necessary component in the design as well. Knowing the constituents in the wastewater aids in the selection of the technology selected to treat, knowing the flow determines the size of the treatment system components. Keep in mind that, although the total volume generated daily is important, the rate of generation and flow variation is also important. In many cases, the majority of water use and discharges occur during a very short period in the day. Collection and pumping systems need to be sized accordingly.

In summary, wastewater flows and components vary dramatically from facility to facility. Regulations governing the discharge of wastewater vary dramatically from municipality to municipality. Mistakes or oversights in accurately characterizing the wastewater will have dramatic impacts on the cost and effectiveness of the treatment system installed to meet limits of reduce surcharges. Although general characterization form similar facilities is a good place to start, do not rely on "typical" characteristics to assess your facility's discharge - it probably won't fit the profile.

USEFUL INFORMATION

Maine Water Environment Association (MeWEA)

www.mewea.org

The mission of the Maine Water Environment Association is to support and enhance Maine's water environment community.

To achieve this we will:

- Promote training opportunities for the water environment community;
- Support balanced environmental policy and practice;
- Promote education and collaboration with the public to protect and enhance Maine's water resources;
- Foster a strong and resilient water environment community

MeWEA Pretreatment Committee – Brewery Resources

https://www.mewea.org/pretreatment-committee/

Brewers Association Wastewater Management Guidance Manual

https://www.brewersassociation.org/educational-publications/wastewater-management-guidance-manual/

Maine Department of Environmental Protection – Stormwater Management Best Practices For Breweries

https://www.maine.gov/dep/water/wd/multisector/breweryBMP2017.pdf

MeWEA Committees

Awards Committee

Collection Systems

Communications

Conventions

Government Affairs

Laboratory

New Media

Treatment Plant Operators

Personnel Advancement

Pretreatment

Public Relations

Safety

Stormwater

Young Professionals

Committee information can be found on the MeWEA website, **www.mewea.org**, or by clicking on the Committee name above

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PROTECTING MAINE'S WATER RESOURCES