BrewTimes™

MARCH 2024




BALAJI ENZYME & CHEMICAL PVT LTD

Akshay Mittal Industrial Estate
A-113, 1st Floor, Building No 5, Sir M V Road, Andheri (East),
Mumbai - 400059 | +91-22-460 31 666
E-mail : info@becpl.in | Web. : www.becpl.in

Introducing BrewTimes :

We M/s Balaji Enzyme & Chemical Pvt Ltd, are pleased to bring to you our March 2024 month edition of BrewTimes.

We would like to use this platform to introduce our association with BetaTec, UK for their natural solutions for ethanol recovery in grain and molasses distilleries. The product is revolutionary and unlike any in the market is 100% natural and antibiotics free. Vitahop series of products helps in ensuring optimum yield and keeps the yeast healthy all naturally.

We are extremely proud of announcing our association with IIT Bombay Research Park. We have begun a journey together to work on sustainable, reliable and innovative solutions for the Food and Beverage Industry.

About Our Company :

We M/s Balaji Enzyme & Chemical Pvt Ltd are a leading supplier of Enzymes, Filter aid, Yeast, Hops, Processing aids, Clarifiers and food fortification products to breweries, distilleries, malt extract industry, starch industry, juice and beverage industry, and other food industry.

BARTH-HAAS GROUP
FOR YOUR SUCCESS

HopAid® Antifoam

Purpose

HopAid® Antifoam is used during fermentation to prevent excessive foam formation. It can be used for top and bottom fermented beers in all kinds of fermenters. Produced with deionised water and hop extract is considered food safe in both USA (GRAS) and EU.

Product Specifications

Appearance:	Creamy pale yellow emulsion
Odour:	Slight odour of hops
Solids:	< 12%
Yeast and Moulds*:	< = 10 cfu/g
TVC*:	< = 100 cfu/g
Centrifuge Test:	Pass / Fail

* Values monitored on a regular basis but not on every batch.

Composition

Ingredient	Range
Hop Extract fraction	5 – 10 %
Food grade emulsifier	0.1 – 2 %
Water	Balance

Application

HopAid® Antifoam should be dosed into cold wort. Either inline or, alternatively, dosed into the fermenter before the cold wort is transferred. This will ensure good mixing with the wort which is essential for optimum performance. Dosing into hot wort will lead to unpredictable losses in the hot trub.

Depending on the brewing recipe and fermentation regime the dose rate for most applications will lie between 5 and 50 g/hL. For a normal strength lager type a starting dose rate of 20 g/hL is recommended. However, fermentations with high levels of foam stabilizing substances such as hop acids and proteins, dark malts and higher fermentation temperatures may require higher dosing rates. Products with high levels of adjuncts may require lower levels of HopAid® Antifoam addition. If the brewer is using a synthetic, silicone based product the dose rate can be used as an indication. In most cases HopAid® Antifoam should be dosed at 2x the concentration as the Silicone based product.

Effect of HopAid® Antifoam on the final beer

Technical studies and feedback from customers have not shown a negative impact on final beer foam, in fact some data suggest a positive one.

HopAid® Antifoam: Yeast and pH

Yeast removes the vast majority of the active components by adsorption on to the cell wall. Any remainder may be removed by filtration.

HopAid® Antifoam is incompatible with strong acids and bases.

Strong acids and strong bases will damage the antifoam, so HopAid® Antifoam should not be added to yeast directly after acid washing of the yeast. Beer pH is fine.

Trial Design:

The trial should consist of 2 initial trial fermentations, both with the same volume of wort and in tanks with the same dimensions. To the first fermentation no HopAid® Antifoam should be added (control sample) and the foam height should be monitored. Ensure that the tank is big enough to include the foam built in the control sample. The second fermentation with HopAid® Antifoam, added in the recommended starting dose rate, should use the same wort volume. To understand the required dose rate and the effects of HopAid® Antifoam, it is important to measure the following attributes if possible:

- Foam height in fermentation tank
- IBUs of the beer
- % of attenuation
- Beer foam stability

Safety

There are no known health hazards for this product. Please consult safety data sheet for full information.

Packaging

HopAid® Antifoam Antifoam is packaged in 1 kg Tetrapacks and 10 kg aluminium foils.

Transport

Transport temperatures should be maintained above 0°C to ensure the product does not freeze

Storage

Ideally store away from direct sunlight and between 5°C and 20°C if unopened. HopAid® Antifoam can be stored in the original unopened containers for up to 15 months. Do not freeze as this will cause the emulsion to collapse. If this occurs the product can be redispersed by shaking to restore its antifoam capacity. Open containers should be stored cool (+5°C) and used within 2 days.

Natural Additions Product Range

General:

The Natural Additions range of products from the Barth-Haas Group has been developed to provide an efficient and flexible means of adding hop aroma and flavour to beer.

Natural Additions products are prepared from whole cone hops by specific extraction and distillation methods with the addition of an enhanced compound of natural origin. Natural Additions products are supplied worldwide exclusively by the Barth-Haas Group and our channel partners.

Characteristics:

Natural Additions products are 100% soluble in beer and other beverages and offer an alternative means of adding different types of natural aroma. They can complement an aroma addition of traditional hop products (cones or pellets) with easier handling and reduced beer losses.

These Natural Additions products available are:

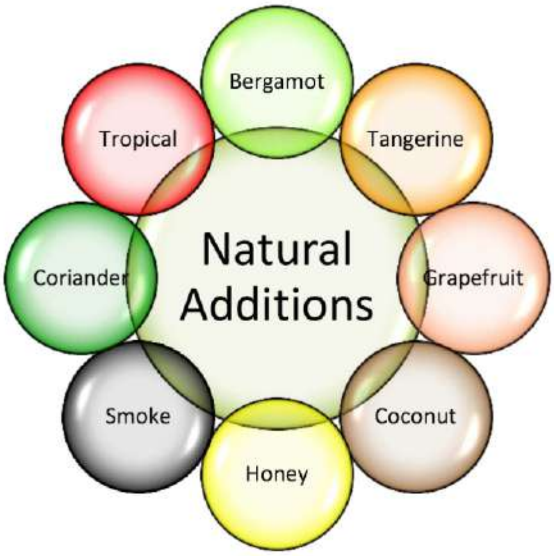


Figure 1: Examples from Natural Additions range

Product specifications:

Description:	water white solution, can be hazy
Specific Gravity (20°C):	0.750 - 1.350

Product Use:

The Natural Additions products are completely soluble in beer and are intended for addition to fined or filtered beers. The required amount of Natural Additions may be metered directly into the beer stream during transfer to bright beer tank or other appropriate vessel. The dose rate of Natural Additions per hectolitre is normally about 10 mL but may vary between 5–40 mL, according to the desired intensity of aroma and beer style.

On a large scale, Natural Additions products are used as a post fermentation addition to filtered beer, where 100% utilisation is feasible. These products may be added without prior dilution to beer either before or after the final filtration, preferably by metered injection into a turbulent beer stream during transfer. If possible, the pump should be set to dose the Natural Additions over approx. 95% of the total transfer time.

Trial Guide:

We recommend benchtop trials to determine which concentration gives the best desired effect. To get a better initial understanding for the effect of individual Natural Additions products and the required dose rate, we recommend dosing directly into a glass of beer. For more accurate results, we suggest following this up with dosing into bottles as explained below. The rate for initial tasting trials should be approximately 10 mL/hL of the Natural Additions as supplied. Natural Additions products can be dosed directly using a micropipette or syringe. For example, a 330 mL bottle, a 33 µL amount of Natural Additions gives a dose rate equivalent to 10 mL/hL. Chill the beer to normal drinking temperature. Open and introduce the required volume of Natural Additions in the headspace of the beer bottle and reclose the bottle. Invert the bottle several times to ensure mixing and chill again for at least two hours before opening and tasting.

E-mail: info@BarthHaasGroup.com
www.BarthHaasGroup.com

Special properties of Natural Additions:
The Natural Additions products have the following properties:

- Natural: 100% derived from hops and another natural source by physical extraction processes.
- Fully soluble: utilisation is 100% because of full solubility in beverages.
- No negative impact on beer quality: does not increase beer haze or reduce beer foam stability.
- Easy handling: provided as a standardised solution for direct dosing.
- Light stability: free of hop (iso-)α-acids; can be used with any packaging type.
- Ideal for brand diversification: differentiate existing products or create new ones.

Packaging:

The standard package size of Natural Additions products is 1 L and 5 L aluminium flasks. Larger package units are available on request.

Storage and shelf life:

Natural Additions products are stable in unopened containers for at least 24 months between 0-20°C.

Safety:

Please refer to our SDS which can be downloaded on our website www.barthhaasgroup.com.

Labelling:

Natural Additions can be labelled in beer with >1.2% abv in Europe according to 1334/2008 as "Natural flavouring". Other possibilities: "Natural flavouring" or "natural hop flavouring with other natural flavourings" or for example "natural hop and honey flavouring"

Technical Support:

We will be pleased to offer help and advice on the use of Natural Additions products and are happy to assist with your product development. For more information on the Natural Additions product range, please contact us at

info@barthhaasgroup.com

PHA® Topnotes

PHA® Topnotes in propylene glycol (PG)

General:

PHA® Topnotes are prepared from cone hops by specific extraction and distillation methods. They consist of original hop oil compounds in a propylene glycol (PG) solution. PG is a permitted carrier for flavours as per regulation 2006/52/EC. PHA® products are exclusively supplied worldwide by the Barth-Haas Group.

Figure 1: PHA® Topnotes

Characteristics:

PHA® Topnotes are soluble in beer (or other beverages). In general, PHA® products offer an alternative means of adding hop aroma independent of any other product or process. Specifically, PHA® Topnotes give a very intense 'dry hop' aroma to beer that is characteristic of the specific variety from which it is prepared. They enhance pleasant existing flavors in the beer/soft drink and can mask some off-flavors. The following PHA® Topnotes are immediately available:

PHA® Topnotes:

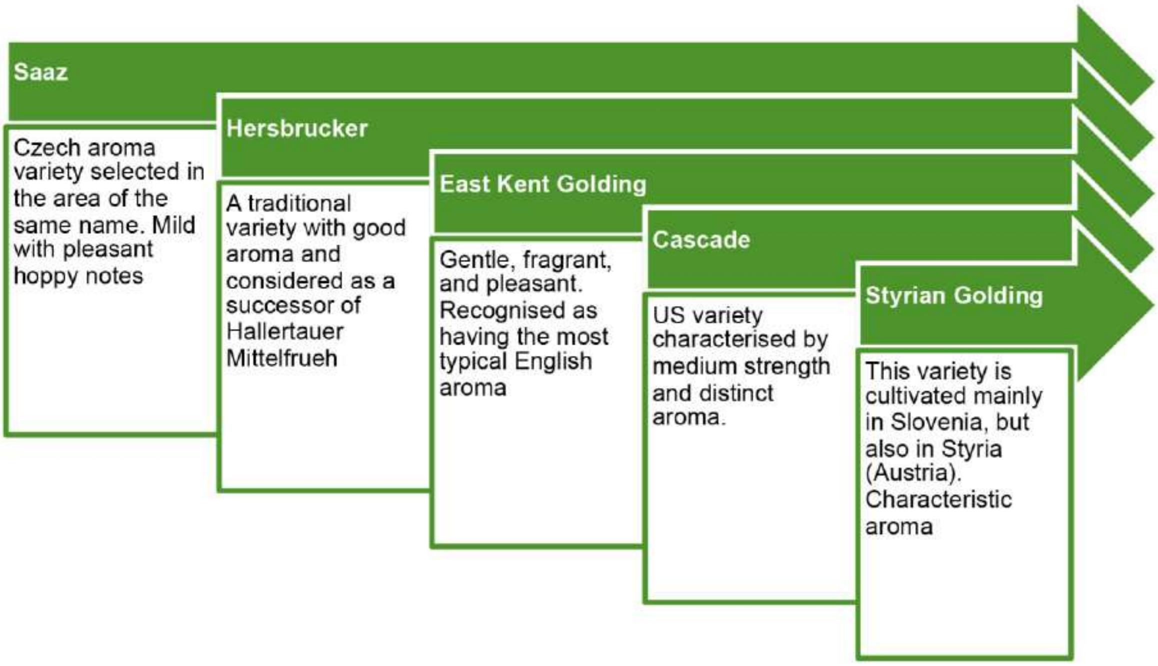


Figure 2: Examples from the PHA® Topnote range

Custom made Products:

Custom-made PHA® Topnotes from other varieties are available on request.

Product specifications:

Description:	water white solution, can be hazy
Specific Gravity (20oC):	1.034 - 1.037
Flash point:	> 90 °C (194 °F)

Product Use:

PHA® products are completely soluble in beer and are intended for addition to fined or filtered beers. The required amount of PHA® may be metered directly into the beer stream during transfer to bright beer tank or other appropriate vessel. A usage rate of PHA® per hectoliter normally is about 10 ml but might vary between 5 – 40 ml according to the desired intensity of aroma. We recommend laboratory scale trials to determine which concentration gives the desired effect. This evaluation can be carried out on bottles of 250 to 500 ml capacity.

On a large scale, PHA® Topnote products are used as a post fermentation addition to finished beer, where 100% utilization is feasible. PHA® Topnote products are lightstable and therefore can be used to introduce hop aroma into a beer brewed using exclusively downstream products such as Tetrahop Gold® and Redihop®. These products may be added without prior dilution to beer either before or after the final filtration preferably by metered injection into a turbulent beer stream during transfer. They can also be added to bright beer without any increase in haze or deterioration in foam stability. If possible the pump should be adjusted to deliver the PHA® over approx. 95% of the total transfer time.

Trial Guide:

We recommend benchtop trials to determine which concentration gives the desired effect. To get a better initial understanding for the effect of individual PHA® products and the required dose rate, we recommend dosing directly into a glass of beer. For more accurate results, we suggest following this up with dosing into bottles as explained below. The rate for initial tasting trials should be approximately 10 mL/hL of the PHA® as supplied. PHA® products can be dosed directly using a micropipette or syringe. For example, a 330 mL bottle, a 33µL amount of PHA® gives a dose rate equivalent to 10mL/hL. Chill the beer to normal drinking temperature. Open and introduce the required volume of PHA® in the headspace of the beer bottle and reclose the bottle. Invert the bottle several times to ensure mixing and chill again for at least two hours before opening and tasting.

Special properties of PHA®:

The PHA® products have the following properties:

- Natural: 100% derived from hops by physical processes.
- Fully soluble: utilisation is 100% because of full solubility in beverages.
- No negative impact on beer quality: Do not increase beer haze or reduce beer foam stability.
- Easy handling: Provided as standardised solution for direct dosing.
- Light stability: free of hop α-acids; can be used with any packaging type.
- Ideal for brand diversification: differentiate existing products or create new ones.

Packaging:

The standard package size of PHA® is 1 and 5 l aluminium flask. Larger package units are available on request.

Storage and shelf life:

PHA® products are stable in unopened containers for at least 24 months. Store at

0-20 °C (32-68 °F) in high-grade stainless steel, glass, aluminum or lacquered steel drums.

Safety:

Please refer to our SDS which can be downloaded on our website.

Technical Support:

We will be pleased to offer help and advice on the use of PHA® in brewing/soft drink production.

E-mail: info@BarthHaasGroup.com www.BarthHaasGroup.com

SUSTAINABLE BREWING PRACTICES

BIJAY BAHADUR

B.Sc. (Hons.); B.Tech. (Gold Medallist); PGDEE; MBA (IIM Raipur) FIE; Chartered Engineer (India); LMIIChE; LMAFST (I)

Introduction

Traditionally, "sustainability" includes three fundamental pillars: environmental, economic, and social well-being. For a brewery to be considered sustainable, it must carefully balance these three pillars. Environmental sustainability entails the efficient utilization of natural resources, reduced greenhouse gas (GHG) emissions, and the minimization of waste generation, all while ensuring these practices can be maintained indefinitely. Economic sustainability involves adopting practices that foster long-term economic growth without adversely affecting the local community's social, environmental, and cultural aspects. In an Indian setting, social sustainability refers to the brewery's ability to support the local community and provide employees with a safe and prosperous working environment.

The brewing industry in India is characterized by high energy intensity and rapid expansion. As the industry grows, it is expected to incur substantial energy costs and contribute significantly to greenhouse gas (GHG) emissions. Recognizing the increasing concerns about environmental impact, breweries in India are actively adopting technologies to minimize their water and energy consumption. This involves utilizing energy-efficient equipment and heat exchangers and integrating renewable energy sources such as solar or wind power. Some breweries also explore water recycling and wastewater treatment systems to address sustainability challenges.

In the Indian context, breweries can make strategic investments to enhance energy efficiency and reduce the carbon footprint of the brewing process. This may include acquiring dynamic wort boiling systems, implementing enhanced insulation, adopting heat recovery measures, or integrating distributed energy systems like solar or combined heat and power. Some leading breweries that emphasize renewable energy have adopted sustainable practices in India. The Indian brewing industry actively promotes sustainability, which is evident through its efforts in best practices and life cycle assessments.

Despite the acknowledged importance of sustainability in brewing in India, adopting energy- efficient or low-carbon technologies poses financial challenges for breweries due to significant upfront costs. These investments may temporarily increase the per-unit cost of beer, making sustainable breweries less cost-competitive unless consumers prioritize eco-friendly products and are willing to pay a premium. While evidence suggests a growing awareness of environmental stewardship among consumers, further studies are needed to ascertain their willingness to pay more for sustainably brewed beer in the Indian market.

To address this gap in knowledge, this analysis explores consumer preferences and their willingness to pay (WTP) for sustainable beer in India. A survey was conducted among beer consumers and purchasers nationwide, incorporating WTP exercises. This analysis draws on insights from sustainable consumption and ecological economics literature by evaluating respondent attributes associated with a higher WTP for sustainably brewed beer.

1.1. Energy

Energy plays a crucial role in a brewery's environmental impact, directly correlating with carbon emissions. The brewing process, known for its high energy demands and substantial water consumption, necessitates a closer look at sustainability practices. Prioritizing internal operational enhancements should precede broader initiatives to optimize supply and distribution chains for breweries aspiring to be environmentally responsible. Various factors, such as brewing processes, styles, recipes, building and equipment conditions, and local climate, influence energy usage, water consumption, and emissions efficiencies. Conservation efforts should prioritize energy, given its potential for significant cost savings and emissions reduction.

1.2. Environmental Characteristics

Breweries rely on electricity, natural gas, and purchased CO_2, contributing to their carbon footprint. Therefore, prioritizing efficiency should be the cornerstone of their efforts to reduce greenhouse gas emissions (GHG). This can be achieved by implementing onsite renewable energy sources like solar power, adopting CO_2 recovery systems, and exploring alternatives to traditional CO_2 usage. These initiatives improve overall operation al sustainability and significantly cut GHG emissions, ensuring a greener future for the brewing industry.

1.3. Social Influence

Beer is highly connected to social environments and has an undeniable ability to bring people together. Beer conjures images of parties, festivals, sporting events, and social gatherings. Craft breweries support local farmers and the community by providing jobs. They support local businesses like arts and non-profit organizations. Beer has three times the economic impact of wine and spirits combined. Breweries are responsible for prioritizing employee well-being and ensuring safe and healthy working conditions, leading to higher job satisfaction.

2. Sustainability Practices in the Brewing Industry

a) Focus on Minimizing Environmental Impact

The brewing industry in India is increasingly seeking ways to make beer production more sustainable. Studies indicate that beer production, packaging, and bottle manufacturing contribute significantly to environmental harm. Therefore, minimizing emissions and resource consumption in these areas is crucial. Breweries actively pursue efficient water and energy use, tracking greenhouse gas emissions and implementing responsible social and environmental practices.

b) Benchmarking Sustainability in the Indian Beer Supply Chain

Analysis of Indian breweries provides valuable insights into their sustainability efforts. By benchmarking brewery performance and establishing standard metrics for the beer supply chain, we can identify best practices and encourage broader adoption of sustainable measures. Investments in dynamic wort boiling systems, enhanced insulation, heat recovery, and renewable energy like solar can significantly reduce the carbon footprint of the brewing process.

c) Transparency and Sharing Best Practices

Leading breweries raise the bar for sustainability reporting, demonstrating the potential for green practices within the brewing industry. However, sustainability extends beyond the brewery walls. Equally important are greenhouse gas reduction plans and responsible supply chain management. These practices are bolstered by energy-efficient technologies, especially in the wort boiling process, where significant strides can be made.

d) Saving Energy and Water in the Indian Brewing Landscape

Research on sustainable brewing technologies, particularly those tackling the energy-intensive wort boiling process, holds valuable lessons for Indian brewers. Breweries can dramatically shrink their carbon footprint by analyzing energy consumption and implementing efficiency improvements. Water management is another critical area, with research and technology spearheading innovations in process water treatment and reuse, both offering immense potential in the Indian context.

2.1. Water

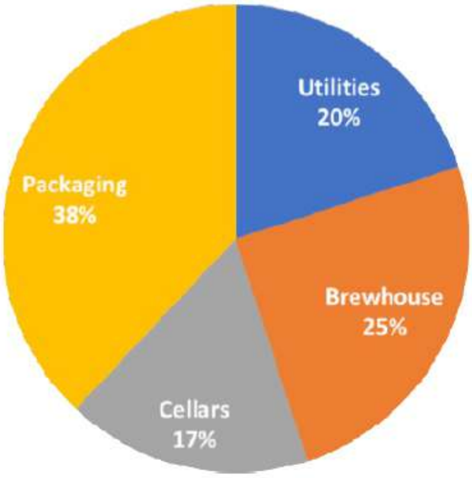
Water is a crucial element in the brewing process, serving as the most critical input. It is utilized in nearly every step of production, starting with the mineral profile of the water—factors such as alkalinity, hardness, and pH—all of which significantly impact the resulting beer. The quantity of water used varies from one brewery to another, influenced by variables such as brewery size, type, brewing process, and location. Despite these variations, numerous water- saving techniques exist for breweries, many of which are easy to implement and have proven effectiveness. Sustainable water use presents an ideal opportunity for craft breweries to reduce their environmental footprint and operating costs while enhancing their brand reputation.

Reducing water consumption in brewing and minimizing wastewater production benefit the brewery, the environment, and local communities. Despite significant improvements over the last decade, water consumption and wastewater disposal challenges persist, posing environmental and economic hurdles that directly impact breweries and the brewing process. As the availability of freshwater decreases and competition for resources increases, compounded by the impending effects of climate change, eco-conscious breweries driven by long-term financial sustainability should proactively adopt water-saving measures. This approach will help them avoid being caught off guard by rising costs, diminishing water supplies, and stricter government regulations.

2.1.1. Water Consumption and Wastewater Generation

There are four main areas where water is consumed in a brewery: the brewhouse, cellars, packaging, and utilities. As shown in Figure 1, these departments account for different percentages of water usage. Breweries can implement data management systems to understand best where water-saving measures can be implemented to optimize water efficiency.

Figure 1: Typical Brewery Water Use per Activities



(Brewers Association, 2012)

When implementing such systems, breweries should ask themselves some basic questions about water usage:

1) What is our average water use for each process?
2) Are there any leaks or areas where water is being wasted?
3) How much water are we discharging?
4) What pollutants are in the discharge wastewater?

The Brewers Association offers a water efficiency toolkit, including checklists for water audit data collection, serving as a basis for conducting surveys on water usage. Furthermore, utilizing key performance indicators (KPIs) is an effective method for assessing water usage. KPIs measure the effectiveness of a reduction program over time. Once a water management program is established and KPIs have been recorded over several brewing cycles, breweries can set concrete goals for reducing water usage.

The initial steps toward reducing water use involve minimizing beer loss while increasing yield. These measures can significantly reduce water consumption and wastewater generation during brewing.

2.2. Brewery Waste

As regulations tighten and effluent quality standards rise, managing brewery waste will become increasingly complex and costly. Brewery waste can be categorized into two main types: (I) wastewater and (ii) solid waste and byproducts.

2.2.1. Wastewater

The brewing process generates significant wastewater, primarily due to its water-intensive nature. For every 1 liter of beer produced, between 3 and 10 liters of wastewater are generated. Understanding the composition of brewery wastewater is crucial in determining the optimal approach for its treatment and disposal.

Effluent from specific brewing steps varies; for instance, washing bottles or kegs for beer packaging produces a substantial volume with only a minor amount of discharged organics. In contrast, fermentation and filtering processes yield effluent with high biochemical oxygen demand (BOD) but low volume, constituting only 3% of total wastewater volume while accounting for 97% of BOD.

Figure 2 illustrates the stages of beer production, highlighting water usage and wastewater production. Table 1 displays typical ranges of brewery waste effluent, while Table 2 outlines the primary areas of wastewater generation.

Figure 2: Stages of Beer Production

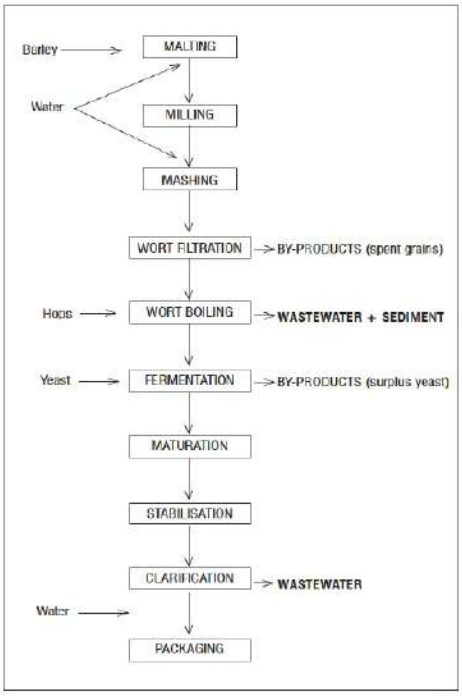


Table 1: Typical Ranges of Brewery Waste Effluent

PARAMETER	TYPICAL RANGE
Water to beer ratio	4 – 10 litre/litre
Wastewater to beer	1.3 – 2 litre/litre lower than water to beer ratio
Biochemical Oxygen Demand (BOD)	600 – 5,000 ppm
Chemical Oxygen Demand (COD)	1,800 – 5,500 ppm
Nitrogen	30 – 100 ppm
Phosphorus	30 – 100 pm
pH	3 – 12
Total Suspended Solids (TSS)	200 – 1,500 ppm

(Brewers Association, 2012)

Table 2: 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
Whirpool	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
Bottle washer	Discharges from bottle washer operation	High pH due to chemical used. Also high SS and BOD.
Keg washer	Discharges from keg washing operation	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.

(Brewers Association, 2012)

2.2.2. Solid Waste and Byproducts

The main brewing process byproducts are spent grains, turb, sludge, yeast surplus, and diatomaceous earth slurry (known as kieselguhr sludge) from water filtration. These various forms of byproducts have unique compositions that give them different qualities and potential uses upon their production. The first solid waste to be produced during the brewing process is spent grain, which accounts for about 85% of the total waste generated. In the mashing of the grains, the essential compounds used in the final beer product are extracted from the solution during the wort filtration process, leaving the bulk of organic solids behind. This organic solid is known as spent grain. It is highly nutritious, and most breweries send them to local farmers to use the spent grains as livestock feed. For every hectolitre of beer produced, about 14-20 kg of spent grains are generally left behind.

Turb also holds nutritional value. It results from boiling wort, where high-molecular-weight proteins in suspension become denatured and coagulate. This resulting conglomeration of proteinaceous mass is referred to as turb. About 0.2-0.4 kg of turb is created for every hectolitre of beer produced.

After the fermentation process, residual yeast is produced. The yeast cell mass can range between 1.5-3 kg for every 100 liters of beer produced. Most breweries reuse this residual yeast for new batches of wort. The number of times a yeast population can be reused depends on the strain of yeast used, the wort composition, and the beer produced. The typical number of times a batch of yeast can be reused ranges from 3-10 times. Like other byproducts of the brewing process, residual yeast is commonly used in animal feed production because of its significant nutritional value. Table 3 summarizes the drivers and barriers to waste reduction.

Table 3: Drivers and Barriers of Waste Reduction

Drivers	Barriers
Lower transportation costs	Could be capital intensive
Reduced waste management cost	May use additional resources
Potential revenue streams from reusable materials	Investment of time
Landfill diversion	Increased storage space

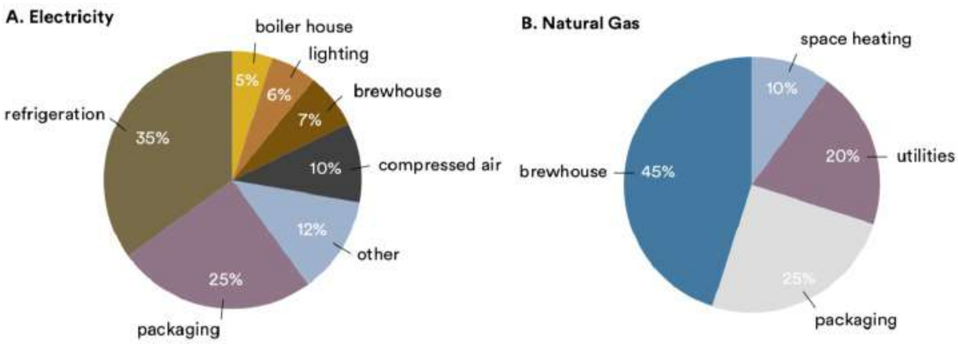
(Brewers Association, 2017b)

2.3. Energy

Energy usage in the breweries varies depending on products, location, and size. The smaller a brewery is, the more energy it uses per hectoliter, as smaller volumes cannot offset the base energy needed to brew one unit. Smaller scale operations make craft breweries should prioritize reducing electricity costs through efficiency measures and exploring onsite distributed generation capacity, such as solar. Energy represents a large proportion of a craft brewery's operating cost, making it crucial for them to adopt innovative energy usage and GHG reduction approaches. Beyond energy efficiency and conservation, these efforts can lead to operating cost reduction, community initiatives, and additional sources of income.

The first step in managing energy costs is understanding how energy is used and where the most significant users can be found. Brewing consumes the most enormous amount of natural gas for heating, while refrigeration generally creates the most significant electrical load. Figures 3a and 3b show the percentage of energy used throughout the operation.

Figures 3a and 3b: Percentage of Energy Used in Breweries



(Source: Brewers Association, 2017a)

Electrical energy powers all equipment; natural gas generates hot water, steam for brewing and packaging, and space heating. Energy reduction efforts inherently reduce greenhouse gas (GHG) emissions in the brewing industry because many energy-intensive processes also emit GHGs. Breweries should establish an energy management practice that tracks usage against key performance indicators (KPIs) to improve their energy reduction efforts.

2.3.1. Carbon Dioxide Recovery Systems

Breweries utilizing carbon dioxide recovery systems stand at the forefront of sustainability, energy efficiency, and cost reduction. These systems generate carbon dioxide (CO_2) as a byproduct of brewing, particularly during fermentation. Instead of venting the CO_2 into the atmosphere, breweries can reuse it for various purposes within the brewing system, such as bottling, carbonation, and purging tanks or kegs. Capturing and reusing the CO_2 gas reduces their energy footprint and greenhouse gas emissions.

The right system depends on brewery operations, size, regional CO2 cost, and available space. By embracing CO2 recovery, breweries can save money and become critical players in a more sustainable future.

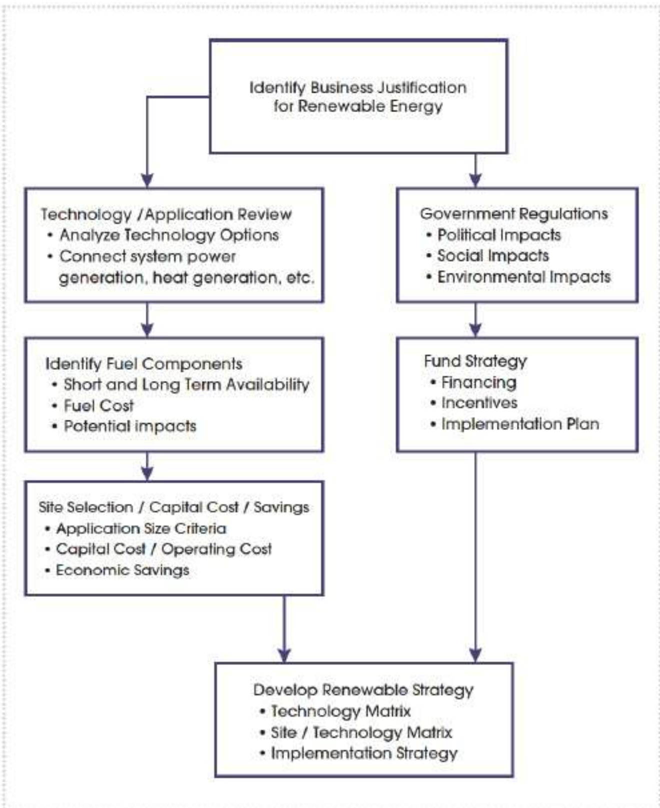
2.3.2. Onsite Renewable Energy

Low-carbon energy sources can be used to supply or supplement the energy requirement of a brewery. Renewable energy can offset the cost of purchasing fossil fuels. In some cases, like photovoltaic solar panels for electricity production, it can even bring the variable energy cost down to zero.

High capital costs for purchasing and installing renewable energy technology and the low return on capital deployed remain the most significant disadvantages to incorporating renewable energy, especially in small breweries. Another disadvantage of renewable energy technologies like solar and wind is that the energy is unavailable on demand or varies depending on operating conditions. The sun needs to shine for solar technology to perform, and the wind needs to be blowing for wind turbines to generate power. Therefore, using renewable technologies to supplement the brewery's energy needs is the optimal solution. A more reliable yet capital-intensive renewable technology is the generation of biogas from treating brewery wastewater in an anaerobic digester, which produces methane-rich biogas that can be used for electricity generation.

To address these challenges, the Brewers Association developed a flow chart outlining the steps and activities to be considered when installing renewable technology at a brewery, as shown in Figure 4. The steps used will differ depending on the type of technology and size. However, this provides a way of reviewing all aspects of the project when considering renewable energy. Renewable energy may be considered for different reasons, including (i) reduction of environmental impacts (GHG emissions reduction); (ii) energy cost savings (lower kWh cost); (iii) hedge against future energy cost increases; (iv) electrical demand management (lower peak demand kW); and (v) energy reliability and security.

Figure 4: Energy Efficiency Evaluation Loop



(Source: Brewers Association, 2017a)

2.4. Social Sustainability

Indian breweries are increasingly playing an active role in social good initiatives. Many breweries donate some of their profits to local charities, environmental organizations, and educational institutions. They also organize community clean-up drives and other volunteer activities, demonstrating their commitment to social responsibility.

In conclusion, while the Indian craft beer market is at a different stage, there are striking similarities in the importance of social sustainability. Building a solid consumer base, fostering inter-brewery collaboration, engaging with the community, and supporting local causes are all crucial aspects of ensuring the long-term success and positive impact of the Indian brewing industry.

3. Conclusions

Utilizing green technologies, integrating brewing industry byproducts, and out-of-the-box thinking are sustainable strategies to reduce pollution from industrial activities. The concept of zero waste goes beyond simply minimizing waste; it envisions a circular economy where companies view residues not as waste but as raw materials for other processes or as functional ingredients in a sustainable brewing process. This transformation requires rethinking resource management, influencing consumer behavior, and establishing an appropriate legal framework and economic incentives.

References

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EXPECTATIONS AND ASPIRATIONS OF THE ANIMAL FEED INDUSTRY AND LIVESTOCK FARMERS FROM ADVANCEMENT IN ANIMAL NUTRITION RESEARCH

DR. DINESH TUKARAM BHOSALE

Regional Commercial Director,
AB Vista South Asia, Pune

As per the latest data by Animal Husbandry Ministry, India produced 230.58 MMT milk during 2022-23. The milk production has increased by 3.83% over the previous year. The average yield per animal per day for crossbred is 8.55 kg and for indigenous/nondescript cows is 3.44 kg. Top five milk producing states are Uttar Pradesh, Rajasthan, Madhya Pradesh, Gujrat and Andhra Pradesh. They together contribute 53.08% of total milk production. In total milk production, contribution of buffalo milk is 45%, cow milk is 52% and goat milk is 3%.

Workforce of 7 million engaged exclusively in the rearing of cattle and buffalo, 69 percent of them are female workers, which is 5.72 percent of the total female workforce in the country of which 93 percent live in rural areas. The milk-consuming population has been consistently rising in the country both in rural and urban areas. The liquid milk market represents about half of the total dairy market in the country. Of the total liquid milk market, the share of the organized sector has increased from 32% to 41% in the last 3 years. It is estimated that the share of the organized sector would reach 54 % by 2026. Niti Aayog estimates that the country is expected to increase its milk production to 330 million metric tonnes in 2033-34 from the current level of 230.58 million metric tonnes so that in coming years there is a possibility of India becoming the contributor of 33 percent of global milk production.

Although I did PhD in Animal Nutrition, I worked with industry and farmers very closely since 1997 and I am in regular touch with academicians as well. It's proved by Indian poultry industry that with better genetics, we can get international level performance with better nutrition and management practices. We need to take quantum jump in next decade or so. Poultry industry became organized in India since 1972 due to availability of commercial breeds, scientific nutrition and management practices. Will this magic happen in dairy sector as well? What we expect from animal nutrition research in India in next 25 years?

In next 25 years or so, our research should focus on short term and long-term goals simultaneously. ICAR and veterinary colleges should communicate technologies to industry and farmers in local languages and in the audio-visual form. Many farmers use social media like youtube, whatsapp, facebook to learn new technologies.

Industry is the best medium to take research from lab to land. Startups have also started working in animal husbandry sector to bring new technologies to farmers. Most of these startups will need technical guidance from scientists and industry.

Startups can act as R&D centers for industry. Industry and scientists should brainstorm to identify research priorities and should work jointly with policy makers and animal husbandry departments to take outcomes to farmers.

Farmers should get right price for his final produce i.e. eggs, poultry meat, milk and milk products, fish and shrimp, mutton, etc. When farmers gets price below production cost, he reduces use of compound animal feeds and switch to feed ingredients, which further reduces productivity. There will be competition from imported products. Processing of chicken should increase in India, which will help to stabilize the prices and supply. FSSAI will become stricter in selling of animal origin products. Around 33% of milk produced in India is processed by organized sector. Farmer producer companies should be promoted.

There is growing demand for A2 milk and milk products and productivity of desi cows and buffaloes can be improved by improving feeding and breeding management. Compound cattle feed should be fed as per the requirements of these cows. Farmers are not able to sustain in rearing indigenous breeds. They will need financial help from state governments. There is need of formation of breed societies and herd registration of specific breeds of livestock. For sustainable development of indigenous breeds, strengthening and empowerment of these associations will play vital role. Indigenous breeds cannot be conserved and improved without active participation of farmers.

Calf rearing is not done in scientific way in India. Feeds like milk replacer, calf starter, grower and heifer feed will help in profitable calf rearing and will help to get maximum number of lactations per animal. Transition feeds should be promoted.

Still there is low awareness among farmers about use of balanced compound feeds. They use feed ingredients directly. Collaboration and coordination between state animal husbandry departments, ICAR/State veterinary Universities and industry needs to be improved for better penetration of good quality compound feeds. There is shortage of good quality manpower including vets to run animal feed sector.

During 2024, India is expected to produce around 28 MMT poultry feed, 16 MMT cattle feed and 3.5 MMT aquaculture feed. Most of the raw materials required for animal feeds are produced in India. But we may face shortages in future, as animal husbandry sector id growing fasting than crop sector.

Availability of good quality feed ingredients and their prices are major challenges for manufacturing of good quality compound feeds. Maize and SBM prices acts as benchmarks for prices of other feed ingredients. Grains and grain by products are used as source of energy and fibre in animal feeds. Government is expected to divert around 15 MMT of maize to ethanol production in next 5-6 years. Around 5 to 6 MMT of DDGS will be available as protein source for animal feeds. This will put strain on maize prices. Small amount of maize is also exported from India. Government should divert land under rice and wheat towards maize production to produce around 50 to 60 MMT, which will meet needs of feed, food, ethanol and export sectors. Government banned exports of broken rice and DORB in 2023. Millets prices are higher than maize in last few years, making it unviable to use in animal feeds. Soybean meal is main protein source in poultry feeds. In 2021, government had allowed imports of soybean meal for limited period to control prices. In future also, government may allow imports if needed. There is need to increase area and yield of not only soybeans but all other oilseeds as well. It will be win-win situation. Our edible oil imports will go down if we produce more oilseeds. We can always export surplus oilseed meals.

Lot of research took place about unconventional feed ingredients. Due to various factors like availability, price and anti-nutritional factors, their use is not more than 5% in total feed production. Although BT cotton is grown in India, there is ban on other GM crops. Therefore both farmers and feed millers are at loss. In scarcity, we should allow import GM maize and SBM. Our solvent extraction industries exports significant amount of oil meals every year. Production of animal protein is still not up to the mark as it is in hands of unorganized players. Adulteration of feed ingredients is major issue. There are not enough QC labs to test it. Use of Future trading and hedging is less. Still feed ingredients are bought and sold through traditional channels. Increase in MSP of major crops have affected prices of all feed ingredients. There is need to change crop patterns due to climatic change. So role of agriculture scientists is very important.

There is need to enhance efficiency of available feed resource use. This information would be of immense use for policy-makers, government agencies, non-government organizations, intergovernmental agencies and development agencies, among others in formulating and implementing sustainable livestock development activities and in preparing and coping with climatic variations such as droughts, floods, severe winter weather events and global climate change.

There is need to integrate quality control system in feed analysis. NIR can play important role to know chemical composition of feed ingredients. Scientists and feed industries must ensure that the quality control systems and good laboratory practices are used in feed analysis laboratories.

Ruminant production is largely based on feeding of crop residues and agro-industrial by- products. However, these resources need to be properly managed. Straw is burned every year causing environmental problems and soil degradation, in addition to loss of this valuable feed resource. Crop residue management could include the use of balers for collection of straw from the field, followed by the use of processing technologies for the manufacture of balanced complete feed for ruminants. The technology for making densified total mixed ration blocks (DTMRBs) or densified total mixed ration pellets (DTMRPs) based on straw and oilseed meals is an innovative approach, which provides an opportunity for feed manufacturers and entrepreneurs to remove regional disparities in feed availability and to supply the balanced feed to dairy and other livestock farmers on a large scale. It can also be effective in disaster management and emergency situations. Other technologies, such as chopping of forages, increase animal productivity and reduce waste of forage. Substantial feed losses can be prevented by using proper postharvest technologies.

There is also need to tap new feed resources. Scientists have done studies on many unconventional raw materials but their availability and safety is more important. Some insects such as the black soldier fly, maggots (larvae of the housefly), yellow mealworm, silkworms and grasshoppers are also good sources of protein and macro-and microminerals. The protein content of insects could range from 40 to 60 per cent on a dry matter basis, with protein quality as good as muscle protein. They are also good sources of iron, zinc, vitamin A and polyunsaturated fatty acids; and have been found to be good feed ingredients for poultry and pig diets.

Area specific mineral mixtures should be fed to our animals. Deficiency of minerals such as Co, Mo, Mg, Zn, Na, Cl etc. could decrease rumen fermentation because these are vital for various activities of rumen microbes.

There is growing concern among consumers about residues of antibiotics, pesticides, heavy metals, mycotoxins, etc. in final products. Feed millers use toxin binders to reduce impact of mycotoxins present in feeds.

Media is spreading negative and wrong news about livestock sector and farmers. There is only one daily newspaper in Marathi for farmers. Many startups have started apps giving lot of information and services to farmers, but how many farmers they reach is big question mark. Scientists should write more and more popular articles to educate consumers and farmers.

The aquaculture industry in India is thriving with a export demand for shrimps which is leading to growth in the shrimp feed industry. There is also an increase in the demand for fish from India both domestically and internationally which requires more effort from the aqua feed market to maintain the demand for high quality fish available in India. This is good opportunity for international and domestic aqua feed industries to establish themselves in the market.

Many animal feed additives are used in animal feed production now a days - supplied by MNCs and Indian companies. There seems to be oversupply and few customers. Commoditization has happened. Feed millers are buying only on price and credit period is prolonged. Import duties on feed additives should be reduced.

Disease challenges like bird flu - is big threat for profitable animal production in India and it impact animal feed consumption also. There is need to do more research on clinical nutrition.

Prominent feed players have started building new feed mills with 10 to 40 TPH plants, but small feed millers needs to upgrade their feed milling technology. There is need to start degree courses in feed milling technology in veterinary colleges.

FSSAI directed all cattle feed millers in India to use Bureau of Indian standards (BIS) standards to control aflatoxin residues in milk and milk products. But penetration of cattle feeds is only 16%. How government will control aflatoxin coming from green and dry fodders and concenrates fed directly to cattle in India? Fodder production and yield should go up in coming years. Silage making should be promoted. Dry fodder should be available at right price throughout the year. There is need of animal feed and fodder policy to secure feed and fodder availability to our livestock. Ration balancing should be promoted among farmers. Many startups are working in this area.

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We should understand that animal diets have the same importance for animals as human diets have for humans. Animal nutrition must get due attention, especially at the policy level. Animal feeding will prove to be the foundation of efficient livestock production.

This article is not complete! You can add your points as well. Implementation will need dedicated team comprising all stakeholders and it will result in taking research from lab to field to benefit our industry and farmers and will give right feedback to our scientists. Let's work together!

DR. VIJAYA TRIPATHI

R & D Head Nutrelis Agro Foods,
Sector 63, Noida.
E. mail: vijayat16@gmail.com
Ph. No. 9792241659

1. Introduction

Precision viticulture refers to the application of advanced technologies and data-driven approaches to optimize grape production in vineyards. It involves the use of tools such as Geographic Information Systems (GIS), remote sensing, global positioning systems (GPS), and sensor networks to gather, analyze, and apply spatially explicit information about vineyard variability. The primary goal of precision viticulture is to improve the efficiency, sustainability, and quality of grape production by tailoring vineyard management practices to specific spatial and temporal variations within the vineyard.

The significance of precision viticulture in modern grape production lies in its ability to enhance decision-making processes and resource management strategies, ultimately leading to improved grape quality, increased yields, and reduced environmental impact. By accurately characterizing the spatial variability of soil, climate, and vine health within a vineyard, precision viticulture allows growers to implement targeted interventions that address specific needs and challenges in different areas of the vineyard. This targeted approach can result in more efficient use of inputs such as water, fertilizers, and pesticides, as well as reduced costs and environmental impacts associated with grape production.

2. Technologies and Tools in Precision Viticulture

1. Geographic Information Systems (GIS):

Geographic Information Systems (GIS) play a crucial role in precision viticulture by providing a powerful platform for vineyard mapping, spatial analysis, and decision-making. GIS technology allows growers to create detailed maps of vineyard attributes such as soil types, topography, microclimates, and vegetation vigor. These maps serve as valuable tools for identifying spatial patterns and trends within the vineyard, such as areas of water stress, nutrient deficiencies, or pest/disease outbreaks.

GIS enables growers to overlay multiple layers of spatial data, such as soil maps, satellite imagery, and sensor data, to gain insights into the spatial variability of vineyard conditions. By integrating GIS with other data sources, growers can make informed decisions about vineyard management practices, such as irrigation scheduling, fertilization, canopy management, and pest/disease control. GIS also facilitates the creation of prescription maps, which guide precision application of inputs based on spatial variability within the vineyard, optimizing resource use and minimizing environmental impact.

2. Remote Sensing Techniques:

Remote sensing techniques, including satellite imagery, aerial drones, and multispectral imaging, are invaluable tools for monitoring vineyard conditions and assessing spatial variability. Satellite imagery provides a broad-scale view of vineyard health and productivity over large areas, allowing growers to monitor changes in vegetation vigor, canopy density, and water stress over time. Aerial drones equipped with high-resolution cameras and multispectral sensors can capture detailed imagery of vineyard conditions at a finer spatial resolution, enabling growers to detect subtlevariations in vine health and identify areas of concern.

3. Sensor Networks:

Sensor networks deployed throughout the vineyard collect real-time data on soil moisture, temperature, humidity, and other environmental variables, providing growers with valuable insights into vineyard conditions. Soil moisture sensors measure the water content of the soil, helping growers to optimize irrigation scheduling and ensure that vines receive the right amount of water at the right time. Temperature and humidity sensors provide information about microclimate conditions within the vineyard, allowing growers to monitor temperature extremes and humidity levels that can impact vine health and productivity.

4. Global Positioning System (GPS) Technology:

Global Positioning System (GPS) technology is essential for precise mapping and navigation within vineyards, allowing growers to accurately locate and monitor vineyard features such as rows, vines, and irrigation infrastructure. GPS receivers mounted on tractors, vehicles, or handheld devices collect spatial data that is used to create detailed maps of vineyard boundaries, row spacings, and planting patterns. GPS data can also be used to track the movement of equipment and personnel within the vineyard, optimize routing and logistics, and ensure efficient use of resources.

3. Applications of Precision Viticulture

- Researching the vine industry can lead to a rich and diverse array of topics, depending on your interests and focus. Here's a list of potential research paper topics related to the vine industry:
- Global Trends in Wine Consumption: Analyze the latest trends in wine consumption worldwide, including shifts in preferences, emerging markets, and the impact of socio- economic factors.

- Climate Change and Viticulture: Investigate how climate change is affecting vineyards around the world, including changes in grape growing regions, vineyard management practices, and wine quality.

- Sustainable Viticulture Practices: Explore the latest advancements in sustainable viticulture practices, including organic and biodynamic farming methods, water conservation techniques, and biodiversity initiatives.

- Technology and Innovation in Winemaking: Examine the role of technology in modern winemaking, including the use of data analytics, automation, and precision viticulture techniques to improve wine quality and efficiency.

- Wine Tourism and Regional Development: Investigate the economic impact of wine tourism on local economies, including the role of wineries, tasting rooms, and wine festivals in driving tourism and supporting rural development.

- Wine Marketing and Branding Strategies: Analyze successful wine marketing and branding strategies, including the use of social media, influencer partnerships, and experiential marketing to engage consumers and build brand loyalty.

- Wine Trade and Tariffs: Explore the impact of international trade policies and tariffs on the global wine industry, including recent trade disputes and their implications for wine producers, exporters, and consumers.

- Wine Law and Regulations: Examine the regulatory framework governing the production, distribution, and labeling of wine in different countries, including appellation laws, labeling requirements, and trade agreements.

- Wine Industry Economics: Investigate the economics of the wine industry, including production costs, pricing strategies, market dynamics, and the role of government subsidies and support programs.

- Cultural and Social Aspects of Wine: Explore the cultural and social significance of wine in different societies, including its role in religious rituals, social gatherings, and culinary traditions.

4. Benefits and Challenges

Benefits:

Improved Resource Use Efficiency: Precision viticulture enables growers to optimize the use of resources such as water, fertilizers, and pesticides by applying them precisely where and when they are needed. This leads to reduced waste, lower input costs, and improved environmental sustainability.

Enhanced Grape Quality: By tailoring management practices to specific areas of the vineyard based on spatial variability in soil, climate, and vine health, precision viticulture helps growers optimize grape quality and consistency. This can lead to higher-quality grapes with desirable characteristics for wine production.

Increased Yield and Profitability: Precision viticulture techniques such as site-specific irrigation, fertilization, and pest management can help maximize grape yields while minimizing input costs. This can lead to higher profitability for growers by increasing overall vineyard productivity and reducing production expenses.

Data-Driven Decision Making: Precision viticulture provides growers with access to real-time data and insights about vineyard conditions, allowing them to make more informed decisions about management practices. This enables growers to respond quickly to changing conditions and optimize vineyard operations for better outcomes.

Sustainability: By optimizing resource use, reducing input costs, and minimizing environmental impacts, precision viticulture contributes to the long-term sustainability of grape production. By adopting sustainable practices, growers can protect natural resources, preserve ecosystem health, and ensure the viability of their vineyards for future generations.

Challenges:

Cost and Complexity: Implementing precision viticulture technologies and practices can be costly and complex, requiring significant investments in equipment, infrastructure, and training. The initial setup costs and ongoing maintenance expenses may be prohibitive for some growers, particularly smaller operations with limited financial resources.

Data Management and Interpretation: Precision viticulture generates large volumes of data from various sources such as remote sensing, sensor networks, and GIS. Managing and interpreting this data can be challenging, requiring specialized skills and expertise in data analysis, statistics, and spatial modeling. Growers may struggle to extract actionable insights from the data or integrate it into their decision-making processes effectively.

Integration with Traditional Practices: Integrating precision viticulture practices with traditional vineyard management practices can be challenging, especially in regions with long-standing agricultural traditions. Growers may face resistance to change from workers, suppliers, and other stakeholders accustomed to conventional methods, making it difficult to adopt new technologies and workflows.

Variable Results: Despite its potential benefits, precision viticulture may not always deliver consistent or predictable results due to the complexity and variability of vineyard ecosystems. Factors such as weather fluctuations, soil heterogeneity, and pest/disease pressures can influence outcomes and limit the effectiveness of precision management strategies, leading to variable results across different growing seasons or vineyard sites.

Accessibility and Adoption: Access to precision viticulture technologies and expertise may be limited in some regions, particularly in developing countries or rural areas with inadequate infrastructure or support services.

Growers may lack access to training, technical assistance, or financial incentives to adopt precision viticulture practices, hindering widespread adoption and uptake of these technologies.

5. Future Trends and Opportunities

In the realm of precision viticulture, emerging trends like the integration of artificial intelligence and machine learning algorithms are poised to revolutionize data analysis and decision support processes. These technologies offer the potential to extract actionable insights from the vast amounts of data generated by precision viticulture tools, facilitating more informed and efficient vineyard management practices. Looking ahead, the future of precision viticulture holds promise in its integration with other agricultural systems, presenting opportunities to enhance sustainability and resilience in the face of climate change. By leveraging precision viticulture technologies in conjunction with advancements in climate-smart agriculture, growers can optimize resource use, mitigate environmental impacts, and ensure the long-term viability of grape production in a changing world.

6. Conclusion

In conclusion, precision viticulture offers numerous benefits to grape growers, including improved resource use efficiency, enhanced grape quality, and increased profitability. By leveraging advanced technologies such as GIS, remote sensing, sensor networks, and GPS, growers can optimize vineyard management practices and achieve better outcomes in grape production. The implications of precision viticulture for the future of grape production and the wine industry are significant, with the potential to enhance sustainability, resilience, and competitiveness. To further advance precision viticulture practices, continued research and innovation are essential, particularly in areas such as artificial intelligence, climate change adaptation, and integration with other agricultural systems. By investing in research, training, and infrastructure, the wine industry can unlock the full potential of precision viticulture and ensure its long-term success in a rapidly changing world.

BECPL'S R&D HEAD DR. VASUDEO ZAMBARE CONFERRED SENIOR SCIENTIST AWARD 2022-23

Dr. Vasudeo Zambare is receiving the Award Memento and Certificate by BECPL's Director Mr. Arun Kainya

Dr. Vasudeo Zambare, Head- R&D and Technical of Balaji Enzyme & Chemical Pvt Ltd has been awarded the prestigious state level **"Senior Scientist Award 2023"** by the Microbiologists Society, India (MBSI). The award was conferred to recognized Dr. Zambare for his extraordinary scientific and technological developments in microbial research for food, feed, fuel and waste mitigations. The award was declared during the International Conference on Microbiological Research: Current Challenges and Future Perspectives at Bharathidasan University, Tamil Nadu, on January 9, 2024. The award was declared in presence Prof. Dr. M. Selvam, Vice-Chancellor of Bharathidasan University, and Prof. A.M. Deshmukh, President, MBSI. Dr Zambare was specially congratulated by BECPL group including the Board of Directors, Mr Abhay Kainya, & Mr. Ashish Sharma and wishing a big success for future assignments and many more milestones.

BECPL TEAM AT WINE & DINE EXHIBITION,NASHIK 24th & 25th February

BODY OF WINE

MRS. MAMATA BHARDWAJA

Business Development Manager (Wine Industry)

Imagine you are attending a wine tasting, you have just been poured a glass, and the sommelier has asked you to appreciate the wine's body.

But what does that mean exactly? It isn't a reference to the flavors present in the wine like fruity, earthy, and spicy are for. And since it is a liquid, moving and flowing and taking the shape of whatever container it's poured into, it's clear that wine body has nothing to do with shape. So, what is wine body?

A wine's body describes the richness and texture or weight of the wine in mouth.

It is an important characteristic of wine. It falls into three categories, full-bodied, medium-bodied and light-bodied. Wine body is not easy to recognize like all other tastes. It takes time and experience to differentiate.

Mainly the weight is due to alcohol. This is because alcohol gives the drink viscosity, which can be simply defined as how little or much a fluid resists flowing. The higher the alcohol content, the more viscous or heavier the wine becomes.

Other factors that shape wine body are grape variety*, oak aging in barrels, residual sugars, and the grape's growing climate (grapes sourced from warmer areas lead to rich and full-bodied wines).

Oak Aging: When examining a wine's body, it's important to take tannin structure into consideration. This structure is one aspect of wine that can change as it ages in an oak barrel.

Wines don't really have physical weight or they are not thicker or thinner. It is just a sensation in our mouth.

Light-bodied wines usually feel thinner like water. Full-bodied wines feel thicker, heavier more like milk. Medium-bodied wines fall somewhere in between these two.

Light-bodied

Wines less than 12.5% alcohol are said to light–bodied wines. Generally white wines fall under this category. The examples are Riesling, Gamay, and pinot noir. Light bodied reds have lighter tannins, bright acidity and slightly lower alcohol content.

Medium-bodied

Wines between 12.5 to 13.5% alcohol are considered as medium-bodied wines. Some whites and rose wines fall under this category. Sauvignon blanc, French burgundy, pinot grigio, are the examples of medium bodied wines.

Full-bodied

Wines more than 13.5% alcohol are considered as full-bodied wines. Merlots, Malbec, Shiraz, zinfandel, cabernet are the examples of full-bodied red wines. While the majority of wines over 13.5% alcohols are usually red, but there are some white wines like chardonnay which are full bodied. Some desert wines are also fall into this category because residual sugar adds texture and weight.

The body of the wine plays important role in wine and food pairing.

It is important to note that wine is not a "one-size-fits-all" type of drink. Flavor notes, body, and other characteristics are a matter of personal preference, and it may take a bit of time and a lot of exploration to figure out which bottle is the best choice for you. The best way to distinguish between light-bodied, medium-bodied and full-bodied wines is, taste particular types of different wines and learn how the sensation differs.

Cheers!!!

AN OVERVIEW OF BREWING ESTER PRODUCTION

SAURABH N. PERKAR

BREWER
ALCHEMY MICROBREWERY, BANGALORE

Brewing is both an art and a science, where beautiful balance of yeast, sugars, and fermentation conditions creates the diverse palette of flavours found in beer. At the core of this complex process lies the production of esters, compounds responsible for the aromatic and flavourful notes that define different beer styles.

Esters are formed when yeast transforms precursor molecules, such as alcohols, during fermentation. The efficiency of this conversion process, known as conversion efficiency, is influenced by several factors. One crucial player is the yeast strain, each with its unique enzymatic activity and metabolic pathways. The yeast strain factor contains the genetic fingerprint of the yeast, impacting the flavour profile it imparts to the final brew.

Fermentation conditions, affected by temperature, aeration, nutrient levels, pH, and more, make up the fermentation condition factor. These conditions influence yeast metabolism, enzymatic activity, and ultimately, the conversion efficiency. For instance, temperature sensitivity dictates the optimal temperature range for a yeast strain, affecting its ability to produce specific esters.

My complex mathematical equation for estimating ester production considers these factors, including yeast strains, fermentation conditions, wort composition, and various parameters like enzymatic activity, metabolic pathways, and stress response. It provides a conceptual framework for brewers seeking to understand and control the flavour development in their beers.

The equation's components, such as conversion efficiency, precursor concentration, and yeast strains factor, act as building blocks. Brewers can experiment with different yeast strains, fermentation temperatures, and wort compositions to tailor the ester production and achieve the desired flavour characteristics.

In the world of brewing, where science meets craftsmanship, mastering ester production is an ongoing quest. Brewers, armed with knowledge and experimentation, should continue to unlock the secrets of flavour, creating unique and delightful experiences for beer enthusiasts worldwide. Cheers to the art of applied science of brewing!

EXPLORING THE ESSENTIAL ROLE OF BEER STABILIZERS IN BREWING

Akshat Jain
Business Development Manager
Balaji Enzyme and Chemical Pvt ltd

Introduction:

In the realm of brewing, achieving consistency, quality, and longevity in beer is paramount. Amidst the array of ingredients and processes involved, beer stabilizers stand out as indispensable tools for brewers. In this article, we delve into the crucial role of beer stabilizers, their functions, types, and significance in ensuring the integrity and shelf-life of this beloved beverage.

Understanding Beer Stabilizers:

Beer stabilizers encompass a range of additives used to maintain the desired characteristics of beer over time. These additives serve various purposes, including preventing haze formation, extending shelf-life, and enhancing flavor stability. While some stabilizers act during fermentation and conditioning, others are employed post-fermentation to safeguard the beer during packaging and storage.

Functions of Beer Stabilizers:

Haze Control

Beer stabilizers help prevent the formation of haze by inhibiting the interaction of proteins and polyphenols, which can lead to cloudiness in the final product. This ensures clarity and brilliance, enhancing the visual appeal of the beer.

Flavor Stability:

Certain stabilizers, such as antioxidants and preservatives, protect beer from oxidation and microbial spoilage, preserving its flavor integrity over time. By mitigating the effects of exposure to oxygen and light, these additives extend the shelf-life of the beer, maintaining its freshness and character.

Foam Stability:

Stabilizers can also contribute to foam stability, ensuring that the beer retains a consistent and long-lasting head when poured, enhancing the sensory experience for consumers.

Types of Beer Stabilizers:

Antioxidants:

Pairing beer with foods rich in probiotics, such as yogurt, sauerkraut, or kimchi, may enhance the gut-friendly effects.

Clarifying Agents:

Substances like silica gel and isinglass aid in clarifying beer by removing suspended particles and haze-forming compounds.

Preservatives:

Chemicals like potassium sorbate and sodium benzoate inhibit microbial growth, preventing contamination and spoilage.

Fining Agents:

Materials such as gelatin and PVPP (polyvinylpolypyrrolidone) are used to remove specific compounds that contribute to haze or off-flavors in beer.

Chelating Agents:

Compounds like EDTA (ethylenediaminetetraacetic acid) help sequester metal ions that can catalyze oxidation reactions, thereby enhancing beer stability.

Significance in Brewing:

Beer stabilizers play a critical role in maintaining the quality and consistency of beer, especially in commercial production where large-scale distribution and extended shelf-life are essential. By addressing key stability issues such as haze formation, flavor degradation, and microbial spoilage, stabilizers ensure that consumers enjoy a product that meets high standards of excellence and remains true to its intended flavor profile.

Conclusion:

In the dynamic world of brewing, where artistry meets science, beer stabilizers emerge as indispensable allies, safeguarding the integrity and longevity of this timeless beverage. Through their diverse functions and applications, stabilizers uphold the highest standards of quality, ensuring that every sip of beer delights the palate with clarity, freshness, and flavor. As brewers continue to innovate and refine their craft, the role of beer stabilizers remains central, underscoring their significance in the pursuit of brewing excellence.

2nd March 2024

Kanak lata
Assistant Marketing Manager
Balaji Enzyme and Chemical Pvt Ltd

Unveiling the Crucial Role of Filter Powder in Brewing

Introduction:

Brewing, an art as old as civilization itself, relies on a delicate balance of ingredients, techniques, and tools. Among these, filter powder emerges as a humble yet indispensable element, often overlooked but crucial in shaping the quality and character of the final brew. In this article, we delve into the significance of filter powder in brewing processes, exploring its functions, types, and impact on the sensory experience of the end product.

The Role of Filter Powder:

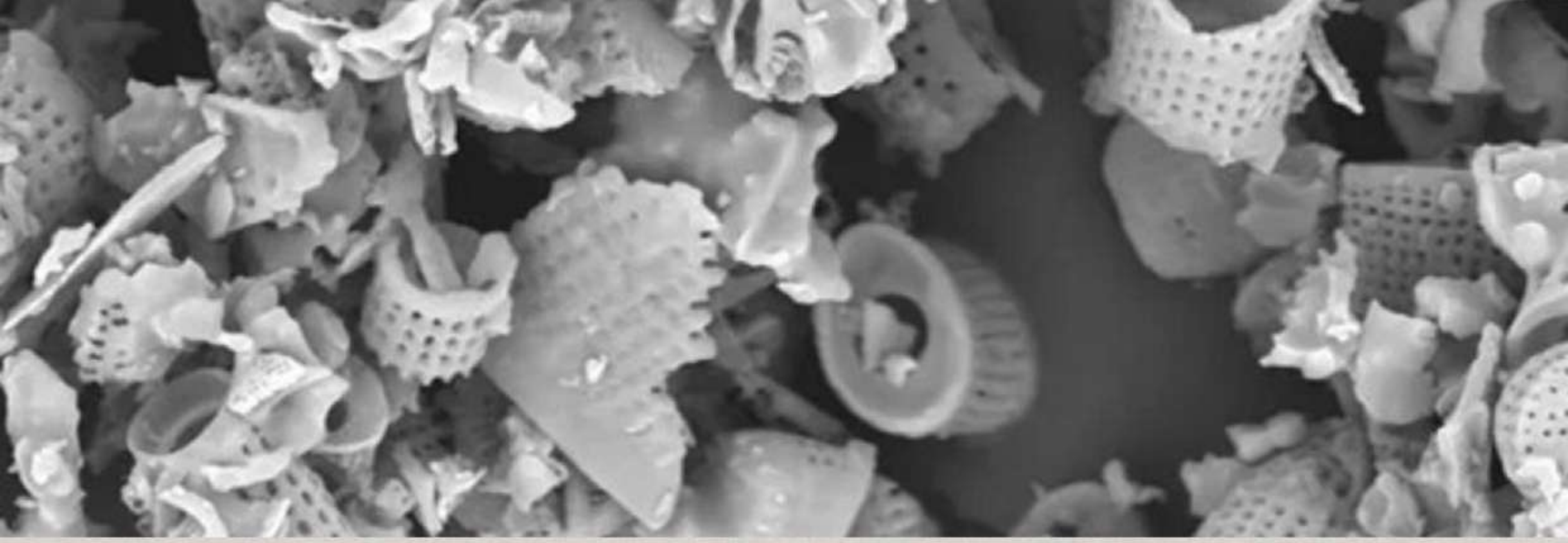
Filter powder, also known as diatomaceous earth or filter aid, plays a multifaceted role in brewing. Its primary function lies in filtration, where it acts as a medium to separate solid particles and impurities from liquid, ensuring clarity and purity in the finished beverage. By trapping unwanted particles such as yeast, proteins, and sediment, filter powder helps achieve the desired level of transparency and stability in the brew.

Types of Filter Powder:

Filter powder comes in various forms, each tailored to specific brewing requirements. Diatomaceous earth, composed of fossilized remains of diatoms, remains a popular choice due to its high porosity and ability to efficiently trap particles. Other types include cellulose-based filter aids and perlite, each offering unique characteristics suited to different brewing processes and end products.

Impact on Brewing Quality:

The use of filter powder significantly influences the sensory attributes of the final brew. By removing excess yeast and protein, it enhances clarity and brightness, lending visual appeal to the beverage. Moreover, effective filtration prevents off-flavors and aromas caused by particulate matter, ensuring a clean and crisp taste profile. This quality control aspect is especially vital in producing premium and specialty brews where consistency and excellence are paramount.



Application in Brewing Processes:

Filter powder finds application across various stages of the brewing process, from wort clarification to post-fermentation filtration. In beer production, it aids in removing residual yeast and haze-forming proteins during conditioning and maturation. Similarly, in wine making, filter powder helps clarify the wine, enhancing its brilliance and stability. Its versatility extends to other beverages such as spirits, juices, and coffee, where clarity and purity are valued.

Conclusion:

In the intricate tapestry of brewing, filter powder emerges as a silent yet indispensable ally, working behind the scenes to refine and elevate the quality of the end product. Its role in filtration not only enhances visual appeal but also safeguards flavor integrity, ensuring a satisfying sensory experience for consumers. As brewers continue to innovate and refine their craft, the importance of filter powder remains steadfast, underscoring its status as a cornerstone of brewing excellence.

SAFE BREWING PRACTICES: ENSURING QUALITY AND HEALTH

Priyanshi Sharma

Introduction:

Brewing your own beer at home can be an enjoyable and rewarding hobby, but it's important to prioritize safety throughout the process to prevent contamination and ensure the quality of your brew. Whether you're a novice or an experienced homebrewer, adhering to safe brewing practices is essential. Here are some key guidelines to follow:

Sanitation is Paramount:

Before you begin brewing, thoroughly clean and sanitize all equipment that will come into contact with your beer. This includes fermenters, airlocks, hoses, bottles, and any utensils. Use a food-grade sanitizer and follow the manufacturer's instructions carefully to eliminate any potential bacteria or wild yeast that could spoil your brew.

Quality Ingredients:

Use fresh, high-quality ingredients for your beer. This includes malt, hops, yeast, and water. Inspect ingredients for signs of spoilage or contamination before use, and store them properly in a cool, dry place.

Proper Brewing Environment:

Maintain a clean and orderly brewing environment. Make sure your brewing area is free from clutter, dust, and pests. Brew in a well-ventilated area with stable temperatures to promote yeast health and fermentation.

Follow Recipes Carefully:

When brewing, follow recipes and instructions meticulously. Pay attention to measurements, temperatures, and brewing times to achieve the desired flavor profile and alcohol content. Deviating from recipes can lead to off-flavors or incomplete fermentation.

Monitor Fermentation:

Keep a close eye on the fermentation process. Use a hydrometer to measure specific gravity and monitor the progress of fermentation. Check for any signs of contamination, such as unusual odors, off-colors, or mold growth. If in doubt, consult experienced brewers or brewing resources for guidance.

Practice Good Hygiene:

Wash your hands thoroughly before handling equipment or ingredients. Avoid touching your face, hair, or other surfaces while brewing to prevent contamination. Use clean, sanitized tools and avoid introducing foreign objects into your beer.

Bottle Safely:

When bottling your beer, ensure that bottles are clean and sanitized. Use priming sugar carefully to carbonate the beer naturally in the bottle. Seal bottles securely with caps or corks to prevent oxygen and contaminants from entering.

Storage and Aging:

Store finished beer in a cool, dark place to prevent oxidation and prolong shelf life. Avoid exposure to direct sunlight, which can cause off-flavors and spoilage. Allow beer to age properly if necessary, following recommended aging times for different styles.

Labeling and Tracking:

Label bottles with the date of bottling and the type of beer to easily track batches and monitor aging. Keep detailed records of your brewing process, including recipes, ingredients, and any deviations or observations made during brewing.

By following these safe brewing practices, you can enjoy the art of homebrewing while ensuring the quality and safety of your beer. Remember, brewing is both a science and an art, and attention to detail is key to producing great-tasting brews every time. Cheers to safe and delicious homebrewing!

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