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VOLUME-36

CONNECT

CATALYSING INNOVATION, DELIVERING SOLUTIONS...

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contents

MD's Desk

Munish Madan
MANAGING DIRECTOR

Hello Friends,

As The Catalysts Group enters its 22nd year of driving innovation, we do so at a pivotal juncture in India's biofuel transformation. Ethanol has emerged as a central pillar in the shift toward cleaner, renewable alternatives, marking a new chapter in the country's energy landscape. It is no longer a mere by-product of sugar manufacturing—it now represents policy momentum, industrial innovation, and environmental responsibility. While molasses-based ethanol laid the foundation, the momentum is steadily moving toward grain-based production, backed by feedstock availability, regional adaptability, and consistent government support.

Grain-based ethanol continues to gain prominence, with production volumes crossing 830 crore litres. As new capacity becomes operational and infrastructure stabilizes, this figure is poised to rise further, driven by a diversified feedstock basket that includes maize, surplus rice, and other region-specific grains. Government support remains a strong enabler, with fixed pricing—such as 71.86 per bulk litre for maize ethanol—and financial incentives helping de-risk investments. Recent large-scale plant expansions and ethanol park initiatives across key grain belts reflect the growing industry-wide confidence in this segment.

Alongside this production growth, the ethanol ecosystem is evolving. Traditional single-stream plants will get replaced by integrated biorefineries—facilities capable of producing not just fuel, but co-products like DDGS, corn oil, rice protein, and even compressed biogas. These co-products add commercial value, open new markets in pharma and animal nutrition, and reduce reliance on ethanol margins alone. However, rising input costs and fluctuating market conditions still pose challenges. Plants are responding by adopting advanced fermentation control, automation, and real-time analytics—driving greater process efficiency, reducing energy consumption, and enhancing overall production performance.

As the industry expands, the need for ethical, long-term sustainability becomes more important than ever. Instead of drawing from food-grade supplies, manufacturers are increasingly turning to responsibly sourced raw materials—such as low-grade, aged, or surplus grains—available in significant volumes across rural belts. Beyond sourcing, sustainability must reflect across the entire value chain—from energy efficiency to waste minimization and emission controls. Only those plants that embrace quality systems, regulatory compliance, and technological adaptability will thrive in the changing landscape.

India's ethanol capacity has now crossed 1,680 crore litres annually, with over 56% coming from grain-based sources. Supply to OMCs exceeded 707 crore litres last year, pushing the blending rate toward the 14.6% mark. This progress, up from just 38 crore litres in 2013–14, reflects how quickly the ecosystem has evolved—powered by innovation, favorable policy, and the resilience of Indian enterprise. The outcome is not just economic—it represents a model of how climate and commerce can align when industry works with purpose and agility.

At The Catalysts Group, we take pride in contributing to this progress. Our focus remains clear: to deliver innovative enzyme and additive solutions that minimize process losses, enhance yields, and empower our partners to scale sustainably and profitably. With over 985 clients in 23 countries, our solutions are already enabling performance improvements across distilleries, refineries, and integrated processing units. We believe the ethanol facility of the future will not just produce biofuel—it will function as a self-sustaining, circular biorefinery that extracts value at every stage, reducing environmental impact while creating economic opportunity.

This milestone year is not just a reflection of where we've been, but a declaration of where we're going. To our dedicated teams, partners, and clients—your commitment has powered this journey. We are proud to be part of a movement that's not just transforming India's energy landscape but shaping a more responsible global future. Together, we catalyze innovation. Together, we deliver impact.

Warm regards,

Munish Madan

GREEN HYDROGEN
ANOTHER BIO- FUEL FROM SUGAR INDUSTRY?

Narendra Mohan
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With an objective to reduce the carbon emissions, restrict rise in the earth temperature, mitigate the issue of climate change and achieve the targets of net zero by 2070, green hydrogen is being considered as the future fuel. It is an established fact that issues of global warming and climate can be taken care to a larger extent by restricting the use of conventional fossil fuels and adopting fuels which are cleaner, green and renewable. Already into production of clean & green energy i.e. bio-electricity, bio-ethanol and compressed bio-gas, in times to come sugar industry may be at the forefront for producing green hydrogen as well.

Across the globe there is continuous and serious brainstorming on the environmental issues and government of various countries are now in the process of exploring potential of non - conventional energy resources or the fuels which result in generation of clean and green energy and formation of "Global Bio-fuel Alliance" is a firm step in this direction. India has also taken a lead to attain the targets of net zero by the stipulated date and we have seen a surge in solar and wind power generation during the last decade or so along with biomass based energy production. Indian sugar industry has already taken a lead by developing clean and green energy by contributing bagasse-based electricity, juice & molasses based ethanol for EBP and compressed biogas or bio-methane produced from filter cake as automotive or fuel for other purposes.

Various countries have set targets to achieve net zero emissions by 2040 to 2070. Green hydrogen is being looked into as a potential source which can play a significant role in this commitment as it can serve as a clean and sustainable energy carrier. India has set its sight on becoming energy independent by 2047 and achieving Net Zero Carbon Emissions by 2070.

NATIONAL GREEN HYDROGEN MISSION

The National Green Hydrogen Mission was approved by the Union Cabinet on 4 January 2022.

The mission outcomes projected by 2030 are:

- Development of green hydrogen production capacity of at least 6 MMT (Million Metric Tonne) per annum with an associated renewable energy capacity addition of about 125 GW in the country
- Over Rs. Eight lakh crore in total investments

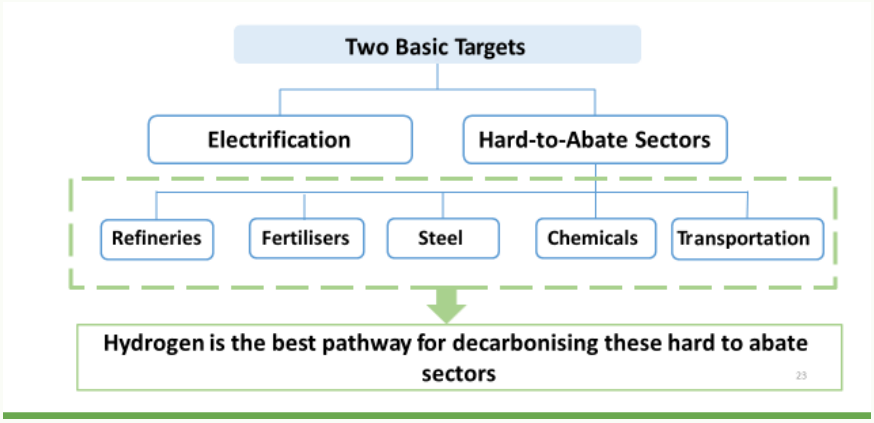
- Creation of over Six lakh jobs
- Cumulative reduction in fossil fuel imports over Rs. one lakh crore
- Abatement of nearly 50 MMT of annual greenhouse gas emissions.

India aims to revolutionise its energy landscape by producing 6 million tonnes of green hydrogen annually from 2030 onwards. This ambitious pursuit aligns with India's domestic consumption figures, with a further aspiration to scale production to an impressive 10 million tonnes.

USES OF GREEN HYDROGEN

Utilization of Green Hydrogen is aimed at serving hard to abate sectors and electrification as shown.

Green Hydrogen is a key feedstock for various industrial processes. Industries like chemicals, refineries, and steel production can use green hydrogen as a cleaner alternative to hydrogen produced from fossil fuels. It can also be used as a fuel for fuel cell vehicles, providing a clean alternative to traditional internal combustion engines. It can be particularly useful for heavyduty transport, such as buses, trucks, and trains.

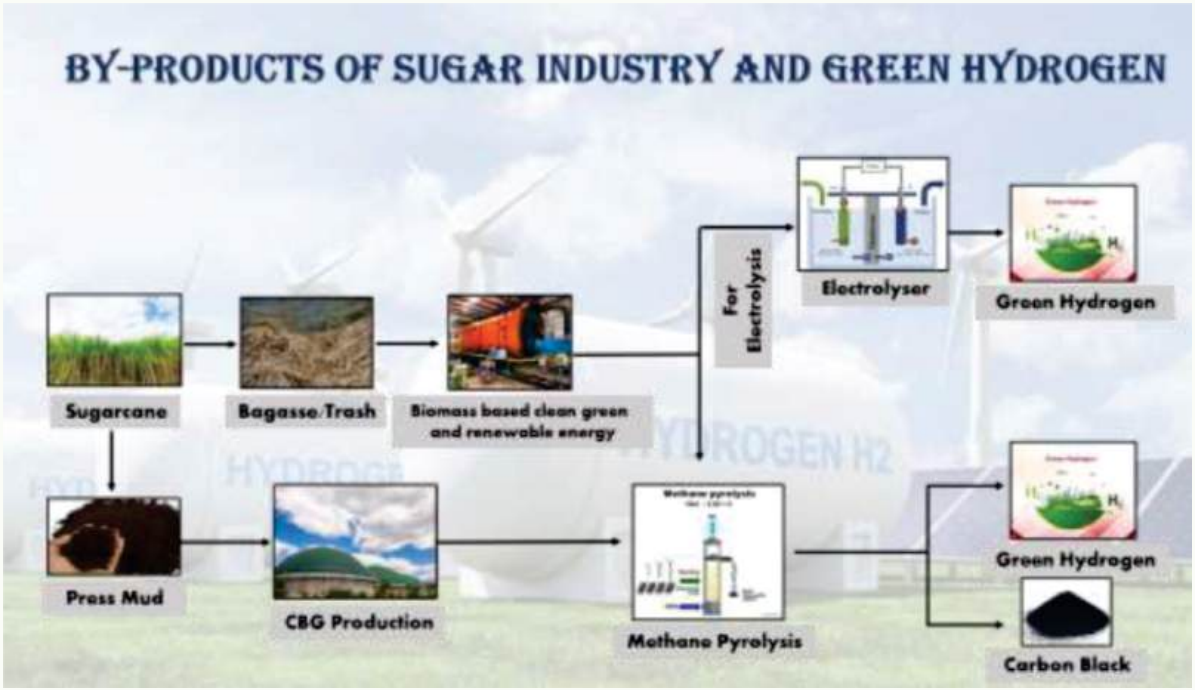


As regards heat and power generation, Green Hydrogen can be burned directly or used in fuel cells to generate heat for residential, commercial, or industrial heating applications. This can be an alternative to natural gas, with the advantage of being a cleaner-burning fuel. Further it can be used as a fuel in gas turbines to generate electricity. This can provide a cleaner alternative to conventional power generation methods, especially in areas where renewable energy sources might not be consistently available. Besides these, Decarbonization of Hard-to- Abate Sectors i.e. Industries that are challenging to decarbonize, such as aviation and certain industrial processes, could potentially benefit from green hydrogen as a clean energy source.

POSSIBLE PRODUCTION OF GREEN HYDROGEN IN SUGAR INDUSTRY

Sugar Industry since produces biomass based clean, green and renewable energy and also the filter cake (press

mud), both the routes for production of green hydrogen i.e. methane pyrolysis and electrolysis of water may be considered as shown in the figure. The bio-electricity may either be used for electrolysis or may be used in catalytic conversion of biogas (methane pyrolysis) produced from filter cake to green hydrogen and carbon black. Green hydrogen production through methane pyrolysis, also known as methane cracking or thermolysis, is a promising technology with the potential to reduce greenhouse gas emissions compared to conventional hydrogen production methods.



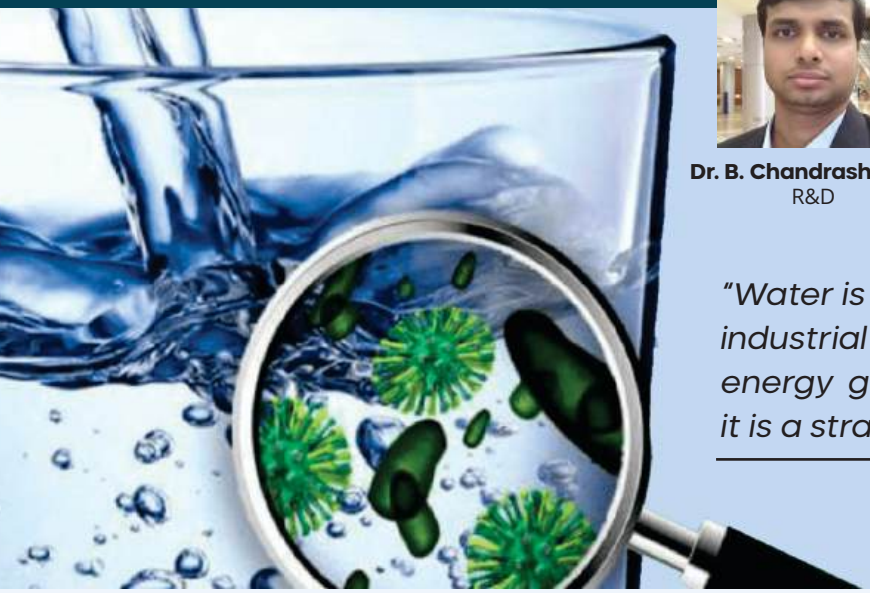
Evaluation of issues involved in production of green hydrogen through these two routes viz. cost, energy efficiency, infrastructure, safety concerns, carbon footprints and sourcing of raw material etc. is required to be meticulously done as each process has its own set of challenges and considerations. Challenges in production of green hydrogen, particularly with respect to cost and competiveness shall have to be addressed to maximize potential of green hydrogen and ensuring its role in a sustainable and low-carbon future. Collaboration among governments, industries, and researchers is crucial for overcoming these obstacles.

Sugar industry is likely to play a role in producing this future fuel at an affordable cost looking to cheap source of production of clean and renewable energy but dedicated efforts are required on this aspect for formulating a strategy.

CONCLUSION

Sugar industry can play a role in producing this future fuel at an affordable cost looking to cheap source of production of clean and renewable power and bio-gas. The use of green hydrogen is part of global efforts for reduction of greenhouse gas emissions and addressing global warming and climate change facilitating transition towards a more sustainable and lowcarbon energy system. Challenges in production of green hydrogen, particularly with respect to production techniques, cost and competitiveness shall have to be addressed to maximize potential of green hydrogen and ensuring its role in a sustainable and low-carbon future.

IMPACT OF WATER BORNE MICROORGANISMS ON DIFFERENT INDUSTRIES



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"Water is essential for nearly every aspect of industrial production, from manufacturing to energy generation. It is not just a resource; it is a strategic asset."

-Erik Olson

Indeed! Water is precious not only for all life forms but for all sort of industries as well. Highlighting Catalysts key verticals, water plays a multifaceted role in sugar, grain, brewery and pulp & paper industries, playing integral roles in extraction, clarification, concentration, crystallization, washing, drying, brewing process, mashing, steeping, fermentation, pulping, bleaching and washing, sanitation and various other processing steps.

Waterborne microorganisms, including bacteria and fungi, cause contamination when present in high concentrations. Stagnant and polluted running water are major sources of these microorganisms. Long-term storage in contaminated containers further increases contamination. Using such water hinders vital industrial processes, causing product losses. Essential minerals like calcium, magnesium, sodium, fluoride, potassium, iron, nitrogen, phosphorus, and zinc support microbial growth. Organic matter in polluted water also boosts microorganism growth. If microbial contamination enters industrial processes, it consumes resources, competes with desired microbes, and alters conditions like pH by producing by-products (e.g., lactic and acetic acids, and extracellular substances), negatively impacting manufacturing.

PROCESS WATER

Industries use groundwater and river water for smooth operations, but microbial contamination due to pollution is now common (Cahoon, 2019). High BOD levels promote microorganism growth. Process water in sugar and alcohol production can contain bacteria such as *Bacillus cereus, Bacillus subtilis, Pseudomonas aeruginosa, Yersinia enterocococolitica, Staphylococcus aureus, Streptococcus faecalis, Clostridium perfringens, Streptomycos griseus, Nocardia lba, Aspergillus niger E. coli, Salmonella enterica,* etc. Filamentous fungi like Penicillium, Cladosporium, and Aspergillus may also colonize in open systems rich in organic matter. This contamination competes with beneficial yeast cultures, reducing product yield, or produces by-products that hinder the process. In breweries and paper industries, such microbial contamination can cause undesirable odours and flavours, lowering.

WASTE WATERS

Evaporator condensate, spent wash, spent lees, and back water are common wastewaters in sugar mills, distilleries, and paper mills. These waters, due to high temperatures and acidic pH (3-4) from distillation and condensation processes, are generally free from microbial contamination. However, acidophilic microbes can grow in these waters if stored improperly. Microbial contamination can also enter through air, equipment surfaces, or water sources. Common bacteria in condensate water include Pseudomonas, Bacillus, and Clostridium, along with Aspergillus and Penicillium fungi, particularly in warm, humid environments. Green algae or cyanobacteria can also proliferate in stored condensate water exposed to light, causing fouling issues.

Spent wash and back water contain organic compounds like residual carbohydrates, sugars, proteins, organic acids (e.g., lactic, acetic, formic acids), and nutrients (nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, zinc, copper, manganese), increasing the risk of microbial contamination (Singh et al, 2020). Common contaminants include lactic acid bacteria, acetobacter, enterobacteria, and Aspergillus species, originating from fermentation vessels, dirty equipment, or poor hygiene.

Similarly, spent lees are rich in organic content and susceptible to microbial contamination. Common microbes include lactic acid bacteria (Lactobacillus, Pediococcus), Acetobacter, Aspergillus, and Penicillium species.

These wastewaters are reused in manufacturing processes, cooling towers, and other utilities to reduce fresh water demand and optimize water use efficiency. However, high microbial contamination can cause issues like choking and reduced heat transfer in cooling towers, hindering the manufacturing process.

In the a nutshell, Table 1 describes the microorganisms, and the problems caused by them in various industries.

Table 1: Microbes, their role and problems caused by them during industrial processes in various industries.

Industries	Microbes	Role	Problems
Sugar	Lactic Acid Bacteria	- Contamination	- pH fluctuations
	Acetobacter aceti	- Acetic acid production	- Contamination - Equipment corrosion
	Dextran-producing bacteria	- Dextran formation	- Formation of dextran in water system - Processing issues
	Molds	- Contamination	- Biofilm formation - Equipment fouling
	Bacillus sp. & *Pseudomonas sp.*	- Contamination	- Microbial growth in water systems - Spoilage and corrosion
Brewery	*Brettanomyces*	- Fermentation	- Off-flavors
	Pediococcus	- Acidification	- Production of diacetyl and other off-flavors
	Enterobacter	- Fermentation	- Spoilage - Off-flavors and aroma defects
	Lactobacillus	- Acidification	- Production of lactic acid and off-flavors
	Pectinatus	- Fermentation	- Production of hydrogen sulfide and off-flavors
Grain	*Pseudomonas, Aspergillus, Fusarium* & *Penicillium*	- Contamination	- Spoilage - Off-flavors and odors in grain products - Production of mycotoxins
	Lactobacillus	-Acidification	-Spoilage
	Bacillus sp.& *Enterobacter*	- Contamination	- Spoilage of grains - Risk of toxin production - Off-flavors
Pulp & Paper	*Pseudomonas* & *Aeromonas*	- Contamination	- Biofilm formation - Equipment corrosion - Off-flavors and odors
	Enterobacter & *Bacillus sp.*	- Contamination	- Slime formation in paper machines - Reduced paper quality
	Aspergillus & *Penicillium*	- Contamination	- Biofouling of equipment and surfaces

Overall, the microbial contamination in process water and recycled wastewaters can impact the quality, stability, and safety of sugar and alcohol production processes. Effective microbial control measures, including sanitation practices, monitoring, and treatment strategies, are essential to mitigate potential risks and ensure product quality and compliance with regulatory standards.

At **The Catalysts Group**, we excel in providing customized solutions to address industry challenges related to microbial contamination. We offer a wide range of highly concentrated antimicrobial solutions that effectively control bacterial contamination. For instance, Bacteroferm targets lactic acid-producing bacteria intensively. Our product line-up includes blends of multiple antimicrobial compounds, such as Bactosafe DF, Bactosafe I, and Bactosafe II, which cater to a broad range of microbes.

These star products are highly effective biocides recommended for dosing in both pre-fermenter and fermenter stages with specified dosages. Additional benefits of our products include the reduction of volatile acid levels in the process, alleviation of byproduct stress on yeast, and a stable shelf life of up to one year.

Role of water is enormous in industries so its treatment, recycling and judicious use are equally important. Hence concluding this article with mind storming thought:

"In industry, water is not just a commodity; it's a lifeline. Without it, production grinds to a halt, and economies suffer. That's why responsible water management is essential for the success of any industrial endeavour."

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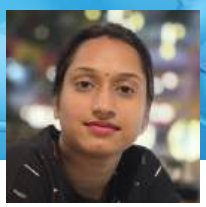
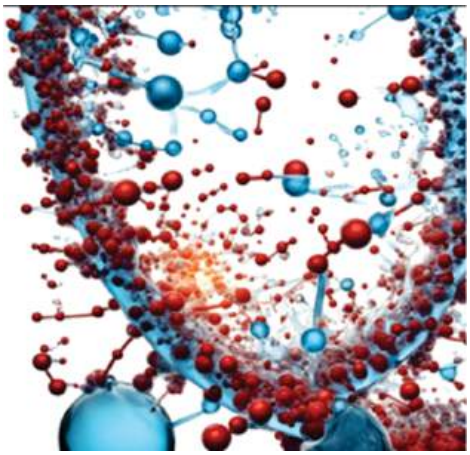
ROLE OF WATER IN FERMENTATION

Dr. Anup
R&D



Apeksha
R&D

Water, the molecule of life, is the cornerstone of biological systems, serving as the medium in which all cellular processes occur. From the smallest microorganism to the grandest multicellular organisms, water is indispensable for sustaining life and it plays a fundamental role in almost every aspect of human existence. In the realm of fermentation industry, its importance cannot be overstated. The sectors from food and beverage to pharmaceuticals and biofuels, relies heavily on water as a crucial ingredient and as a medium for facilitating biochemical reactions.



Water's ability to dissolve a wide range of chemical and compounds, makes it an ideal solvent for biochemical reactions within biological systems. Within cells, water surrounds and interacts with cell's biomolecules such as proteins, nucleic acids, and carbohydrates, helps in their folding, assembly, and enzymatic activity. Moreover, it plays a very important role in cells metabolic pathways, including glycolysis, photosynthesis, and protein synthesis. As water helps in substrate transport, enzyme catalysis, and product formation. The aqueous environment provided by water enables the dynamic interactions essential for cellular function and homeostasis. Moreover, water helps in the stabilization of the structure of the biopolymers, such as proteins, nucleotides and carbohydrates. At cellular level, the role of water molecules in the stabilization of the lamellar structure of the plasma membranes and thus in the preservation of membrane permeability. In the intracellular medium, the molecules of water linked with other molecules, such as polyols, sugars or enzymes, contribute to the maintenance of the cellular volume, especially when the cell is placed in a hypertonic medium and particularly during desiccation or freezing conditions. Similarly, water plays many crucial roles in fermentation can be described as follows: -

1. Solvent and Reactant

Water serves as a universal solvent, dissolving various compounds and facilitating their interaction during fermentation. In microbial fermentation, microorganisms utilize water as a medium to break down substrates into desired products. For instance, in the production of alcoholic beverages such as beer and wine, yeast cells ferment sugars in the presence of water to produce ethanol and carbon dioxide.

2. Temperature Regulation

Maintaining optimal temperature is crucial for the efficiency and success of fermentation processes. Water, with its high specific heat capacity, acts as a thermal buffer, absorbing and releasing heat to regulate the temperature within fermentation vessels. Industrial fermenters often employ water jackets or circulating water systems to control the temperature, ensuring that microbial cultures thrive under favourable conditions. This thermal stability is essential for preserving the viability and activity of microorganisms throughout the fermentation cycle.

3. Nutrient Transport and Metabolic Support

Microbial growth and metabolism during fermentation necessitate a constant supply of nutrients and substrates. Water plays a pivotal role in transporting these essential components to microbial cells, enabling their proliferation and metabolic activity. Additionally, water serves as a reactant in biochemical pathways, participating in hydrolysis reactions and providing hydrogen and oxygen atoms for the synthesis of cellular building blocks. In biorefineries and biofuel production, water facilitates the hydrolysis of biomass into fermentable sugars, a critical step in the conversion of renewable feedstocks into valuable products.

4. pH Regulation and Ionic Balance

The pH level of the fermentation medium profoundly influences microbial growth and product formation. Water, as a solvent, helps maintain the pH balance by dissolving acids, bases, and buffering agents present in the fermentation broth. Moreover, water molecules participate in ionization reactions, contributing to the ionic strength of the medium and influencing enzyme activity and substrate availability. Proper pH regulation is imperative for optimizing the performance of microbial cultures and ensuring the desired outcomes of fermentation processes.

5. Waste Management and Product Recovery

In addition to its role as a reaction medium, water plays a critical role in waste management and product recovery in the fermentation industry. After fermentation, the spent broth contains by-products, residual nutrients, and microbial biomass, which must be separated and treated to recover valuable products and minimize environmental impact. Water-based separation techniques such as filtration, centrifugation, and precipitation are commonly employed to isolate target compounds and purify fermented products. Furthermore, water serves as a medium for downstream processing steps such as distillation, extraction, and crystallization, facilitating the concentration and purification of fermentation-derived products.

Therefore, Water is an indispensable component of the fermentation industry, serving as a solvent, reactant, thermal regulator, nutrient transporter, pH buffer, and separation medium. Its versatile properties enable the efficient production of a wide range of fermented products, from food and beverages to pharmaceuticals and biofuels. As the demand for sustainable and eco-friendly manufacturing practices grows, optimizing water usage and implementing water-saving technologies will be paramount for the continued growth and success of the fermentation industry. By recognizing the pivotal role of water and embracing innovative approaches, we can harness its potential to drive advancements in fermentation technology and meet the evolving needs of society.

ROLE OF HPLC AND GC ASSESSING IN WATER QUALITY OF TREATED WATER AND BIOETHANOL MONITORING

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The increasing necessity for the expansion of utilizing sustainable renewable energy sources has led to a rise in the global production of biofuels (Moraes et al., 2015).The processes involved in biofuel production result in the generation of significant quantities of wastewater, particularly stillage, which is the liquid residue left after ethanol distillation following the fermentation of carbohydrates (Wilkie et al., 2000). Whether derived from sugar crops, starch crops, dairy products, or cellulosic materials, the production of ethanol from biomass leads to the simultaneous formation of stillage, which poses a significant environmental risk [1]. Among the various raw materials used, cassava stands out due to its cost-effectiveness, high yield, and minimal competition for cultivable land. During ethanol fermentation, substantial volumes of fresh water are utilized, and approximately 8–15 L of distillery waste is produced per liter of ethanol (Saha et al., 2005). Consequently, achieving substantial growth in ethanol production will necessitate the implementation of efficient strategies for managing stillage. So, analysing recycled water from wastewater treatment plants before reusing it in the fermentation process is crucial for ensuring its quality and suitability. High Performance Liquid Chromatography (HPLC) and Gas Chromatography (GC) are invaluable tools for this purpose.

The separation method HPLC with Refractive index Detector, Photo Diode Array (HPLC–RID, PDA) and GC with flame Ionisation Detector (GC-FID used in bioethanol production monitoring has been around for over 20 years, yet still remains the most popular method for fermentation monitoring due to the ability to separate different classes of compounds (sugars, organic acids, and alcohols) all in one chromatographic separation [2].

When using treated wastewater in fermentation processes, it's essential to monitor various parameters to ensure the quality and suitability of the water for microbial growth and product formation. Then these hyphenated chromatographic technique, can play a crucial role in monitoring specific contaminants and key components in the water. Here are some important parameters to monitor using these techniques

1. Quality Control of Water

Treated water is an important component in fermentation processes as it serves as the medium for microbial growth and biochemical reactions. HPLC and GC analysis of treated water ensures that it meets the required quality standards for fermentation. By detecting and quantifying contaminants, organic acids, and other by products, these analytical techniques help prevent potential inhibitory effects on microbial activity and ensure the success of the fermentation process [2].

2. Detection of Inhibitory Substances

Treated water may contain residual substances from the water treatment process or environmental contaminants that can inhibit microbial growth and fermentation efficiency. HPLC and GC analysis can identify these inhibitory substances, such as volatile acids, aldehyde, ketones or residual disinfectants, allowing for their removal or mitigation before they impact the fermentation process [3]. Minimizing the presence of inhibitory compounds helps optimize fermentation conditions and improve the overall efficiency of the process.

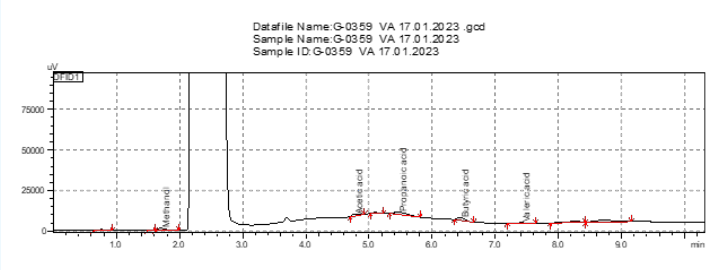
3. Assessment of Microbial Metabolites

During fermentation, microorganisms produce various metabolites, including ethanol, organic acids, aldehydes, and other volatile compounds (Figure-2). HPLC and GC are used to analyze the composition and concentration of these metabolites in the fermentation broth. Monitoring metabolite profiles provides insights into microbial activity, fermentation kinetics, and product formation, allowing for real-time process control and optimization

S.No.	Type of water	Test
1.	Process water	VA/Sugar
2	UV water	VA
3.	Leese	VA/Alcohol
4	Hot water	VA/Alcohol
5.	UV Outlet	VA
6.	Spent wash	VA/Alcohol
7.	Condensat	VA/Aldehyde/Sugar
8.	PRC/RC Leese	VA/Alcohol
9.	Pit water	VA/Alcohol
10	CPU Water	VA
11.	ETP Outlet	VA

Table-1 Type of water analysed of by HPLC and GC during fermentation process

**Volatile acids(VA) - Acetic acid, Lactic acid, Valeric acid, Butyric acid, Propionic acid etc.*



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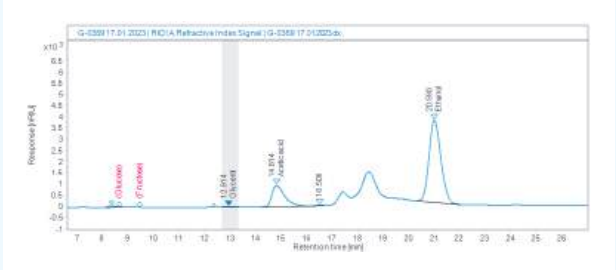

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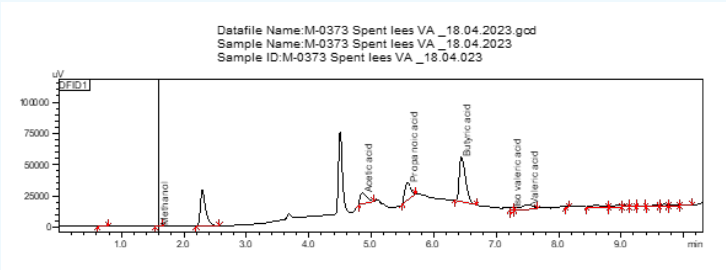

(c)

Figure 2. Chromatogram (a) Hot water GC analysis (b) Hot water HPLC analysis (c) Spent lees GC

Figure -3 GC with FID detector

GC with FID for Contaminant Analysis: GC with FID is highly sensitive and selective for the analysis of organic compounds, including volatile contaminants **(Table -1),** in water samples. This technique can detect a wide range of organic compoounds, by products, and residual chemicals from water treatment processes that may inhibit microbial fermentation or affect ethanol production efficiency. By monitoring contaminants at ppm levels, GC with FID enables proactive management of water quality, ensuring that the fermentation process is not compromised by the presence of harmful substances **(Figure-3).**

Figure -4 HPLC with R.I and PDA detector

HPLC with RID for Volatile Acid Analysis: HPLC with RID is well-suited for the analysis of volatile acids, such as acetic acid, lactic acid, and other organic acids, in water samples. These acids can accumulate in the fermentation broth due to microbial metabolism and can negatively impact the fermentation process, leading to decreased ethanol yield and productivity. By accurately quantifying volatile acids at ppm levels, HPLC with RID allows for early detection of acid build-up in the water, enabling timely interventions such as pH adjustment or nutrient supplementation to maintain optimal fermentation conditions (Figure-4).

Early detection of these contaminants allows for timely corrective actions to be taken, minimizing the risk of process disruptions, fermentation failures, or product quality issues. By controlling water quality parameters within optimal ranges, producers can consistently produce high-quality ethanol with desirable characteristics, meeting customer specifications and regulatory requirements.

In summary, leveraging the analytical capabilities of HPLC-RID and GC-FID for water quality monitoring enables ethanol producers to mitigate the risks associated with volatile acids and contaminants, ensuring the smooth operation and efficiency of the fermentation process.

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Account for 90% of beer production worldwide, Lager beer with the word “lager” comes from the German expression "zu lagern" whose translation is "to store”. There is substantial evidence that the first lagered beers were produced in the 12th and 13th centuries, probably using mixed cultures containing some cryophilic bottom-fermenting yeasts. These yeast cultures differed from the modern lager yeast, which belongs to *Saccharomyces pastorianus* species and are currently associated with bottom-fermenting yeast. *S. pastorianus* is an inter species hybrid between *Saccharomyces cerevisiae* and *Saccharomyces eubayanus* (parental species). Also, it is well accepted that the lager yeasts we know today have a common ancestor, which means they originated from one hybridization event, probably occurring at the beginning of the 17 centuries in Bavaria. Additionally, through domestication in different breweries, two clear lineages were developed from the common ancestor: the Saaz and Frohberg groups.

S. eubayanus was first isolated in 2011 from the cold Patagonian forests. Later, wild populations were also found in other cold regions of the globe. This explains why the resulting hybrid *S. pastorianus* is well adapted to fermenting at low temperatures. The most widely accepted theory explaining how the hybrid was formed is that a wild *S. eubayanus* was probably introduced as a contaminant in the beer fermentative environment dominated by *S. cerevisiae*. From which wild population the parental *S eubayanus* originates is still a subject of debate. However, the German researcher Mathias Hutzler and his collaborators, after analyzing different evidence including historical records and contemporary phylogenetics research, proposed recently that *S. eubayanus* could also be part of the beer fermentative environment and used to produce former bottom-fermenting beers. The coincidence in one single brewery of beers produced with *S. cerevisiae* and bottom fermenting cultures carrying *S. eubayanus* was likely the event that facilitated the formation of the hybrid. Furthermore, analysis of the evidence also allowed this group of researchers to speculate that the hybridization event occurred in the early 1600s in a Bavarian brewery.

The history of beer yeast domestication, particularly lager yeast, is fascinating. With more archeological evidence, DNA samples analyzed, and literature reviewed, more information will be available that will allow brewers and researchers to understand better the processes leading to the domestication and generation of different variants of brewing yeasts.

Choosing the right yeast for your lager(s) can be challenging and at Fermentis, we offer plenty of solutions for you.

SafLager™ E-30 (Newest launch)	SafBrew™ LD-20	SafLager™ W-34/70	SafLager™ S-23	SafLager™ S-189
This strain has been meticulously selected for its ability to produce aromatic and flavorful beers. With a profound ester production, it delivers a unique banana-like flavor that's perfect for lagers and fruity-oriented styles. Our medium sedimentation yeast won't form clumps but will instead leave a powdery haze when resuspended in the beer. Whether you're brewing a classic lager or pushing the boundaries with a more creative recipe, our new yeast will give your beer a unique twist	The perfect choice to produce very dry and neutral lager beers with reduced residual sugars and a fairly neutral flavor profile. It is an All-In-1™ solution made of both active dry yeast and enzymes. SafBrewTM LD-20 allows the production of beers containing the same level of alcohol with a reduction of up to 20% of carbohydrates* including dextrins. This blend performs in many different brewing conditions, at low temperature fermentation	This famous brewer's yeast strain from Weihenstephan in Germany is used world-wide within the brewing industry. SafLager™ W-34/70 allows the brewing of beers with a good balance of floral and fruity aromas and gives clean flavors and high drinkable beers	Bottom fermenting brewer's yeast originating from Berlin in Germany, SafLager™ S-23 is recommended to produce fruitier and more estery lagers. Its profile gives beers with a good length on the palate	Originating from the Hürlimann brewery in Switzerland, this lager yeast strain's profile allows to brew fairly neutral flavor beers with a high drinkability. Depending on the conditions, it tends to present noticeable herbal and floral notes.

THE ESSENCE OF BREWING: EXPLORING THE ROLE OF WATER IN THE BREWERY

Mrityunjay Verma
R&D

Dipti Verma
R&D

Introduction:

Water is crucial for brewing beer, shaping its taste, aroma, and character. It's not just an ingredient; it's the foundation of the brewing process. The mineral composition and pH level of water affect every stage of brewing. Since brewing is water-intensive, with several gallons used per gallon of beer produced, efficient water management is essential. Many breweries save water by recycling, using water-efficient equipment, and optimizing cleaning methods. Understanding the relationship between water and beer helps brewers create a wide variety of flavourful brews, making water an unsung hero in crafting the perfect beer.

The Foundation of Flavour

Beer is primarily composed of water, accounting for over 90% of its makeup, making water quality essential in brewing. Various water sources, whether from a pristine mountain stream or a municipal supply, contain distinct mixes of minerals and ions. Key minerals such as calcium, magnesium, sodium, sulphate, and chloride significantly influence the beer's flavour profile.

The Role of Minerals:

Minerals in water serve multiple functions throughout the brewing process. Calcium, for instance, plays a crucial role in enzyme activation during mashing, aiding in the conversion of starches into fermentable sugars. Magnesium influences yeast health and fermentation vigour, while sulphate and chloride ions impact the perception of bitterness and sweetness, respectively. By carefully adjusting the mineral content of water,

brewers can tailor it to suit specific beer styles, enhancing their characteristics and bringing balance to the final product.

Carbonate: It determines the buffering capacity of water, it can bind with metal ion, increasing the water pH.

NH_4^+ : When the concentration of NH_4^+ in water exceeds 0.5mg/L, the water is contamination, in the production process NH_4^+ will be oxidate into nitrite which is toxic to yeast.

SO_4^{2-} : Sulphate enhances beer aroma by promoting degradation protein and starch, however to much sulphate can result unpleasant & bitter flavour.

Cl^- : Chloride promotes the colloidal stability and clarification of beer, it can give rich, refreshing, gentle flavour. Its content in the water brewing should be 20 mg / L-60mg / L, the maximum of chloride cannot exceed 100mg / L. it will cause premature of yeast, and corrode the container more than 300mg/L.

Ca^{2+} : When the content of Ca^{2+} is 40-70mg / L, it maintains the heat resistance of enzyme. The oxalic acid concentration decreases as the total hardness of mashing water increases. Most of the oxalic acid in wort is deposited when the Ca^{2+} in mashing water adds up to 80-100mg/L.

Na^+ & K^+ : Na^+, K^+ make beer light rough, not soft, requiring brewing water in the Na^+, K^+ content is low, if they are more than 100mg/L, this water not suitable for brewing light beer.

pH Balance:

Another critical aspect of water management in brewing is pH balance. The pH level of water affects enzymatic activity during mashing and can influence the stability of the final beer. Generally, a slightly acidic pH is desirable for mashing, as it promotes efficient starch conversion. However, excessively low or high pH levels can lead to undesirable flavours and haze formation. Brewers employ various techniques, such as acidification or blending with neutral water, to achieve the optimal pH for each stage of the brewing process.

Regional Variation:

One fascinating aspect of water in brewing is its regional variation. Different geographical locations boast distinct water profiles, shaped by factors such as geological formations and local water treatment practices. Historically, beer styles have evolved in tandem with the available water sources, giving rise to regional brewing traditions and flavour preferences. For example, the soft waters of Pilsen, Czech Republic, are celebrated for their role in producing crisp and clean lagers, while the sulphurous waters of Burton-upon-Trent, England, are renowned for their contribution to the distinctive character of British ales.

Water Conservation:

In an era where environmental sustainability is paramount, breweries are increasingly mindful of their water usage. From grain to glass, brewing is a water-intensive process, requiring significant quantities for mashing,

lautering, cooling, and cleaning. Many breweries have implemented water-saving measures, such as recirculation systems, wastewater treatment, and rainwater harvesting, to minimize their environmental footprint without compromising the quality of their beer.

Conclusion:

Water is the unsung hero of the brewing world, silently shaping the flavours and aromas that tantalize our taste buds. From its mineral composition to its pH balance, every aspect of water chemistry influences the brewing process, allowing brewers to craft an endless array of beer styles with precision and finesse. As we raise our glasses in celebration of the brewer's art, let us also raise a toast to the humble yet mighty molecule that makes it all possible: water.

IMPACT OF MOLASSES SLUDGE ON YEAST STRESS DURING ETHANOL FERMENTATION

Neeraj Kumar
Technical Solutions

Ethanol fermentation is a widely practiced industrial process, utilizing yeast to convert sugars into ethanol and carbon dioxide. Molasses, a by-product of sugar refining, is commonly used as a feedstock for ethanol production due to its high sugar content. However, molasses sludge, a residue from molasses processing, presents challenges to yeast during fermentation. This article delves into the technical intricacies of how molasses sludge imposes stress on yeast cells, hindering their fermentation efficiency.

Introduction:

Ethanol fermentation plays a pivotal role in various industries, including biofuel production, beverage manufacturing, and pharmaceuticals. Saccharomyces cerevisiae, commonly known as baker's yeast, is the microorganism predominantly employed for ethanol production due to its robust fermentation capabilities. Molasses, a viscous syrup derived from sugar cane or sugar beet processing, serves as an economical and abundant source of fermentable sugars for ethanol fermentation. However, the presence of molasses sludge, a

by-product of molasses purification, poses challenges to yeast cells, impacting their viability and fermentation performance.

Physicochemical Characteristics of Molasses Sludge:

Molasses sludge exhibits distinct physicochemical properties that influence its interaction with yeast cells during fermentation. The sludge is characterized by high viscosity, attributed to its elevated content of dissolved solids and suspended particles. This high viscosity impedes the diffusion of nutrients and oxygen to yeast cells, limiting their access to essential substrates and compromising fermentation efficiency. Furthermore, molasses sludge typically exerts a high osmotic pressure due to its concentrated sugar content, resulting in water loss from yeast cells and triggering osmotic stress responses.

Impact of Osmotic Stress on Yeast Physiology:

The high osmotic pressure in molasses sludge subjects yeast cells to osmotic stress, necessitating adaptive responses to maintain cellular homeostasis. Upon exposure to hyperosmotic environments, yeast cells activate osmoregulatory mechanisms to counteract water loss. This includes the synthesis and accumulation of compatible solutes such as glycerol and trehalose, which function as osmoprotectants to mitigate osmotic stress. However, the diversion of metabolic resources towards osmoregulation reduces the efficiency of fermentation pathways, leading to decreased ethanol production rates.

Toxic Compounds in Molasses Sludge:

Molasses sludge may contain various impurities and by-products, including organic acids, furans, phenols, and heavy metals, which can exert toxic effects on yeast cells. Organic acids such as acetic acid and formic acid can disrupt cellular membranes and inhibit enzymatic activities involved in sugar metabolism. Furans, generated during the thermal processing of molasses, interfere with glycolytic enzymes, impairing the efficiency of ethanol production. Phenolic compounds present in molasses sludge induce oxidative stress in yeast cells, leading to cellular damage and reduced viability.

Influence of Low pH on Yeast Metabolism:

The acidic nature of molasses sludge, with pH levels typically ranging from 4.0 to 5.5, further exacerbates yeast stress during fermentation. Low pH conditions disrupt the proton gradient across mitochondrial membranes, impairing ATP synthesis and diminishing cellular energy levels. Additionally, acidic environments inhibit the activity of glycolytic enzymes, perturbing the flux of sugar metabolism. Consequently, yeast cells experience metabolic inhibition and reduced fermentation capacity in acidic molasses sludge.

Nutrient Limitation in Molasses Sludge:

While molasses provides abundant fermentable sugars, it may be deficient in essential nutrients required for yeast growth and metabolism. Nitrogen, a critical nutrient for protein synthesis and nucleic acid metabolism, is often limited in molasses-based fermentation. The absence of nitrogen sources hampers yeast proliferation and compromises fermentation efficiency. Furthermore, vitamins and minerals such as vitamins B complex, zinc, and magnesium serve as cofactors for key enzymes in fermentation pathways. Their deficiency in molasses sludge impairs enzyme function and inhibits ethanol production.

Conclusion:

Molasses sludge presents a multifaceted challenge to yeast cells during ethanol fermentation, impacting their physiology and metabolic activities. The high viscosity, osmotic pressure, presence of toxic compounds, low pH, and nutrient limitation collectively contribute to yeast stress and reduced fermentation efficiency. Understanding the complex interplay between molasses sludge characteristics and yeast physiology is essential for optimizing ethanol production processes and developing strategies to mitigate yeast stress in industrial fermentation settings. Further research into the mechanisms underlying yeast-molasses interactions will facilitate the advancement of sustainable and efficient biofuel production technologies.

Typical sugarcane molasses sludge composition:

The composition of sugarcane molasses sludge can vary depending on factors such as the source of the molasses, the sugar extraction process, and any additional treatments or refining steps. However, typical sugarcane molasses sludge composition includes the following components:

Sugars: Sugarcane molasses sludge is rich in fermentable sugars, primarily sucrose, glucose, and fructose. These sugars serve as the primary carbon sources for yeast during fermentation.

Organic Acids: Molasses sludge may contain organic acids such as acetic acid, formic acid, and lactic acid. These organic acids can contribute to the acidic pH of the sludge and may affect yeast metabolism during fermentation.

Proteins: Sugarcane molasses sludge contains proteinaceous material, including amino acids and peptides. While not as abundant as sugars, proteins can serve as nitrogen sources for yeast growth and metabolism.

Ash: Molasses sludge typically contains inorganic minerals and ash derived from the sugarcane plant material. These minerals include potassium, calcium, magnesium, and traces of other elements such as iron, zinc, and manganese.

Impurities: Molasses sludge may contain various impurities and contaminants, including suspended solids, organic compounds, and by-products of the sugar extraction process. These impurities can include non-sugar organic compounds, such as phenolic compounds, furans, and aromatic compounds, as well as trace amounts of heavy metals.

Water: Molasses sludge has a high moisture content, with water comprising a significant portion of its composition. The moisture content can influence the viscosity and flow properties of the sludge.

It's important to note that the specific composition of sugarcane molasses sludge can vary depending on factors such as the processing method, the stage of sugar extraction, and any treatments or refining steps applied to the molasses. Analytical techniques such as chromatography, spectrometry, and elemental analysis are commonly used to determine the detailed composition of molasses sludge in industrial settings.

NANOFILTRATION MEMBRANE TECHNOLOGY

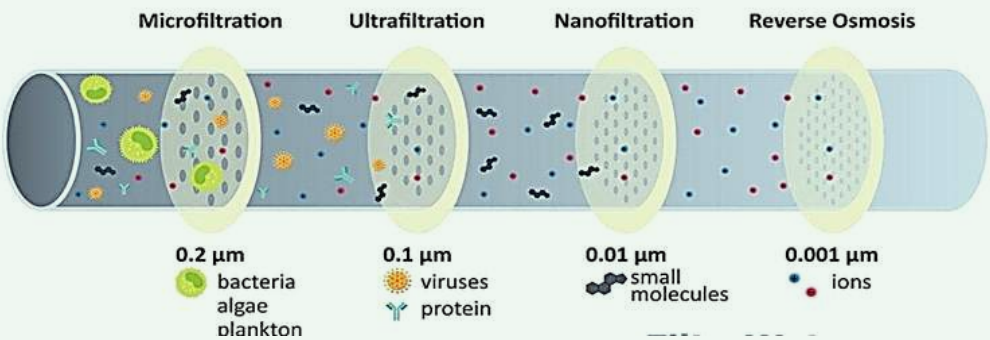
Vishal Dhiman
R&D

Nanofiltration is primarily employed to eliminate larger monovalent ions, such as heavy metals and divalent ions, responsible for water hardness. This technique is commonly utilized for water softening due to its utilization of fewer fine membranes, resulting in lower feed pressure compared to reverse osmosis (RO) systems. Additionally, nanofiltration exhibits a lower fouling rate in contrast to RO systems.

Nanofiltration can be viewed as a coarser version of RO membranes, featuring a pore size around 0.001 micron. It effectively eliminates most organic molecules, nearly all viruses, a significant portion of natural organic matter, and a variety of salts. Furthermore, nanofiltration membranes possess ion-selective properties, allowing them to differentiate between various ions. This capability stems from the membrane's tendency to attract solid-loaded groups within its structure, potentially leading to electrostatic repulsion or attraction forces between the liquid components and the membrane surface, resulting in a degree of ion selectivity.

Considering the sieve effect with a pore size of 1 nm and the molecular size of chlorides (0.12 nm), it is anticipated that specific ions will diffuse through the membrane. In nanofiltration (NF), a high-pressure pump is utilized to elevate the pressure on the salt side of the membrane, prompting water to cross the semipermeable NF membrane while leaving nearly all dissolved salts in the reject stream. Concurrently, it can reduce monovalent ions by 60-80%.

Compared to microfiltration and ultrafiltration, nanofiltration demonstrates superior performance.



Nanofiltration membranes come in various types:

1. Spiral Modules: These modules comprise layers of polyamide membrane wound in a spiral fashion. The wound layers are sealed with a cap at the membrane's edge. A permeate collection tube is positioned at the center of the wound module, where all the clean water is gathered after passing through the spiral windings.

2. Tubular Membrane Modules: Tubular modules are structured like tubes with porous walls and operate

through tangential crossflow.

Commonly used membrane materials include polymer thin films like polyethylene terephthalate and metals such as aluminium.

A membrane system typically consists of several key components:

- Feed Pump
- Membrane Elements housed in pressure vessels
- Pipes
- Cleaning System

Importance of Nanofiltration as a pre-treatment before RO treatment

Appropriate pre-treatment to ensure optimum performance of reverse osmosis (RO) systems is necessary. RO manufacturers consistently recommend specific inlet water parameters to uphold optimal performance and prolong membrane lifespan. Any deviation from these parameters can result in significant downtime and damage to production processes.

Traditional pre-treatment methods often fall short of achieving these recommendations and other parameters outlined by RO manufacturers with complete reliability. Recognizing these limitations, membrane filtration, particularly nanofiltration (NF), is increasingly acknowledged as the ideal pre-treatment method preceding RO.

Nanofiltration (NF) stands out as theoretically the most effective pre-treatment strategy before an RO system. It effectively eliminates a wide range of potential elements from the feed water that are responsible for membrane fouling, including particles, turbidity, bacteria, and small molecular weight organic matter.

Specific advantages and disadvantages of NF

Advantages:

- **Lower Discharge Volumes:** NF typically generates lower discharge volumes and lower retentate concentrations compared to RO, especially for low-value salts.
- **Reduction of Salt and Dissolved Matter:** NF effectively reduces salt content and total dissolved solids (TDS) in brackish water.
- **Removal of Heavy Metals and Sugars:** NF contributes to the reduction of heavy metals and sugars in water.
- **Decrease in Nitrates and Sulphates:** NF processes result in a reduction of nitrates and sulphates in water.
- **Improvement in Water Aesthetics:** NF reduces color, tannins, and turbidity in water, enhancing its visual clarity.
- **Water Softening:** Specific softening membranes used in NF can effectively soften hard water.
- **Chemical-Free Operation:** NF operates without the need for added salt or chemicals, making it an environmentally friendly option.
- **pH Regulation:** The pH of water after nanofiltration is typically non-aggressive.
- **Disinfection:** NF contributes to water disinfection, enhancing its safety.

Disadvantages:

- **Higher Energy Consumption:** NF typically consumes more energy compared to ultrafiltration (UF) and microfiltration (MF), ranging from 0.3 to 1 kWh/m^3.
- **Pre-Treatment Requirement:** Some heavily polluted waters require pre-treatment, such as pre-filtration (0.1 - 20 microns), particularly with spiral-wound membranes.
- **Limited Retention:** NF has limited retention capabilities for salts and univalent ions.
- **Sensitivity to Free Chlorine:** NF membranes are sensitive to free chlorine, necessitating the use of active carbon filters or bi-sulphite treatment for high chlorine concentrations.

- **Cost and Maintenance:** NF membranes are relatively expensive and require regular maintenance. Replacement intervals depend on factors such as total dissolved solids, flow rate, and feed composition. Compared to reverse osmosis membranes, NF membranes tend to be more costly.

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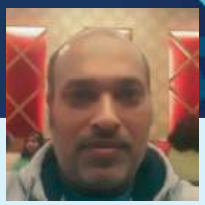
HOW COMPANIES REAP HUGE DIVIDENDS BY INVESTING IN LEADERSHIP TRAININGS



Shivoham Tayal
Finance

In today's highly competitive business environment, the ability to effectively lead and inspire teams is more critical than ever. Companies that invest in leadership training often see significant returns on their investment, not just in financial terms but also in organizational culture and employee satisfaction. This article explores the various ways in which investing in leadership training can yield substantial dividends for companies.

Enhancing Employee Performance and Productivity

Improved Decision-Making

One of the primary benefits of leadership training is the enhancement of decision-making skills. Effective leaders can make informed, strategic decisions that drive the company forward. Training programs equip leaders with the tools and techniques necessary to evaluate situations, consider various outcomes, and choose the best course of action. This leads to better operational efficiency and improved overall performance.

Increased Employee Engagement

Leadership training also plays a crucial role in increasing employee engagement. When leaders are well-trained, they are more capable of fostering a positive work environment where employees feel valued and motivated. Engaged employees are more productive, committed, and less likely to leave the organization, reducing turnover rates and associated costs.

Building a Strong Organizational Culture

Fostering Innovation

A strong leadership training program encourages a culture of innovation. Leaders who are trained to think creatively and embrace change are better equipped to foster an innovative mindset within their teams. This can lead to the development of new products, services, and processes that give the company a competitive edge in the marketplace.

Enhancing Communication

Effective communication is a cornerstone of strong leadership. Leadership training helps leaders develop the skills needed to communicate clearly and effectively with their teams. This not only helps in the smooth execution of projects but also in building trust and transparency within the organization. Clear communication helps in aligning the team with the company's vision and goals, ensuring everyone is working towards the same objectives.

Developing Future Leaders

Succession Planning

Investing in leadership training is also an essential component of succession planning. By developing a pipeline of well-trained leaders, companies can ensure that they have capable individuals ready to step into leadership roles as they become available. This continuity is crucial for maintaining stability and achieving long-term business success.

> *"86% of business leaders believe leadership development is critical to their organization's success."*
>
> ***- Boston Consulting Group (BCG)***

Identifying High Potential Employees

Leadership training programs often help in identifying high-potential employees who may be suited for future leadership roles. By investing in their development early on, companies can nurture these employees, providing them with the skills and experience necessary to take on greater responsibilities in the future.

Financial Returns and Business Growth

Higher ROI

While the initial investment in leadership training can be substantial, the return on investment (ROI) is often significantly higher. Companies with effective leaders tend to outperform their competitors, achieve higher profit margins, and experience sustained growth. The skills and strategies learned in leadership training can lead to better resource management, more effective teams, and increased operational efficiency.

> *"Companies with strong leadership development programs outperform their peers by 17% in revenue growth."*
>
> ***- Harvard Business Review***

Competitive Advantage

Leadership training provides companies with a competitive advantage. Leaders who are well-trained can navigate the complexities of the business world more effectively, leading their teams to innovate and adapt to changing market conditions. This agility allows companies to stay ahead of the competition and capitalize on new opportunities.

Improving Employee Retention and Satisfaction

Career Development

Employees are more likely to stay with a company that invests in their professional development. Leadership training is an excellent way to show

employees that the company values their growth and is willing to invest in their future. This leads to higher employee satisfaction and loyalty, reducing turnover rates and the costs associated with recruiting and training new employees.

> *"94% of employees would stay at a company longer if it invested in their career development, including leadership training."*
>
> **- *LinkedIn Learning***

Empowering Employees

Leadership training not only benefits those in leadership positions but also empowers all employees. When leaders are well-trained, they can effectively mentor and support their team members, fostering an environment of continuous learning and improvement. This empowerment leads to a more motivated and capable workforce, driving the company towards its goals.

Conclusion

Investing in leadership training yields significant dividends for companies, ranging from enhanced employee performance and productivity to stronger organizational culture and improved financial returns. By developing capable leaders, companies can foster innovation, ensure effective communication, and build a pipeline of future leaders. The benefits of leadership training extend beyond the immediate financial gains, contributing to long-term business success and a thriving organizational environment. In an ever-evolving business landscape, the importance of effective leadership cannot be overstated, making leadership training a crucial investment for any company seeking sustained growth and success.

HEALTH PREREQUISITE

BEING VIGILANT ABOUT YOUR OWN SYSTEM AND FOOD

Nisha Malhotra
Human Resources

In today's fast-paced world, maintaining good health is more important than ever. One of the fundamental aspects of health is being vigilant about your body and food intake. This involves paying close attention to the signals your body sends you and making conscious choices about what you consume. This article delves into the importance of being vigilant about your body and food intake, providing insights and actionable tips to help you achieve optimal health.

Understanding Your Body's Signals

Listening to Your Body

Your body constantly communicates with you through various signals. These signals can include hunger, thirst, fatigue, and even pain. Being attentive to these signals can help you understand what your body needs.

- **Hunger and Fullness:** Recognize when you are genuinely hungry and when you are full. This can prevent overeating and help maintain a healthy weight.
- **Fatigue:** Persistent fatigue can be a sign of nutritional deficiencies, lack of sleep, or underlying health issues. Addressing these signals promptly can prevent more serious health problems.

Regular Health Check-ups

Regular health check-ups are crucial for early detection and prevention of potential health issues. Annual physical exams, blood tests, and screenings can help monitor your health and catch any problems early.

Frequency	Check-up/Screening
Annual	Physical Exam, Blood Tests
Bi-annual	Dental Check-up
Every 2 Years	Eye Exam, Cholesterol Screening

The Importance of Balanced Nutrition

Macronutrients and Micronutrients

A balanced diet includes an appropriate mix of macronutrients (carbohydrates, proteins, and fats) and micronutrients (vitamins and minerals). Each nutrient plays a vital role in maintaining bodily functions.

- Carbohydrates: Provide energy for daily activities.
- Proteins: Essential for building and repairing tissues.
- Fats: Support cell growth and protect organs.
- Vitamins and Minerals: Crucial for immune function, bone health, and overall well-being.

Whole Foods vs. Processed Foods

Whole foods, such as fruits, vegetables, whole grains, and lean proteins, are rich in nutrients and beneficial for health. Processed foods, on the other hand, often contain added sugars, unhealthy fats, and preservatives, which can contribute to various health issues such as obesity, diabetes, and cardiovascular diseases.

"A diet rich in fruits, vegetables, whole grains, and healthy fats can reduce the risk of chronic diseases by up to 80%."

- Harvard School of Public Health

Food Type	Benefits	Drawbacks
Whole Foods	Rich in nutrients, high in fiber, support overall health	Often require more preparation time, can be more perishable
Processed Foods	Convenient, longer shelf-life	High in added sugars, unhealthy fats, and preservatives; can lead to health issues

The Role of Hydration

Importance of Staying Hydrated

Water is essential for almost every bodily function, including digestion, absorption, circulation, and temperature regulation. Staying hydrated helps maintain optimal body functions and prevents dehydration, which can cause fatigue, headaches, and impaired cognitive function.

Age Group	Recommended Daily Water Intake
Children (4-8)	5 cups (1.2 liters)
Teenagers	8-11 cups (1.9-2.6 liters)
Adults	11-15 cups (2.7-3.7 liters)

Signs of Dehydration

Being vigilant about your hydration levels is crucial. Common signs of dehydration include:

- Dark yellow urine
- Dry mouth and skin
- Fatigue and dizziness
- Headaches

"Staying hydrated can improve cognitive function by 30% and physical performance by up to 20%."

- Center for Disease Control and Prevention (CDC)

Mindful Eating Practices

Eat Slowly and Mindfully

Mindful eating involves paying full attention to the experience of eating and drinking. This includes noticing the colors, smells, textures, flavors, and even the sounds of your food. Eating slowly allows your body to register fullness, which can prevent overeating and promote better digestion.

Avoid Emotional Eating

Emotional eating can lead to overeating and unhealthy food choices. Being aware of your emotional triggers and finding healthier ways to cope with stress, such as exercising or meditating, can help you maintain a balanced diet.

Regular Physical Activity

Benefits of Exercise

Regular physical activity is a cornerstone of a healthy lifestyle. It helps control weight, reduces the risk of chronic diseases, improves mental health, and increases lifespan. Aim for at least 150 minutes of moderate-intensity aerobic activity or 75 minutes of vigorous-intensity activity each week, along with muscle-strengthening activities on two or more days a week.

Activity Type	Recommended Duration
Moderate-intensity aerobic	150 minutes per week
Vigorous-intensity aerobic	75 minutes per week
Muscle-strengthening	2 or more days per week

Importance of Sleep

Quality Sleep for Optimal Health

Quality sleep is as important as nutrition and exercise for maintaining health. Poor sleep can affect your mood, cognitive function, and overall health. Adults should aim for 7-9 hours of sleep per night.

Age Group	Recommended Sleep Duration
Children (6-12)	9-12 hours
Teenagers (13-18)	8-10 hours
Adults	7-9 hours

Practical Tips for Being Vigilant About Your Health

Keep a Food Diary

Tracking what you eat can help you become more aware of your food intake and identify any areas for improvement. It can also help you recognize patterns and triggers that lead to unhealthy eating habits.

Regular Physical Exams

Scheduling regular check-ups with your healthcare provider helps you stay on top of your health and address any issues early. Keep a record of your health screenings and vaccinations.

Stress Management

Chronic stress can negatively impact your health. Practice stress management techniques such as deep breathing, yoga, and mindfulness meditation to maintain a balanced and healthy lifestyle.

Conclusion

Being vigilant about your body and food intake is essential for maintaining optimal health. By paying attention to your body's signals, consuming a balanced diet, staying hydrated, practicing mindful eating, engaging in regular physical activity, and ensuring quality sleep, you can enhance your overall well-being. Incorporating these practices into your daily routine not only prevents health issues but also improves your quality of life. Remember, small, consistent efforts can lead to significant positive changes in your health over time. Investing in your health by being vigilant about your body and food intake is a crucial step toward a healthier, happier life.

Employee Engagement

NEW Joiners

Parveen Bhatia
Accounts
01-Nov-24

Sanya Mahindru
Marketing
19-Nov-24

Amit Mahadev Patil
Technical Solutions
20-Nov-24

Yash Kumar Sahu
Technical Solutions
26-Nov-24

Imankalyan Nag
Technical Solutions
26-Nov-24

Santosh Haridas Sarde
Technical Solutions
29-Nov-24

Mohit Kumar
Technical Solutions
02-Dec-24

Rajneesh Gupta
BD
02-Dec-24

Rajan Mishra
QMS
03-Dec-24

Ogireddy Sri Apoorva
R&D
10-Dec-24

Dadason D. Thavare
Technical Solutions
20-Dec-24

Pawan Kumar
Accounts
23-Dec-24

Employee Engagement

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Siddagonda S. Karikatti
Logistics
07-Feb-25

Aakriti Koul
QMS
10-Mar-25

Abhishek Sharma
BD
10-Mar-25

Mihit Shree
BD
10-Mar-25

Anuj Rajput
R&D
31-Mar-25

Alok Singh
Technical Solutions
02-Jan-25

Vinay Rathaur
CRM
10-Feb-25

Cheevendra N.
Technical Solutions
24-Feb-25

Bonthalakoti S.
Technical Solutions
24-Feb-25

Avanindra Babu
BD
10-Mar-25

Abhishek Sharma
Technical Solutions
31-Mar-25

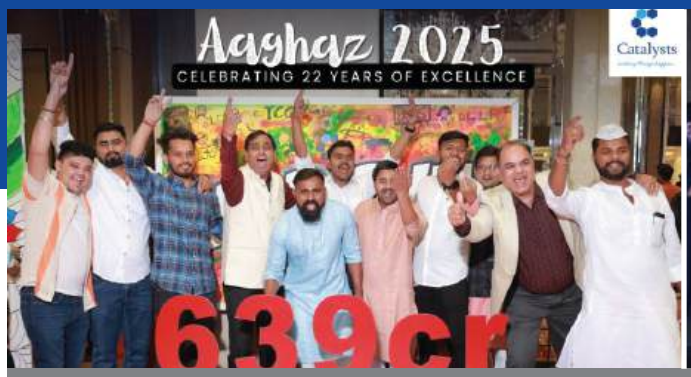
Anmol Minz
Technical Solutions
31-Mar-25

Sudip Maity
Technical Solutions
31-Mar-25

Arnab Gon
Technical Solutions
31-Mar-25

Partha Dey
Technical Solutions
31-Mar-25

Company's Celebrations & Activities



Aaghaz 2025, Delhi, May 2025


Unnati Social Foundation, Rajnagar Extension, Apr. 2025

Closing 2025 (635+ Cr), HO, Delhi, Apr. 2025

Marathon, Greater Noida West, Mar. 2025


One-Day Outing @ Browntown Resort (South India Team), Hyderabad, Mar. 2025


Isha Foundation, Chattarpur, Delhi, Mar. 2025


One day outing (HO & Plant Team) @ Rurban Resort, Ghaziabad, Feb. 2025


Belagavi Office Opening, Belagavi, Karnataka, Jan. 2025

CSR Initiative, Nirbhed Foundation, Ghaziabad, Jan. 2025

Seminar & Conferences

Shakti Ethanol Summit 2025 Leaf, France, Apr. 2025

UP Sugar Mills Association(UPSMA), Lucknow, May 2025

Jagran Institute, Kanpur, Apr. 2025

SISSTA Chennai, Belagavi, Apr. 2025

The Catalysts Group & Joe White Maltings collab Brew, Bangalore, May 2025

Philsutech ATBEM, Planta Centro Bacolod Hotel & Residences, Feb. 2025

Company's Celebrations & Activities

Catalysts HO Team Outing, Jim Corbett, August 2024

Secret Santa on Christmas eve at all offices

CSR Activity - Lakshya Trust, Modinagar, Ghaziabad

Seminar & Conferences

Brew Asia, Singapore, 3-4 October 2024

Brews & Spirits Conference, Bengaluru, September 2024

DSTA Conference, Pune, July 2024

Fermentis Sharing Days, France, Dec. 2024

Seminar & Conferences

Catalysts Technical Workshop, Indore, Aug. 2024

Catalysts Technical Workshop, Pune, Sept. 2024

Catalysts Technical Workshop, Durgapur, Oct. 2024

Leaf Technical Workshop, Delhi, Nov. 2024

Seminar & Conferences

Dates July 19, 2024 (Friday) Venue Hyatt Centric, New Delhi, Indi

Events & Conferences - IAPSIT & Sugarcon Conference, Vietnam, Sept. 2024

Events & Conferences - STAI Conference, Jaipur, July 2024

In last 22 years, Catalysts prevented losses of worth

₹ 10,700+ Crore

of customers in Distilling, Sugar and Brewing Industries

39+	985+	23+
Products	Clients	Countries

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THE CATALYSTS GROUP

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Certifications:

FSSC 22000 · DSIR Recognized · KLBD · fssai · ISO 9001:2015 Certified Company · Halal Certified · Kosher Certified