Catalysts

CONNECT

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Contents

MD's Desk

Munish Madaan
MANAGING DIRECTOR

Hello Friends,

I hope this edition finds you in good health and high spirits. As we step into the third quarter of the year, I am pleased to share some significant developments in the global and Indian financial sectors, particularly in relation to India's Ethanol program and the growing trend of grain-to-ethanol plants.

Worldwide, the sugar industry is experiencing a transformative shift towards ethanol production. In countries like Brazil, a significant portion of sugarcane is now directed towards ethanol, with only 40-45% allocated for sugar production. Similarly, India has made remarkable progress in its Ethanol Blending program, achieving the 10% blending target after years of focused efforts. With the aim of reaching 20% blending by 2025, this policy allows for the utilization of various feedstocks, including grains, providing flexibility to mills and enhancing distilleries' capacity utilization.

While India accounts for 19% of global sugar production, its share in ethanol production stands at only 2%. To achieve the ambitious E20-by-2025 target, distilleries will need to produce 1,021 crore litres of ethanol annually. Currently, the ethanol production capacity from sugar mills is 440 crore litres per year, while grain-based distilleries contribute over 260 crore litres per year.

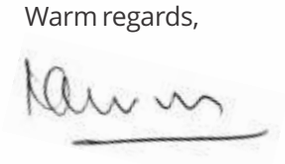
Despite some concerns surrounding weather and rainfall patterns across the country, we remain hopeful that the upcoming season will bring abundant crops and success to our farmers and the industry as a whole. This growth will not only benefit our economy but also contribute to the larger cause of sustainable energy and reducing our carbon footprint.

At The Catalysts Group, we have been at the forefront of supporting the Ethanol program in India. Our expertise in providing enzymes, yeasts, and additive-based solutions has enabled our clients to maximize ethanol production while ensuring optimal utilization of resources. We have witnessed the positive impact of our solutions on the efficiency and profitability of distilleries, contributing to the nation's ethanol goals.

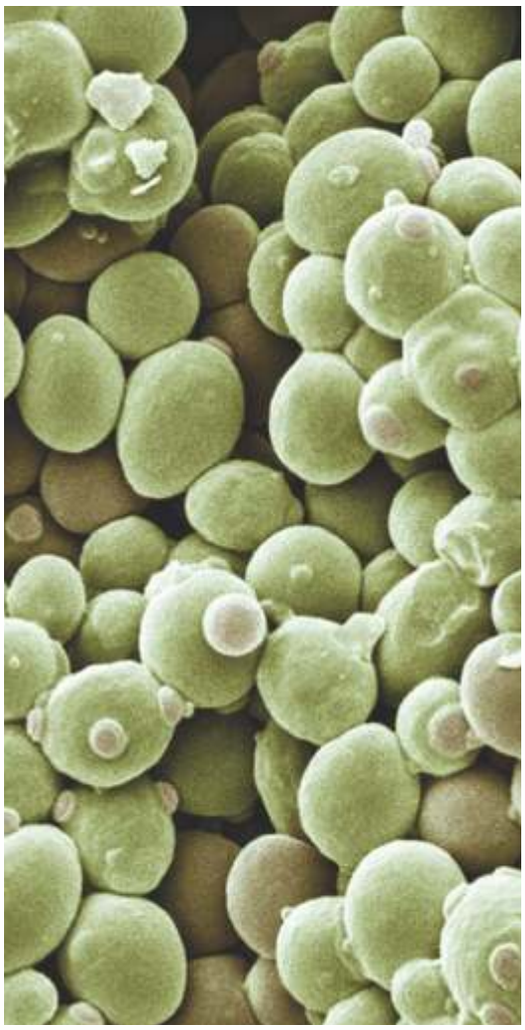
As we move forward, we remain dedicated to our mission of preventing losses and providing unmatched solutions to the distilling, sugar, and brewing industries. We are excited about the opportunities that lie ahead and are committed to supporting our clients in their journey towards increased ethanol production and sustainable growth.

Wishing you all continued success and a prosperous future.

Warm regards,



Munish Madaan



Biggest Myth: All Yeasts strains are same



Contributed by

Awadhesh Nath Tiwari, Marketing

Mehak Madan, Technical Solutions

Dharmender Pathak, Technical Solutions

In the world of sugarcane processing and distilleries, yeast plays a critical role in ethanol production from molasses and grain feedstocks. While many people may assume that all yeast strains are the same, this article aims to debunk this myth by highlighting the diversity and significance of different yeast strains. In this issue of Catalysts Connect, we will explore the untapped potential of yeast and its impact on ethanol production.

Global Yeast Diversity: Yeast is a diverse group of microorganisms belonging to the fungi kingdom. Scientists have identified and characterized 2500 yeast species worldwide. Each yeast strain offers unique benefits and challenges in ethanol production due to variations in genetic makeup, metabolic capabilities, and fermentation characteristics.

Importance of Yeast Selection:

The choice of yeast strain has a significant impact on fermentation efficiency, ethanol yield, and overall product quality. Factors such as sugar utilization and stress tolerance vary between yeast strains. Hence, selecting the right yeast strain is crucial for optimizing ethanol production in terms of both quantity and quality.

The importance of yeast's appropriate characteristics for fermentation in ethanol production cannot be overstated. Selecting the right yeast strain is pivotal for optimizing the fermentation process. Traits such as fermentation efficiency, glucose utilization, and tolerance to high sugar concentrations directly impact the yeast's ability to convert sugars into ethanol effectively. High fermentation efficiency leads to rapid conversion, yielding optimal ethanol production. Efficient glucose utilization ensures maximum use of available sugars, enhancing ethanol output from raw materials. With industrial-scale ethanol production often yielding concentrated fermentation mediums, yeast strains with good osmotic pressure tolerance are vital to maintain a steady and efficient process.

Additionally, temperature and alcohol tolerance are essential to sustain fermentation activity as ethanol concentrations increases. By considering these characteristics and choosing suitable yeast strains, ethanol producers can enhance productivity, yield, and overall efficiency, contributing to a more sustainable biofuel industry.

Industry Perspectives:

High gravity fermentation is a common practice for the Indian ethanol industry to achieve highest possible output of alcohol. High gravity fermentation presents several challenges in ethanol production, affecting both yeast viability and overall process efficiency.

One notable challenge is the loss of sugar as residual sugar, wherein yeast strains struggle to fully utilize the sugars, leading to increased residual sugars at the end of fermentation. This results in a decrease in ethanol yield and a **longer fermentation cycle**, hampering overall productivity.

Furthermore, low gravity fermentation generates a higher volume of wastewater, adding to the environmental and economic burdens of ethanol production. The increased wastewater generation necessitates additional energy for downstream processing, **impacting the overall cost and energy efficiency of the process.**

Intolerance to ethanol stress is another significant challenge faced by yeast during high gravity fermentation. **Yeast strains with low tolerance** to ethanol-induced stress experience lower fermentation efficiency, **leading to suboptimal ethanol production levels**.

Moreover, yeast strains may exhibit lower cell counts, reduced viability, and slower budding due to their inability to cope with chemical stresses present in the fermentation medium. This adversely affects the fermentation process and further hinders ethanol production.

Extra Resudial Sugar in wash due to unsuitable sugar/low stress tolerant yeast				Estimated Revenue Loss @ 100 KLPD Distillery							
in ppm	in %	Eq. to Ethanol Loss %	Eq. to Ethanol / MT in Lt	Rice		C-Heavy Molasses		B-Heavy Molasses		Syrup	
				Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly
5000	0.5	0.30	2.98	₹ 1,32,664	₹ 38,79,916	₹ 7m960	₹ 2,38,795	₹ 1,62,815	₹ 48,84,442	₹ 1,49,247	₹ 44,77,408
10000	1	0.55	5.94	₹ 2,64,040	₹ 79,21,192	₹ 15,842	₹ 4,75,272	₹ 3,24,049	₹ 97,21,463	₹ 2,97,045	₹ 89,11,346
15000	1.5	0.88	8.84	₹ 3,92,840	₹ 1,17,85,188	₹ 23,570	₹ 7,07,111	₹ 4,82,121	₹ 1,44,63,640	₹ 4,41,945	₹ 1,32,58,345
20000	2	1.19	11.85	₹ 5,26,791	₹ 1,58,03,744	₹ 31,607	₹ 9,48,225	₹ 6,46,517	₹ 1,93,95,504	₹ 5,92,641	₹ 1,77,79,223

The effect of various parameters, such as residual sugar and yeast stress tolerance, on ethanol production reveals substantial **monthly revenue losses of up to Rs 1.58 Cr for grain, Rs 1.77 Cr for syrup and Rs 1.93 Cr for molasses as feedstock in a 100 KLPD (Kilo Litres Per Day) plant**. Moreover, an average loss of around 1-2% of ethanol in wash, caused by the use of unsuitable yeast strains, contributes to approximately 0.7 to 1.5 litres of extra wastewater generation per litre of ethanol produced. For a 100 KLPD plant, this loss translates to an extra **70-150 KL (Kilo Litres) of wastewater generated**. This loss accounts for around 10-20% decrease in

ethanol production and **results in** an **additional cost** of **30 Lakhs INR** on the treatment of excess generated wastewater annually.

Addressing the challenges of high gravity fermentation is crucial for enhancing yeast viability, ethanol yield, and wastewater management in ethanol production. By selecting yeast strains with higher stress tolerance and optimizing fermentation conditions, ethanol producers can minimize losses, improve efficiency, and ensure a more sustainable and cost-effective ethanol production process.

Factors to Consider When Selecting Yeast for Ethanol Production:

When selecting yeast for ethanol production, several key factors should be considered to ensure optimal fermentation efficiency and ethanol yield. These factors include:

1. Fermentation Efficiency: Choose yeast strains with high fermentation efficiency to maximize the conversion of sugars into ethanol.
2. Stress Tolerance: Opt for yeast strains that can withstand stress conditions, such as osmotic stress from sugar and ethanol, to ensure robust fermentation performance.
3. Glucose Utilization: Select yeast strains that efficiently metabolize glucose to fully utilize the primary sugar present in the raw materials.
4. Ethanol Tolerance: Consider yeast strains with good ethanol tolerance to sustain fermentation activity as ethanol concentrations increase.
5. Nutrient Requirements: Ensure that the selected yeast strain has appropriate nutrient requirements for healthy growth and optimal fermentation.
6. Organic Acid Tolerance: Choose yeast strains with low organic acid production or those capable of tolerating higher levels of organic acids to avoid fermentation inhibition.
7. Inhibitor Tolerance: Evaluate yeast strains' capability to withstand the presence of inorganic inhibitors like salts, which can hinder fermentation.

By carefully assessing these factors, ethanol producers can make informed decisions and choose yeast strains that best align with their production requirements, ultimately leading to higher ethanol yields and improved efficiency in the biofuel production process.

It is important to note that yeast selection should be based on a combination of laboratory evaluations, field trials, and industry experience. **Distillers may also consult with yeast suppliers to determine the most suitable yeast strain for their specific ethanol production requirements.**

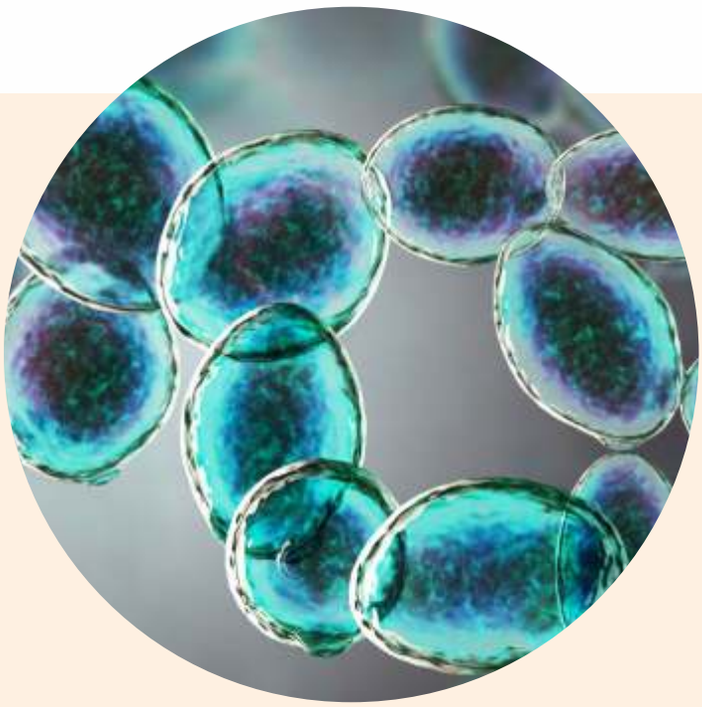
Factors	**Yeast Selection for Ethanol production**
Fermentation Efficiency	High fermentation efficiency in whichever feedstock whether it be molasses, cane syrup or grain
	- Optimal utilization of fermentable sugars. Indicator of underutilisation of fermentable sugar will be high residual sugar % at the end of fermentation cycle.
Stress Tolerance	Tolerance to stress factors in fermentation
	- Robust performance under challenging conditions such as high organic (lactic acid and acetic acid) and inorganic (Sulphur, Calcium etc) content, temperature and pH.
Nutrient Requirements	Efficient nutrient uptake while fermentation
	- Optimal fermentation performance with healthy cell count and high cell viability.
Other Factors	Compatibility with specific feedstock being used.
	- Specific adaptation to specific feedstock (cane syrup, molasses, grain). For each feedstock, the required strain characteristics will be different. Hence, suitability to the feedstock will be important.

Conclusion:

In conclusion, yeast is crucial for ethanol production from molasses and grain feedstocks. Different yeast strains offer untapped potential for better fermentation efficiency and ethanol yield. However, challenges like residual sugar and stress tolerance highlight the importance of choosing the right yeast.

To unlock the full potential of yeast in ethanol production, we encourage distilleries and ethanol producers to take advantage of **our free audit worth ~ 45,000 rupees**. Our team will conduct a comprehensive evaluation of your current fermentation process, yeast selection, and production parameters. Through this audit, we aim to identify opportunities for improvement and offer tailored solutions to enhance ethanol yield, minimize revenue losses, and ensure a more sustainable and cost-effective ethanol production process.

Contact our business development team on 9582963000 or email us on dm@thecatalystsgroup.com today to embark on a journey of unleashing the true power of yeast in ethanol production. Together, we can revolutionize your ethanol production process and pave the way for a greener, more efficient biofuel industry.



How to select

A CORRECT YEAST PRODUCT FOR YOUR DISTILLERY?

Contributed by

Dr. Sibabrata Mukherjee

Fermentation Expert, Leaf by Lesaffre

Lea Geoffroy

Marketing Manager, Leaf by Lesaffre

Yeast is a key element in industrial ethanol production and each cell works like a production unit. From fermentable materials, yeast produces the major product ethanol and several co-products, such as CO2 and glycerol. As in the case of the production unit, the choice of yeast is an important technological decision that will have a direct impact on the plant's performance and profitability.

An ethanol yeast adapted to your raw materials

Industrial ethanol can be produced from **a variety of raw materials** (broken or surplus rice, corn, cane, beet, cassava, wheat, agricultural residues and other dedicated crops). The **characteristics and quality** of these

feedstocks vary depending on the geographical area and from season to season. Drawing upon Lesaffre's 170 years of fermentation expertise and capabilities, at Leaf we therefore develop and select strains with an improved tolerance to stresses related to the nature of the substrate - *such as the presence of inhibitors like organic acids, ethanol* - or that can detoxify the mash.

A yeast fitting your ethanol plant specificities

Your plant is unique. The choice of yeast must consider **your specificities and objectives**. In the case of a very high-gravity (VHG) process, a yeast strain with higher sugar or osmo-tolerance and ethanol tolerance levels is preferred. In addition, some strains are more resistant to the high temperatures encountered in hot areas such as India.

Fermentation is a key step in the industrial ethanol production process and the **optimization of its performance** is directly related to the yeast's characteristics. In addition to optimization of process parameters in the plant, **yeast performance optimization** can bring **productivity gains** through faster fermentation kinetics, and/or yield gains from setting right the level of nutrition, limiting contamination growth and process tweaks that allow for more ethanol to be produced from the same amount of feed stocks which is a big part of the ethanol producer's operation cost.

Benefiting from Lesaffre R,D&I ecosystem

As a science and technology company, Lesaffre is continuously looking for new opportunities for innovation that will help our customers. To accelerate the development of innovative solutions, we are able to draw on 600 R&D experts and collaborate with more than 60 promising academic partners and start-ups.

Inaugurated in October 2022, the Lesaffre Campus is an innovation booster for the group. **As of right now, 60% of the Lesaffre Campus area is dedicated to research labs and industrial pilots**. The new facilities also provide the company collaborators with new R&D cutting-edge equipment that is amongst the most efficient, such as Europe's largest biofoundry.

An easy-to-handle yeast product format

Yeasts are available on the market in different formats: culture or cream, compressed and dry products.

Culture yeast consists in a slant that needs several steps from lab to the fermentor to produce biomass at the ethanol plants. All these steps can increase the risk of contaminants too. The bacteria content in culture yeast may vary significantly from one production to the other.

Whereas yeast products are a **standardized quantity and quality** of a pure culture of a selected and specialized yeast strain, released based on specific and most strict quality control - *microbiology, composition, yeast vitality & physiology tests, application tests*.

The production starts in Lesaffre's yeast bank laboratory in Lille, France. Leaf's yeasts have been developed and/or selected by Lesaffre R,D&I team to **best suit the needs and specificities of our customers' processes**. The selected yeast strain is propagated in dedicated labs and purpose-built manufacturing facilities. The production process goes through several stages of fermentation on molasses-based complex

nutrients with aerobic conditions. By the end of the fermentation steps, the yeasts are concentrated by centrifugation. At this stage, the yeast is in liquid format (20% of dry matter). The metabolism of resulting yeast is active and should be stored at low temperature to remain stable. It usually has a short shelf life of 3 weeks.

Lesaffre production capabilities allow Leaf to go a few steps further, concentrating the yeast on rotative filters then extruding it. At this stage the yeast is under compressed form (35% of dry matter). The final step for Leaf's yeasts is the drying plant, removing water from the yeast. The fluid-bed drying technology allows to **reach approximately 96% of dry matter, without killing the yeast**.

After drying, the yeast metabolism is on hold. The final product, called active dry yeast (ADY) presents itself as small particles of approximately 1mm. They are vacuum-packed to preserve them from oxygen and moisture. This means, **the yeast is very stable** and can be stored 2 years at room temperature and will not lose any viability. The advantage of such active dry yeast is also that the yeast is ready to pitch after a short rehydration.

Leaf's active dry yeast products are commercialized in India for more than 10 years, with the support of the Catalysts Group, our partner and distributor. Working together as a team, we streamlined to excel in all the aspects of the supply chain to ensure our customers the reliability of supply. We continuously shared our respective knowledge: Leaf providing expertise on yeast and industrial ethanol production and Catalysts about the local specificities.

Relying on Lesaffre's industrial excellence and quality

For over a century, Lesaffre has been honing its skills and forging unparalleled expertise in **developing the highest quality fermentation products**. With decades of experience and a multi-local presence, the Group has the global reach and local awareness to provide services **tailored to each customer's specific needs**. Today, two-thirds of Lesaffre's employees work in its **77 manufacturing facilities**, producing thousands of tons of yeast every day for distribution around the world.

Whatever the end use of the microorganisms, their production is supported by Leaf and Lesaffre's **advanced technical expertise and global control and assurance quality policy**. The management program deployed in all subsidiaries, and supported by **Lesaffre's control laboratories**, meets the most stringent requirements, and enables us to produce stable and consistent products, while ensuring product traceability and optimal levels of health and quality.

The entire bioethanol production process is **continuously improving** to valorize all co-products and **increase plant profitability**. To meet today's challenges, the industry innovates and develops new solutions adapted to local conditions; the same is true for yeast. We develop and market **innovative and high-quality fermentation solutions for today and tomorrow's processes**.

For more information: This article was written by Sibabrata Mukherjee, Ph.D., Technical Service Representative and Lea Geoffroy, Marketing Manager at Leaf. Visit: leaf-lesaffre.com

Unleashing the Yeast's Party Power in Alcohol Production

Contributed by

Dr. B Chandrashekhar, R&D

Yeast is a crucial component in ethanol production as it is responsible for the fermentation process that converts sugars into ethanol. Specifically, the yeast species Saccharomyces cerevisiae is commonly used in ethanol production due to its ability to efficiently ferment sugars and withstand the harsh conditions of the fermentation process. The adaptability and versatility of yeast make it a very fascinating microorganism in the context of alcoholic production. In fact, in the world of brewing and fermentation, there is sometimes playful anthropomorphism associated with yeast and people may describe yeast as having a "party" inside the fermenting vessel, with yeast cells actively "feasting" and "celebrating" as they convert sugars into ethanol. Yeast has a voracious appetite for sugars, and its enthusiasm for consuming sugar sources can be amusing. It's almost as if yeast has an insatiable sweet tooth! Saccharomyces cerevisiae's love for sugar is often joked about, with references to yeast having an insatiable sweet tooth or an unwavering dedication to converting sugar into alcohol. These humorous aspects highlight the playful side of working with Saccharomyces cerevisiae and its role in fermentation processes.

Another interesting aspect of yeast in alcoholic production is its ability to adapt and evolve. Yeast strains used in ethanol production have been subjected to continuous selection and improvement over centuries of brewing and fermentation practices. Through this process, certain yeast strains have developed unique characteristics that make them well-suited for specific types of alcoholic beverages or environmental conditions. Moreover, yeast can undergo natural or deliberate genetic modifications to enhance its performance. Researchers have used genetic engineering techniques to modify yeast strains, allowing them to tolerate higher ethanol concentrations, consume a broader range of sugars, or resist inhibitory substances present in the feedstock for enhanced overall productivity.

How does yeast produce ethanol?

During ethanol production, yeast consumes the sugars present in the feedstock, such as corn, rice, sugarcane, or other biomass, and converts them into ethanol and carbon dioxide through a metabolic process called alcoholic fermentation. The yeast cells metabolize the sugars and produce ethanol as a byproduct, along with carbon dioxide. The ethanol is then separated and purified for use as a biofuel or other applications. Here's a step-by-step explanation of how yeast converts sugars into ethanol:

1. **Activation:** This is typically done by adding yeast to a warm water solution with a source of nutrients, such as sugar or malt extract. The warm temperature and nutrient-rich environment stimulate yeast cells to become active and begin multiplying.
2. **Sugar Uptake:** Once the yeast is activated, it is introduced to a solution containing sugars. These sugars can come from various sources, such as malted grains, fruits, sugarcane molasses or other feedstocks used in ethanol production. The yeast cells take up the sugars through their cell walls.
3. **Glycolysis:** Inside the yeast cells, the sugars undergo a series of enzymatic reactions called glycolysis. During glycolysis, the sugars are broken down into smaller molecules, including pyruvate. Glycolysis breaks down one molecule of glucose (a 6-carbon sugar) into two molecules of pyruvate (a 3-carbon compound). In this process, a small amount of ATP, which is the cell's energy currency, is generated through substrate-level phosphorylation, resulting in a net gain of two ATP molecules per glucose molecule.
4. **Conversion to Ethanol:** Following glycolysis, the pyruvate molecules are further metabolized to produce ethanol and carbon dioxide. This occurs in a process called fermentation. In the case of ethanol production, the main pathway involved is known as ethanol fermentation or alcoholic fermentation. During alcoholic fermentation, the pyruvate molecules lose a carbon dioxide molecule and are converted into acetaldehyde. This reaction is catalyzed by the enzyme pyruvate decarboxylase. Acetaldehyde is then rapidly reduced by the enzyme alcohol dehydrogenase, using the electrons and hydrogen ions generated during glycolysis. This reduction converts acetaldehyde into ethanol. This reduction step does not produce ATP directly.
5. **Carbon Dioxide Release:** As a byproduct of the conversion process, carbon dioxide is released. This is why you often see bubbles during fermentation, as the carbon dioxide gas is formed and escapes from the solution.
6. **Additional Metabolism:** In addition to ethanol and carbon dioxide production, yeast may also metabolize other compounds present in the fermentation medium, depending on the specific conditions. This can include the utilization of other sugars or the conversion of byproducts from the feedstock into various compounds.

Alcoholic fermentation is an anaerobic process and in terms of energetics, alcoholic fermentation is an inefficient process compared to aerobic respiration, which produces more ATP (adenosine triphosphate) per glucose molecule. During alcoholic fermentation, the net ATP yield is relatively low. Overall, the net ATP yield from alcoholic fermentation is only two ATP molecules per glucose molecule. In contrast, under aerobic conditions, where oxygen is available, glucose can undergo complete oxidation through processes such as the Krebs cycle and oxidative phosphorylation, yielding a much higher ATP output.

However, it's important to note that while the ATP yield is low in alcoholic fermentation, the primary purpose of this process is to regenerate the coenzyme NAD+ (nicotinamide adenine dinucleotide) from NADH (reduced form). This allows glycolysis to continue, providing a means for yeast to produce ATP in the absence of oxygen. The production of ethanol is a byproduct of this metabolic adaptation.

In summary, while alcoholic fermentation is energetically less efficient compared to aerobic respiration, it actually serves as an essential pathway for yeast to generate ATP and maintain metabolic activity when oxygen is limited or absent.

Factors influencing yeast performance during fermentation:

Several factors can significantly influence yeast metabolism and growth during alcoholic fermentation. Here are some key factors:

1. **Temperature:** Yeast is sensitive to temperature, and different strains have different temperature preferences. Generally, yeast fermentation occurs within a temperature range of 25-40°C. Extreme temperatures can stress or kill the yeast cells, affecting their metabolism and growth.
2. **Nutrients:** Yeast requires various nutrients for healthy growth and fermentation. These include nitrogen sources (such as amino acids and ammonium ions), vitamins, minerals (such as zinc and magnesium), and other trace elements. Inadequate nutrient availability can lead to sluggish fermentation, reduced growth, and production of off-flavors. Nutrient supplementation is often necessary, particularly in feedstocks with low nutrient content, to support optimal yeast metabolism.
3. **pH Level:** Yeast fermentation is influenced by the pH level of the fermentation medium. Most yeast strains prefer a slightly acidic environment, with a pH range of 4.0-6.0. Outside of this range, yeast growth and fermentation efficiency can be compromised. pH control is important to ensure optimal yeast metabolism and to prevent the growth of undesirable microorganisms.
4. **Oxygen Levels:** Yeast fermentation is an anaerobic process, meaning it occurs in the absence of oxygen. Oxygen availability can affect yeast growth and metabolism, particularly during the initial stages of fermentation. Oxygen exposure can lead to the production of reactive oxygen species (ROS), which can damage yeast cells and impair fermentation.
5. **Sugar** Concentration: The concentration of sugars in the fermentation medium affects yeast metabolism and growth. Yeast can tolerate a wide range of sugar concentrations, but extremely high or low sugar levels can be detrimental. High sugar concentrations can impose osmotic stress on yeast cells, while low sugar concentrations may limit yeast growth and fermentation rates.
6. **Inhibitors:** Some compounds like acetic acid, furfural, and hydroxymethylfurfural (HMF) reduce yeast growth, fermentation efficiency, and ethanol yield. Pretreatment processes or detoxification strategies may be employed to minimize the impact of inhibitors on yeast metabolism.
7. **Fermentation Time:** The duration of fermentation can also impact yeast metabolism. Prolonged fermentation periods can lead to the accumulation of fermentation byproducts, such as higher alcohols and organic acids, which can affect the flavor and quality of the ethanol.

Conclusion

On average, under optimal conditions, a single Saccharomyces cerevisiae cell can produce around 0.5-0.6 grams of ethanol per gram of consumed sugar. This value represents the theoretical maximum ethanol yield achievable under ideal circumstances. However, in practical scenarios, the actual ethanol productivity is often lower due to various factors, including incomplete fermentation, energy losses in cellular processes, and metabolic limitations. By carefully managing the above factors and providing suitable conditions, such as temperature control, nutrient supplementation, and pH adjustment, yeast metabolism and growth can be optimized, leading to efficient and productive alcoholic fermentation for ethanol production. The selection of yeast strains for ethanol production is also important, as different strains may exhibit variations in fermentation efficiency, temperature tolerance, nutrient requirements, and resistance to inhibitors.

Contributed by
Bhoopendra Bhardwaj, R&D

PROBLEMS DURING *molasses fermentation* & THEIR SOLUTIONS

Molasses fermentation is the process of converting molasses into ethanol, through the action of yeast or other microorganisms. While molasses fermentation is a well-known process in today's scenario. Many of distillers are maintaining it very well, but there are some challenges are their which can hamper the process drastically. Here are some common challenges which is faced by every distillers:-

1.Contamination:

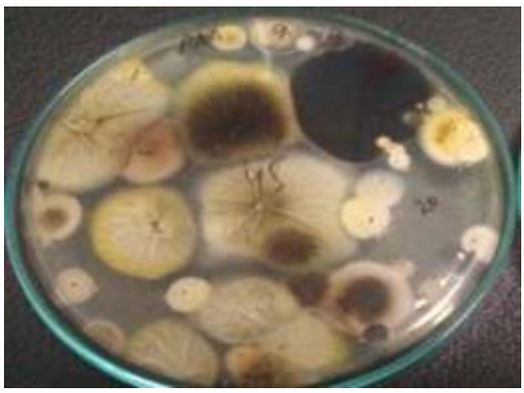
The presence of unwanted microorganisms such as bacteria, fungi or wild yeast can cause contamination of the fermentation process, resulting off-flavors in final product, low yields, or even stuck fermentation.

Bacterial contamination is one of the most common types of contamination found in molasses. The bacteria can come from several sources, such as the raw materials (Sugarcane), the processing unit (Sugar plant), or the storage tanks. The most common bacteria found in molasses are Acetic acid & lactic acid bacteria, which can produce acetic acid & lactic acids that can negatively affect the fermentation process.

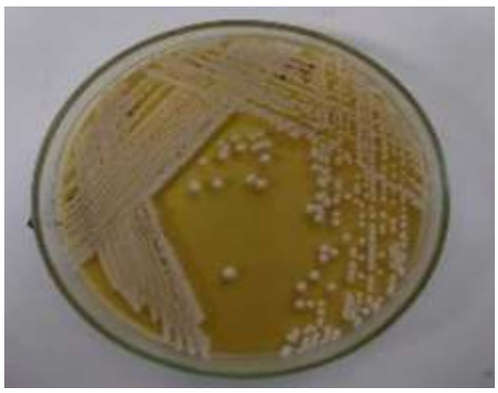
Bacteria

Lactobacillus sp./MRS

Fungal contamination is also a concern in molasses production, particularly in humid environments. The most common fungi found in molasses are Aspergillus and Penicillium, which can produce mycotoxins that can be harmful to both humans and animals.



Fungus/PDA



Yeast/YPD

Wild yeast contamination can also be a problem in molasses fermentation. Wild yeasts are naturally present in the environment and can enter the fermentation process from the air or through contaminated equipment. Wild yeasts can compete with the desired yeast strain for nutrients and can cause unwanted off-flavours and aromas in the final product.

To prevent contamination, proper hygiene practices and sanitation protocols should be followed throughout the production and fermentation process. The use of antimicrobial agents and monitoring of fermentation parameters can also help control contamination.

2. Nutrient imbalance:

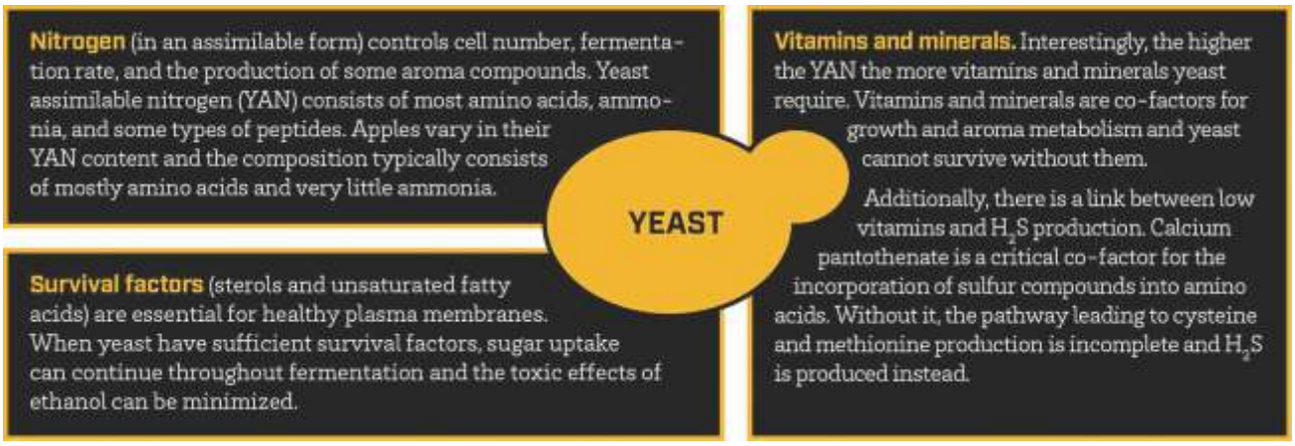
Molasses lacks some essential nutrients required for optimal yeast growth and fermentation. This can result in slow fermentation rates, low alcohol yields or stuck fermentations.

Molasses is a complex mixture of sugars, minerals, and other nutrients, but it may not contain all the nutrients required for optimal yeast growth and fermentation. This can lead to nutrient imbalances and result in slow fermentation rates, low alcohol yields or even stuck fermentation process.

One of the most critical nutrients required for yeast growth and fermentation is nitrogen. Nitrogen is essential for protein synthesis, cell growth, and energy production in yeast. Molasses may not contain enough nitrogen to support optimal yeast growth and metabolism, particularly during the later stages of fermentation.

Other essential nutrients for yeast growth and fermentation include phosphorus, potassium, magnesium, and vitamins. Molasses may contain these nutrients, but not necessarily in the optimal proportions or amounts required for yeast growth and fermentation.

To address nutrient imbalances, proper addition of these nutrients is necessary for proper yeast gwoth. Nutrient supplements such as Nitro Nutrient (Urea), yeast extract, diammonium phosphate, and Zink/magnesium sulfate can be added to molasses to improve yeast growth and fermentation performance.



Nutrient supplementation: Adding nutrients such as nitrogen and phosphate can support yeast growth and metabolism, reducing the impact of high sugar concentration.

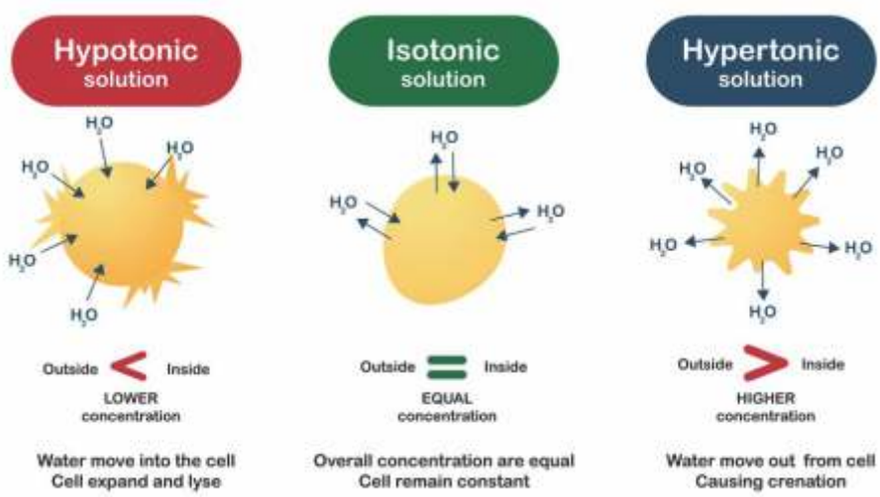
3. High sugar concentration:

The high concentration of sugar in molasses can be toxic to yeast at the start of fermentation, causing stress and leading to a lag in growth.

Molasses is a byproduct of the sugar refining process and has a high sugar concentration, typically between 40-60%. While high sugar concentration is beneficial for ethanol production, it can also create challenges during molasses fermentation.

One of the primary challenges associated with high sugar concentration is osmotic stress. When yeast is introduced into a high sugar environment, water will flow out of the yeast cells to balance the sugar concentration, causing dehydration and osmotic stress. This can result in a lag in growth, reduced fermentation rates, and reduced alcohol yields.

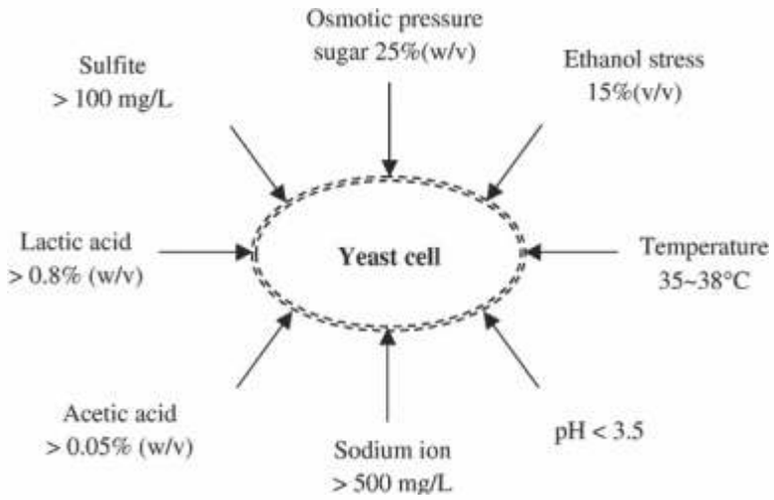
Another challenge associated with high sugar concentration is the production of inhibitory compounds. When yeast metabolizes sugars, it produces ethanol and other by products such as acetic acid, aldehydes, and esters. At high sugar concentrations, the accumulation of these by products can become toxic to yeast, leading to reduced fermentation rates and stuck fermentations.



Osmotic pressure on cell due to different sugar concentration

To address the challenge of high sugar concentration, various strategies can be employed, such as:

Proper yeast strain selection: Selecting yeast strains that are better adapted to high sugar concentrations



Environment Stress factors for yeast cells

can improve fermentation performance.

Selection of yeast is most important factor for better fermentation, select the yeast which can perform better in all stress conditions like high sugar, high acid formation, and other organic salts. Yeast can also survive in high alcohol percentage.

Controlled addition of sugar: Slow and gradual addition of sugar can reduce the osmotic stress on the yeast and improve fermentation performance.

As per today's scenario all the distillers are using recycling stream in their fermentation, so the stress factor during recycling stream should be in the balance mode. Higher Spent wash recycling will also enhance the sugar & organic load on the yeast, so it will be added as per the stress factor on yeast or it should be added in late hour of fermentation.

4. Foaming:

The high concentration of soluble solids in molasses can lead to excessive foam formation during fermentation, which can cause problems with aeration and mixing.

Foaming is a common issue that can occur during molasses fermentation, particularly in high-sugar and high-viscosity environments. Foaming can create several challenges, such as reducing the efficiency of aeration, leading to poor oxygen availability and poor yeast growth, and creating difficulties with temperature control.

Foaming occurs when gas bubbles, primarily carbon dioxide, produced during fermentation get trapped in the thick and viscous molasses, leading to the formation of a stable foam. The foam can become so thick that it can block the mixing and aeration system, leading to reduced efficiency and even complete failure of the fermentation process.

To address foaming issues during molasses fermentation, several strategies can be employed, such as:

Use of antifoaming agents: Antifoaming agents such as silicone-based compounds, vegetable oils, or surfactants can be added to the fermentation medium to reduce the surface tension of the molasses and prevent the formation of stable foam. However, the use of antifoaming agents can also have a negative impact on fermentation performance.

Controlling agitation: Controlling the speed and intensity of agitation can help reduce the formation of foam. Lower agitation speeds can minimize the amount of air being introduced into the fermentation medium, reducing the production of carbon dioxide and preventing the formation of foam.

These are the normal challenges which is faced by all the distillers, after overcome these type of challenges we can manage properly our fermentation process & definitely we can achieve our goals.

Why INVESTMENT IS ESSENTIAL: TAX SAVING BENEFITS AND BEYOND

Contributed by
Rajesh Patel, Accounts

Investment is not just about growing your wealth; it also offers several tax-saving benefits and serves as a crucial financial planning tool for Indian citizens. In this article, we will explore the reasons why investment is necessary, focusing on the tax advantages it provides and the broader financial advantages it offers.

Wealth Creation and Financial Goals:

Investment plays a vital role in wealth creation, allowing individuals to generate additional income and build a financial cushion for the future. By investing wisely in diverse asset classes such as stocks, mutual funds, real estate, and fixed deposits, individuals have the opportunity to grow their wealth significantly over time. Moreover, investments help individuals achieve their financial goals, whether it's buying a house, funding education, or planning for retirement.

Tax Saving Benefits:

Investments offer numerous tax-saving benefits under various sections of the Income Tax Act. The government provides incentives to encourage individuals to invest and save for the future. Popular investment options such as Public Provident Fund (PPF), Employee Provident Fund (EPF), National Pension Scheme (NPS), and tax-saving fixed deposits allow individuals to claim deductions under Section 80C, thereby

reducing their taxable income. Additionally, investments in Equity-Linked Savings Scheme (ELSS) and certain government bonds offer tax benefits under Section 80CCD and Section 54EC, respectively.

Long-Term Capital Appreciation:

Investing in equity markets or long-term investment vehicles like mutual funds and stocks can provide significant capital appreciation over time. By staying invested for the long term, individuals have the potential to earn substantial returns on their investments, outpacing the rate of inflation. This capital appreciation helps protect against erosion of purchasing power and ensures financial security in the future.

Diversification and Risk Mitigation:

Investments enable individuals to diversify their portfolios, reducing the risk associated with investing in a single asset class. By spreading investments across various sectors and asset classes, individuals can mitigate risk and optimize returns. Diversification helps individuals weather market fluctuations and safeguards their investments against the impact of any particular sector or asset's poor performance.

Benefits	**Advantages**
Wealth Creation	Potential for generating substantial returns and building wealth
Diversification	Spreading investments across various asset classes reduces risk
Financial Goals Achievement	Helps in achieving long-term financial goals, such as buying a house or funding education
Tax Saving	Tax deductions and exemptions on specific investments
Inflation Hedge	Protects the value of money against rising inflation
Retirement Planning	Builds a retirement corpus for a secure and comfortable future
Financial Independence	Creates passive income streams and reduces dependence on regular employment
Tax-efficient Investing	Optimizes tax liabilities and enhances after-tax returns

Conclusion:

Investment is a crucial aspect of financial planning for Indian citizens. Beyond the tax-saving benefits it offers, investing provides opportunities for wealth creation, helps achieve financial goals, and ensures long-term financial security. By adopting a disciplined approach and seeking professional guidance, individuals can harness the power of investments and build a strong financial foundation for themselves and their families.

Journey from Waste to Wealth: Biogas Production

Contributed by
Prerna Srivastava, R&D

As we all are aware of the fact that energy demand all over the world has been increasing drastically to fulfil the growing needs of population and technological advancements. In recent years, as a sustainable energy source, biogas has been drawing more attention worldwide because of many reasons as it is renewable, economical, has good calorific value and the by-products of biogas production process can be utilized as a natural fertilizer. Therefore, by transforming 'trash' into sustainable energy and nutrient-rich fertilizers, biogas systems can not only solve waste management problems but also add value.

Basically, biogas is composed of methane (CH_4), which is the primary component of natural gas, at a relatively high percentage (50 to 75 percent), carbon dioxide (CO_2), hydrogen sulphide (H_2S), water vapor, and trace amounts of other gases. Biogas is produced through anaerobic fermentation of organic matter catalysed by different group of microorganisms acting at different stages of the overall digestion process. The first stage, Hydrolysis involves conversion of complex polysaccharides to simple sugars and other monomers by hydrolytic bacteria like Clostridium, Cellulomonas, and Ruminococcus. The simple organic matters are then converted by bacteria such as Acetobacterium, Clostridium, and Bacteroides into organic acids by the process of acidogenesis, which are then converted to acetate by the process of acetogenesis. Finally, as a metabolic byproduct, methane is produced by a class of bacteria known as methanogens (Methanobacterium, Methanosarcina, and Methanococcus) and the process is called methanogenesis. All these anaerobic microbial groups are essential to the production of biogas.

The entire process is carried out in an Anaerobic Digester. Commonly, there are two type of digester which are in use - Continuous Stirred Tank Reactor (CSTR) and other is Up-flow Anaerobic Sludge Blanket Reactor (UASB). By using such digesters several industries are generating biogas in significant amount and utilising their industrial organic waste to create wealth out of it.

Feedstock is very crucial in the generation of biogas. The feedstock can be obtained from different industries. Spentwash from alcohol distillery, press-mud from sugar mills and paper mill waste are some of the common feedstocks which are being used by the industries to produce methane. But these feedstocks are complex in nature due to which few challenges are being faced by the industries. For example, spent wash has a high concentration acid, toxic inhibitors like phenolic compounds and antimicrobials which inhibit the microbial

activity and digestion process. In case of press-mud, the conversion of complex polysaccharides such as cellulose, hemicellulose and lignin to simpler sugars and monomers is challenging for the bacteria. While the paper mill's waste contains some heavy metals, toxins and other chemicals which retard the microbial action in the digester. Other than these feedstock related challenges, complex regulatory systems like obtaining approvals, permits, and financial aids that may involve lengthy and complicated procedures may also hinder the implementation of biogas technology.

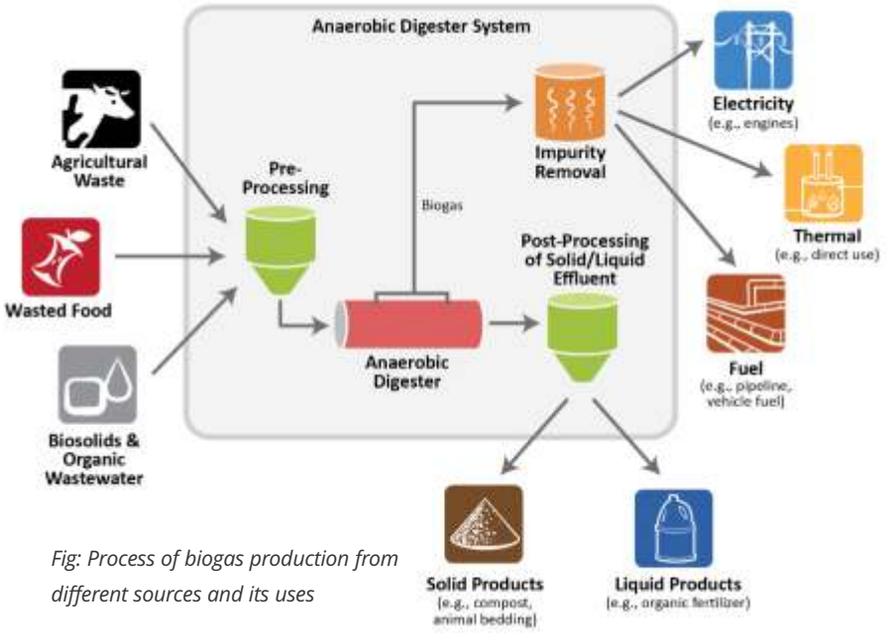


Fig: Process of biogas production from different sources and its uses

To overcome these hurdles, our Indian government is aggressively encouraging the industries to establish biogas technology based on waste and renewable resources through number of initiatives and policies. Installation of biogas and Bio-CNG plants is supported technically and financially by the National Biogas and Manure Management Programme (NBMMP) and Ministry of New and Renewable Energy (MNRE) to fuel the expansion of the nation's biogas production. The government has put waste management regulations into place that support the responsible handling and disposal of organic waste and highlight the idea of "waste to wealth".

As a responsible stakeholder of nation, we all must understand how biogas production is important and why our government is giving stress to setup more and more biogas plants. So, we the Catalysts group are here to help the industry in completing its journey from waste to wealth. Since the production of biogas is a complex process and to overcome such a complex biological process of biogas generation we are committed to serve the industry to run biogas plants more effectively by providing innovative and sustainable solutions in the form of our products- 'Nutriboost CPNS', Enzymes and Microbial Cultures which will boost the digestion process and methane generation. Nutriboost CPNS is source of micronutrients and enzymes that provides essential building blocks required for the growth and stabilization to anaerobic bacteria during biogas production process. Our product improves digestion by supplying specific micronutrients to the anaerobes to enhance the microbial metabolism that results in higher COD reduction and biogas yield, and also help to build and maintain the bacteria population for longer period, under stressed conditions. We are also working on developing microbial consortium and enzyme-based products that can break down complex organic material in press-mud, distillery Spentwash, and paper mill waste in a more efficient way, to boost methane production and make the overall process easy to operate.

So, it's high time to think about biogas technology, and in your journey from waste to wealth we 'The Catalysts Group' are here with our customer-oriented solutions at every step.

References
https://www.iea.org/policies/4308-national-biogas-and-manure-management-programme
.
·Bassani, I., Kougias, P.G Treu, L., Angelidaki, I., & Fotidis, I. A. (2017). High-rate methane production from barley straw in biogas reactor: Insights into pretreatment and microbial community. Bioresoource Technology, 245 (Part B), 899-907.
https://www.downtoearth.org.in/blog/pollution/biogas-a-sustainable-solution-for-curbing-pollution-improving-livelihoods-enhancing-quality-of-life-82285

HR as a Business Partner

Contributed by
Lav Sharma, Human Resources

In today's dynamic business landscape, Human Resources (HR) has evolved from a traditional support function to a strategic business partner. At The Catalysts Group, we recognize the critical role of HR in driving organizational success. In this article, we will explore the concept of HR as a business partner and look into the key attributes and practices that make our HR department a strong strategic partner for our organization.

Strong Business Acumen:
At The Catalysts Group, our HR team possesses a deep understanding of our industry, market dynamics, and business objectives. We are committed to staying abreast of industry trends, economic factors, and competitive landscapes to ensure that our HR strategies are aligned with our business goals. By possessing strong business acumen, our HR professionals can effectively contribute to strategic decision-making processes and provide insights and solutions that drive organizational growth.

Passionate about People Success:
As HR professionals, we are passionate about the success and well-being of our employees. We recognize that our people are the driving force behind our organization's success. Through comprehensive talent management strategies, employee engagement initiatives, and career development programs, we foster an environment where employees can thrive and reach their full potential. By investing in the growth and success of our people, we create a motivated and high-performing workforce that propels the organization forward.

Business-Aligned HR Practices:
Our HR practices are strategically aligned with our business objectives. We design and implement HR programs that support the achievement of our organizational goals. From recruitment and selection to performance management and rewards systems, every HR practice is tailored to contribute to our overall business success. By ensuring that our HR practices are aligned with our business strategy, we create a cohesive and integrated approach that drives employee engagement, productivity, and organizational performance.

Entrepreneurial Spirit and Focus:
The HR team at The Catalysts Group possesses an entrepreneurial spirit and a focus on innovation. We actively seek opportunities to drive change, embrace new technologies, and implement best practices that enhance

our HR processes and deliver greater value to the organization. By fostering an environment of innovation and continuous improvement, we position ourselves as agile and forward-thinking partners who are responsive to the evolving needs of our organization and its employees.

Leadership Abilities and Competence:

Our HR professionals exhibit strong leadership abilities and competence, enabling them to effectively collaborate with stakeholders at all levels of the organization. They possess excellent communication and interpersonal skills, allowing them to build relationships, influence decision-making processes, and facilitate organizational change. Through their leadership capabilities, our HR team champions the importance of people-centric strategies and fosters a culture of transparency, trust, and accountability.

Strong HR Capability:

The Catalysts Group's HR team has a strong foundation of HR expertise and capabilities. We stay updated with the latest HR trends, laws, and regulations, ensuring compliance and effective HR management. Our team comprises experienced professionals who bring a diverse range of skills and knowledge, enabling us to provide comprehensive HR support to our organization. With a focus on continuous learning and development, we strive to enhance our HR capability and deliver exceptional value to the business.

Aligning HR with Business Objectives:

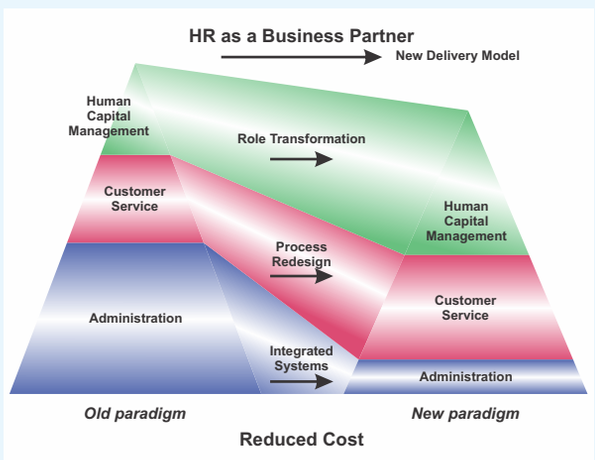
As an HR department, our primary goal is to align HR strategies and initiatives with the company's overall business objectives. By understanding the unique needs of each department and collaborating closely with leaders and managers, HR becomes a strategic partner in driving organizational success. We work towards creating a positive work culture, attracting and retaining top talent, and ensuring that our workforce is equipped with the skills and resources necessary to achieve our business goals.

Driving Talent Management:

One of the key roles of HR as a business partner is talent management. We believe that our employees are our most valuable asset, and attracting, developing, and retaining top talent is crucial for our long-term success. HR plays a pivotal role in recruiting and selecting the right candidates, designing effective onboarding programs, and providing ongoing training and development opportunities to enhance employee skills and capabilities. Through robust performance management systems and career development initiatives, we empower our employees to reach their full potential and contribute to the growth of the organization.

Conclusion:

As HR professionals at The Catalysts Group, we embrace the role of HR as a strategic business partner. Through our strong business acumen, passion for people success, business-aligned HR practices, entrepreneurial spirit and focus, leadership abilities, and strong HR capability, we drive the organization's success by fostering a high-performance culture, attracting, and retaining top talent, and aligning HR strategies with our business objectives. By consistently collaborating with stakeholders and keeping pace with industry trends, we position ourselves as strategic partners who contribute to the overall growth and success of The Catalysts Group.



WHAT IS *Lean 6 Sigma?*

Contributed by
Ravi Bhushan Jha, R&D

Lean Six Sigma is a methodology that combines the principles and tools of both Lean and Six Sigma to improve the quality, efficiency, and effectiveness of business processes.

Figure 1

Lean is a philosophy that originated in the Toyota Production System (TPS), which focuses on eliminating waste, improving flow, and creating value for the customer. Lean principles include continuous improvement, respect for people, just-in-time production, and visual management.

Six Sigma is a data-driven methodology that uses statistical analysis to identify and eliminate defects or variations in a process. It focuses on reducing variability and increasing process capability to achieve near-perfect quality levels. It's also emphasizes the importance of leadership, training, and organizational culture in achieving sustainable results.

Combining the principles of Lean and Six Sigma, is

Figure 2

aims to create a culture of continuous improvement and waste reduction while maximizing value for the customer. The methodology involves defining the customer requirements, identifying and measuring key process metrics, analysing data to identify root causes of problems or inefficiencies, and implementing solutions to improve the process. Lean Six Sigma uses a structured problem-solving approach such as **DMAIC (Define, Measure, Analyse, Improve, Control) to guide the improvement process**.

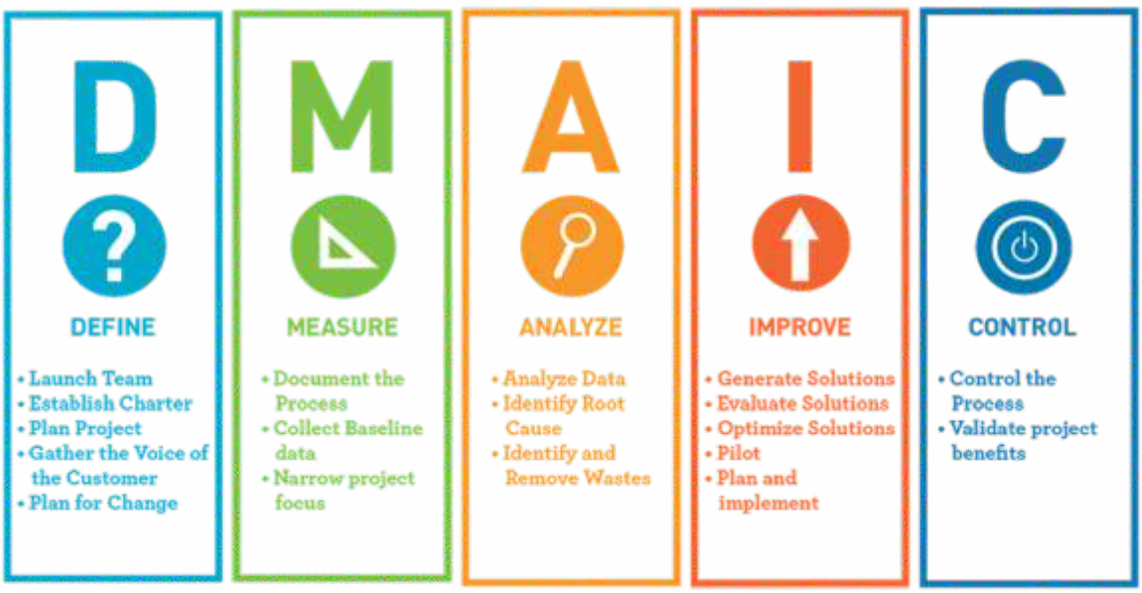


Figure 3

Implementation Methodology:-

1. **Define the problem or opportunity:** Identify the problem or opportunity for improvement by collecting data, conducting a process audit, and analysing process performance metrics.
2. **Establish project goals:** Set specific, measurable, achievable, relevant, and time-bound (SMART) (ref pic – 4) goals for the project based on the identified problem or opportunity.
3. **Create a project team:** Assemble a cross-functional team with representatives from different departments or areas of expertise to collaborate and work together on the project.
4. **Map the process:** Create a process map to identify and understand the steps involved in the process and to identify areas where waste or inefficiencies occur.
5. **Identify the root causes:** Use tools like the fishbone diagram, Pareto chart, and statistical analysis to identify the root causes of the problem.
6. **Develop and implement solutions:** Brainstorm and prioritize potential solutions to the problem and develop an action plan for implementation. Test the solutions and make adjustments as needed.
7. **Monitor and control:** Establish a system to monitor and control the process to ensure that the improvements are sustained and that the process remains in control.
8. **Standardize and optimize:** Develop standard work procedures to ensure consistent results and continuous improvement. Implement a continuous improvement program to optimize the process over time.

Importance and benefits of Lean Six Sigma in food business operations and supply chain management include:

a. **Increased food safety:** It helps to identify and eliminate potential hazards in the food production process and supply chain, which can help to improve food safety.
b. **Improved product quality:** It can help to identify and eliminate defects in the food production process and supply chain, which can lead to higher quality products.

c. **Reduced waste:** It helps to identify and eliminate waste in the food production process and supply chain, which can reduce costs and improve efficiency.
d. **Improved productivity:** By streamlining processes and reducing waste, it can help to improve productivity in food business operations and supply chain management.
e. **Data-driven decision making:** Lean Six Sigma relies on data to drive decision making, which helps to ensure that improvements are based on objective information.
f. **Continuous improvement:** It is a continuous improvement methodology that encourages organizations to continually improve their processes over time, leading to ongoing improvements in food business operations and supply chain management.
g. **Improved customer satisfaction:** By improving quality, reducing lead times, and increasing efficiency, it can help to increase customer satisfaction in the food industry.

Overall, Lean Six Sigma is a powerful methodology for improving food business operations and supply chain management. It helps to identify and eliminate waste, reduce defects, and improve productivity and quality, which can lead to significant improvements in food safety, efficiency, and customer satisfaction.

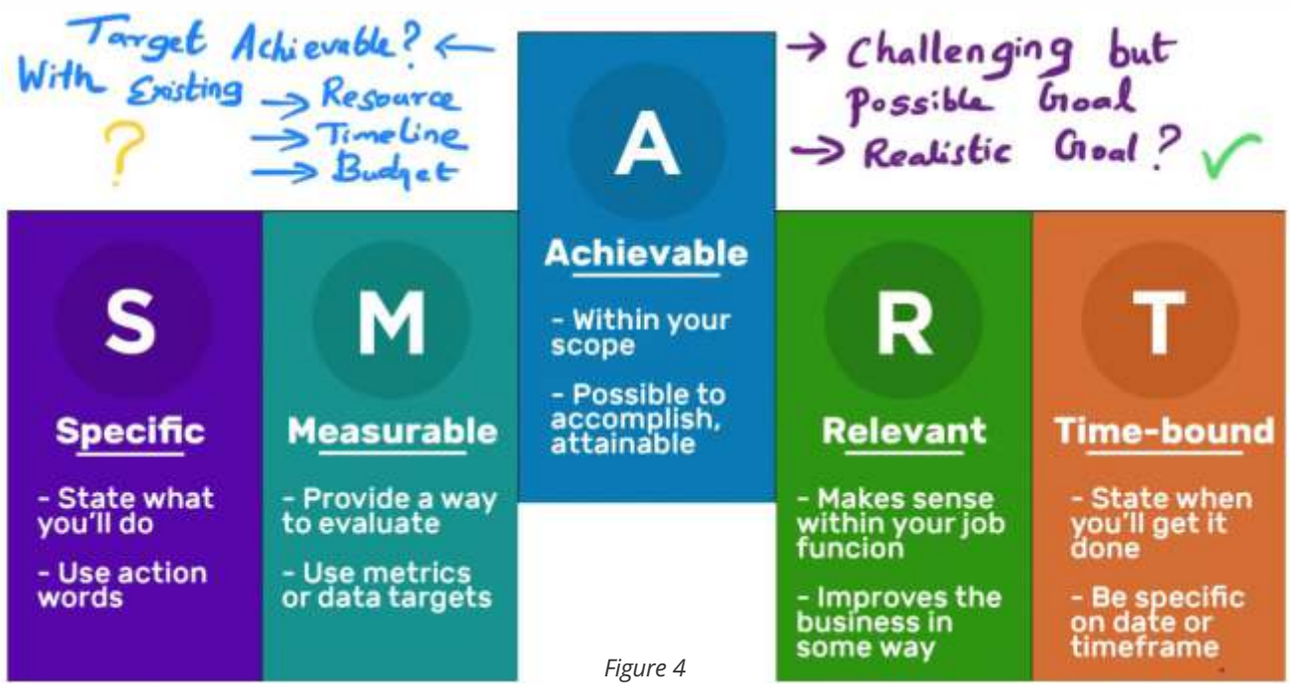


Figure 4

Step into the world of 'Lean Six Sigma' with us. At Catalysts, our journey starts with a comprehensive screening process, analyzing raw materials from diverse geographies. This forms the foundation of our meticulous development phase.

Quality assurance isn't just a phrase; it's our driving force. For each of the 4 main stages - screening, development, validation, and revalidation - our products undergo a battery of checks. Raw materials are sourced globally and tested thoroughly. With a minimum of 5 validations and revalidations, each conducted by different skilled scientists, you can rest assured that our products are backed by science and precision. Statistical significance is our guiding principle, with Experimental Designs carried out in triplicates, showcasing our commitment to consistent quality.

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MIS
18-Apr-23

Sagar Ramesh More
Technical Solutions - Grain
24-Apr-23

Tarun Manrai
IT
24-Apr-23

Sangramshinh B. Desai
Technical Solutions - Grain
24-Apr-23

Manu Rathi
Technical Solutions - Grain
24-Apr-23

Nashit Khan
Technical Solutions - Grain
02-May-23

Anupam S. Patel
Technical Solutions - Grain
03-May-23

Rohit Suryakant Sargar
Technical Solutions - Grain
03-May-23

Shubham Garg
R&D
05-May-23

Akshay Uttam More
Technical Solutions - Grain
11-May-23

Pravin B. Alanjkar
Technical Solutions - Grain
15-May-23

Pritam Pravin Patil
Technical Solutions - Grain
15-May-23

Ajinkya F. Dagde
Technical Solutions - Grain
15-May-23

Lalit Kumar
Technical Solutions - Grain
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Sandip Vishnu More
Technical Solutions - EBM
01-Jun-23

Sandeep N. Zambare
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Logistics
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Catalysts Bio-Technologies Pvt. Ltd. | Naturegen Biotechnologies LLP

Delhi • Ghaziabad • Hyderabad • Belagavi • Pune

CORPORATE OFFICE

240, Functional Industrial Estate,
Patparganj, Delhi - 110092, India

REACH US

+91 11 49867313 / 49867314
+91 9582963000
info@thecatalystsgroup.com
www.thecatalystsgroup.com
thecatalystsgroup catalysts_2 catalystsgroup

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