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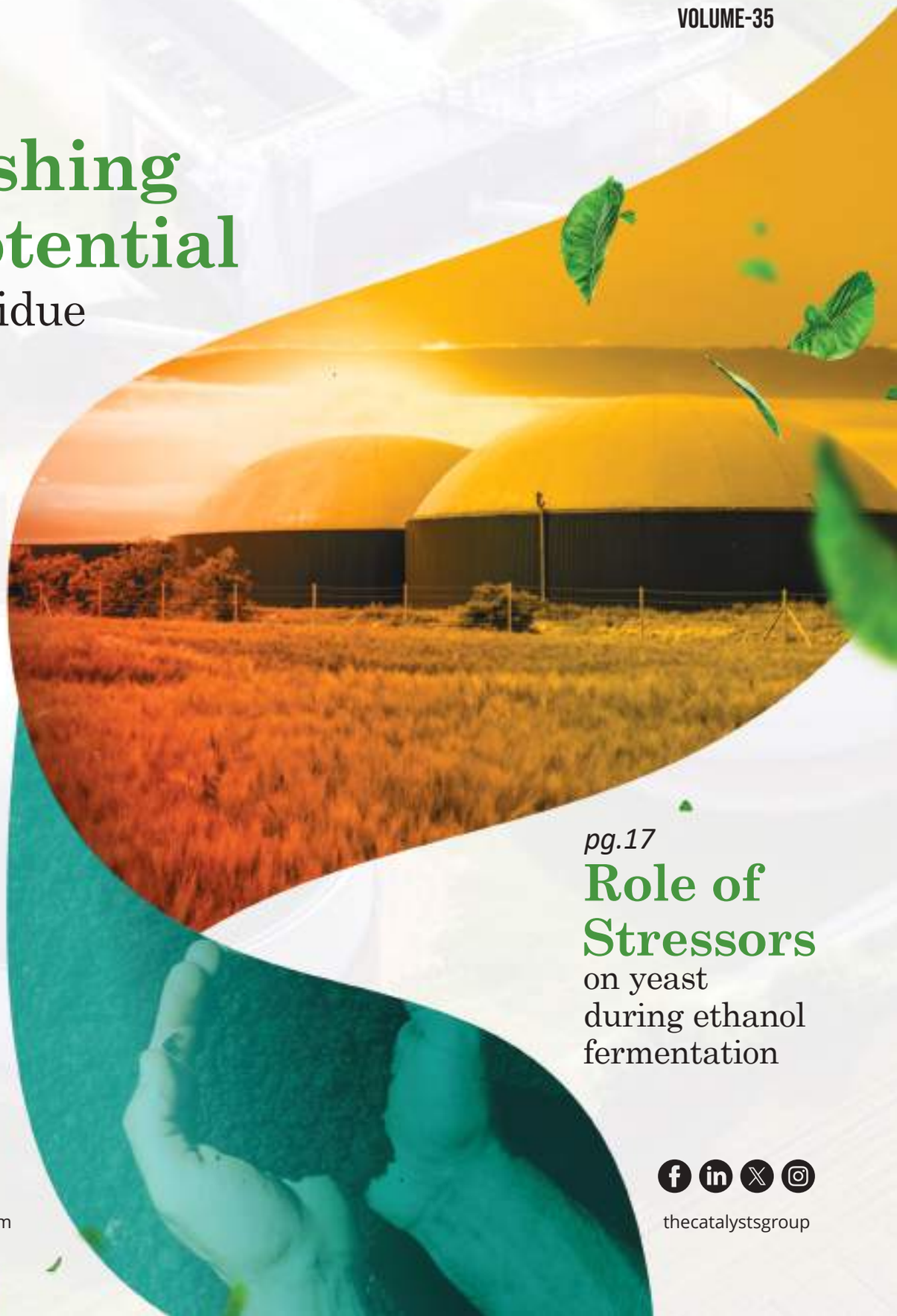

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MD's Desk

Munish Madan
MANAGING DIRECTOR

Hello Friends,

Wishing you all a very happy new year filled with prosperity, growth, and unwavering optimism. As we step into 2024, I extend my heartfelt gratitude to our dedicated team, clients, and partners who have been the pillars of strength in our remarkable journey.

The Catalysts Group completes 21 years of pioneering industrial biotech solutions. We are an expert in preventing losses, providing customized solutions and stand as India's number 1 and most trusted biotech company in Distilling , Sugar, and Brewing industries. This would not have been possible without the dedication and support of the leadership and entire team members in the past and present. We are equally grateful to our customers and business partners for the trust and support throughout!

There have been some key decision and developments in recent times such as - government's restrictions on sugarcane syrup usage for ethanol, focus on maize as a feedstock for ethanol, price hike by OMCs for maize-based ethanol, molasses export curb etc. - having significant impact on the industry as a whole. I am hopeful that these developments will ultimately be contributing to our country's growth like last decade. India as a country has made tremendous progress in last 10 years and government's initiatives played a pivotal role in these overwhelming achievements.

The last decade witnessed substantial growth in ethanol production. Government policies, investment opportunities, and blending percentage progress have made India a significant player in the global ethanol landscape. The country's total ethanol production capacity stands at 1380 crore litres, with molasses-based ethanol contributing about 875 crore litres, and grain-based ethanol adding up to 505 crore litres.

Installation of new ethanol distilleries and expansion of existing ones have attracted investment opportunities exceeding 40,000 crores in both urban and rural areas. Effective government policies have resulted in a remarkable increase in ethanol supply to OMCs, surging by over 13 times from 38 crore litres in ESY 2013-14 to about 502 crore litres in ESY 2022-23. The blending percentage has escalated from 1.53% in ESY 2013-14 to the targeted 12% in ESY 2022-23.

The exploration of food waste and crop residue aligns with India's commitment to sustainable practices. Collaborative efforts, innovation, and policy support are crucial for seamless integration into the ethanol production ecosystem. Shifting to alternative feedstocks is necessary for long-term resilience, demanding careful planning and support for existing facilities to adapt to the changing landscape.

Pressmud, a byproduct of the sugar industry, holds potential for Compressed Biogas (CBG) production. It offers an opportunity for sugar mills to generate additional revenue while contributing to sustainable energy practices. We at The Catalysts Group are all geared up with innovative solutions to support the industry in this endeavour.

Despite dynamic conditions, uncertainties, and global shifts, India will be the cynosure of the global economy in the times to come. As we navigate through 2024, let us embrace the opportunities and challenges, fostering innovation, sustainability, and success.

Warm regards,

Munish Madan

Unleashing the Potential of Agri residue for Green Energy

CBG (Compressed Biogas) revolution

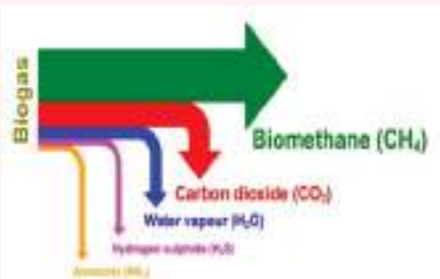
Dr. KVTS Pawan Kumar
R&D

Awadhesh Nath Tiwari
Marketing & Corp. Comm.

Renewable energy stands as our guide to a cleaner, greener future, countering the looming threat of climate change. With rising temperatures and the Specter of extreme weather events, the demand for eco-friendly alternatives grows more pressing. In this critical context, biogas emerges as a superhero, quietly transforming our energy landscape by offering a robust alternative to fossil fuels. This article underscores the potential of converting agricultural lignocellulosic residues into Compressed Biogas (CBG). It also explores the wider landscape of green energy in India as the nation progresses towards carbon neutrality.

Biogas can be produced from a variety of organic waste sources, encompassing agricultural waste (including the burning of stubble by farmers, a significant contributor to winter pollution in the national capital), press mud, spent wash, condensate, municipal solid waste, and food waste. This potential presents new economic opportunities for farmers, waste management firms, and other stakeholders involved in biogas production.

The potential of biogas in green energy generation and Government of India initiatives



Leveraging biogas in India's waste-to-energy transition holds substantial potential for ensuring energy security, affordability, entrepreneurial opportunities, job creation, and stimulating local economies. This approach effectively addresses India's waste management challenges by implementing circular economy models. Govt of India has identified the potential of Biogas and during November 2022, The Ministry of New and Renewable Energy (MNRE), Government of India has notified the National Bioenergy Program. The primary goal of Swachh Bharat Mission (SBM-U 2.0) is to create garbage-free urban areas by emphasizing sustainable sanitation, efficient waste management, and promoting circular economy practices. The ambitious target is to establish 15,000 Tons Per Day (TPD) Bio-Compressed Biogas (CBG) plants by 2026. The Ministry of Housing and Urban Affairs (MoHUA) has directed States/Urban Local Bodies (ULBs) to support Oil and Gas

Marketing Companies (OGMCs) in establishing CBG plants, aiding such as long-term concession agreements, land leases, and ensuring a continuous supply of segregated organic municipal waste.

In Nov 2023 the government has mandated the phased blending of compressed biogas (CBG) into compressed natural gas (CNG) and piped natural gas (PNG) from the fiscal year 2025-26, targeting 5% blending by 2028-29. Blending percentages are set at 1% in 2025-26, increasing to 3% and 4% in the following two years. Until 2024-25, blending remains voluntary. The move aims to stimulate CBG demand, reduce liquefied natural gas imports, save forex, promote a circular economy, and contribute to net-zero emissions. CNG, a cleaner fuel than petrol and diesel, constitutes nearly 14% of total passenger vehicle sales in India. Biogas, mainly methane and carbon dioxide, can replace natural gas after purification.

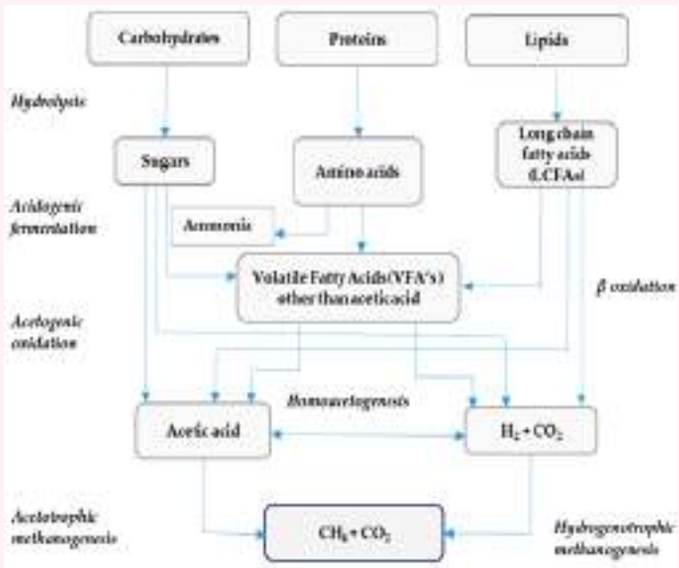
Achieving the targeted 5% blending of biogas with natural gas not only has the potential to reduce LNG imports by $1.17 billion but can also result in a 2% decrease in per capita CO2 emissions, benchmarked against the 2019 figure of 1.9 metric tonnes of CO2 per person in India. Moreover, diverting organic waste from landfills is highlighted as a measure with numerous benefits. The mandatory CNG blending initiative is expected to attract investments of around Rs 37,500 crore and pave the way for the establishment of at least 750 compressed biogas (CBG) projects by 2028–29, according to government estimates.

Biogas

Is a mixture of gases produced by organic matter in the absence of oxygen (anaerobically), primarily consisting of methane and carbon dioxide.

Compressed Biogas (CBG)

Compressed Biogas (CBG), originating from the anaerobic decomposition of organic materials, is predominantly composed of methane. The production process includes purification steps to eliminate impurities, and the ultimate product is subjected to high-pressure compression, hence acquiring the name "Compressed Biogas."



Biogas production pathway (Source: Rabii et al, 2019)

Amenable feed stock for biogas production

Biodegradable feedstocks, in various physical states, encompass agricultural wastes, crop residues, industrial by-products, animal wastes, aquatic waste, forest residues, and municipal solid wastes, all utilized for biogas production. Agricultural sources include animal manures, vegetable by-products, and energy crops. Industrial origins involve organic wastes from agroindustry, food industries, fodder, brewery & distillery industries, as well as by-products from biofuel production and biorefineries. Municipal sources consist of source-separated household waste, sewage sludge, municipal solid waste, and food residues. Aquatic biomass includes microorganisms (planktonic), macroalgae, and fish.

Sl. No.	Feedstock Type	Biogas Production
1	Agri waste and residues	45.8 Mm3 daily and 278.71 Mt/annum biogas generation potential
2	Livestock waste	12 million dung fed house-hold biogas units (with 3448Mm3 biogas generation potential) - working since 2010, 17,850 Mm3 biogas, can be produced only by the dung
3	Solid waste	9.23 Mm3 /day biogas production at a rate of 95 m3 /t
4	Wastewater sludge	15,392 million L/day
5	Industrial waste	34,627,395 m3 waste per annum produced, biogas production potential – Distillery, 87,366,094 m3 per day Dairy units, 219,409 m3 per day Poultry farms, 438,227 m3 per day Black liquor, 412,278 m3 per day Slaughterhouse, 494,225 m3 per day

Feedstock from Sugar & distillery Industries

The unsung hero of Biogas – Press mud

Press mud, a sugar industry byproduct known as filter-cake, holds untapped potential for biogas production. Often dismissed as waste, it contains methane, a crucial element for biogas. Instead of being used as organic fertilizer or traded for sugar cane, forward-thinking sugar mills are leveraging Press mud for biogas, offering environmental benefits and economic gains. Biogas production, using anaerobic digesters, transforms Press mud and spent wash into raw biogas. Scrubber refinement yields Bio CNG, a sustainable alternative to traditional LPG and CNG. The residual matter becomes potent organic manure, completing a sustainable cycle. Press mud's methane-rich composition makes it suitable for anaerobic digestion, generating Compressed Biogas (CBG)—a renewable, eco-friendly gaseous fuel. This shift from waste to energy underscores Press mud's role as a valuable resource in sustainable energy endeavours.

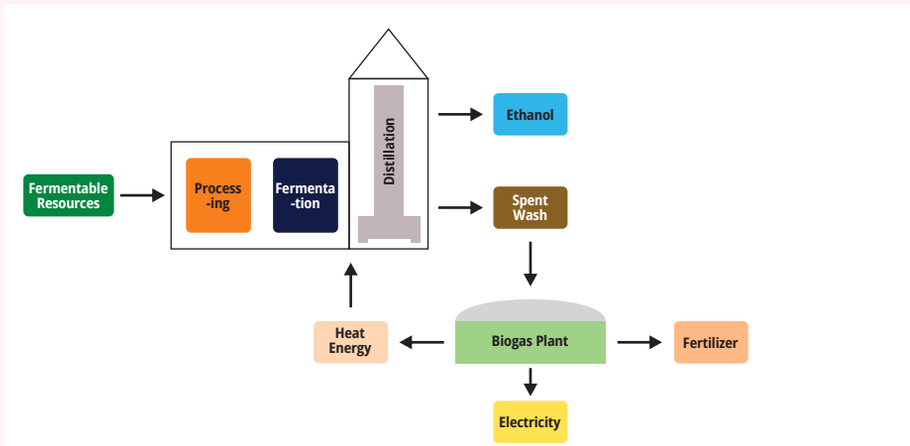
In 2022-23, India's 531 operational sugar mills comprised 330 private, 190 cooperative, and 11 public mills achieved a sugar production of 32.74 million tons, accompanied by around 11.4 million tons of Press mud. This quantity of press mud holds the potential to generate 460,000 tons of Compressed Biogas (CBG), valued at Rs 2,484 crore, considering the minimum guaranteed price of Rs 54/kg under the central government's SATAT scheme.

The Distillery Dilemma - Navigating Spent wash Challenges with Biogas Innovation

Distilleries, acknowledged for their role in producing ethanol as an eco-friendly fuel, occasionally cast an environmental shadow by disposing of spent wash—a dark brown wastewater notorious for its significant pollution. Its release into water bodies has severe consequences, harming aquatic life, depleting oxygen levels, and emitting unpleasant Odors. Managing or finding a profitable application for spent wash is not just a regulatory obligation but an urgent environmental imperative.

Traditionally, biogas generated from spent wash served the purpose of hydrogen sulphide (H2S) removal, typically

burned directly in boilers. Recent investigations have uncovered a more cost-effective alternative: Bio-CNG. By substituting traditional fossil fuels, Bio-CNG not only aligns with economic efficiency but also signifies a pivotal moment in the distillery sector's journey toward sustainability. The availability of spent wash for 240-270 days, compared to press mud for 180 days in a year, adds an advantage as a feedstock.



Biogas Plant utilization in a Distillery

Challenges in biogas production

Storage of feedstock

Feedstock such as press mud is accessible solely during the sugar production season and requires storage for an extended duration to facilitate year-round biogas production during the off-season. The primary objective should be to preserve the volatile solids intact while storing press mud, a task made challenging by its susceptibility to rapid microbial degradation. This poses difficulties in both storage and utilization. The complexities of storage, attributed to the gradual decomposition, call for innovative solutions to mitigate methane emissions.

Pretreatment of complex feedstock

The composition and intricate nature of diverse feedstocks approved for biogas production pose a significant challenge in the overall anaerobic digestion process. These feedstocks predominantly consist of lignocellulosic materials, comprising cellulose, hemicellulose, and lignin, intricately interconnected in a complex structure. Cellulose, characterized by its high crystallinity, poses challenges in depolymerization due to its rigidity and insolubility in water. Modifying the cellulose structure is both difficult and essential for efficient utilization. Adequate pretreatment methods play a crucial role in disrupting cellulose bonding, thereby enhancing its degradability. Without proper pretreatment, the crystalline nature of cellulose adversely affects the hydrolysis rate, consequently impacting biogas production.

Nutrition to handle microbial growth

The fluctuations in feedstock composition leads to elevated Chemical Oxygen Demand (COD) levels, increased temperature, and heightened acidity. Operating the anaerobic digester becomes challenging due to reduced bacterial growth and COD removal rates resulting from these variations. Over time, this leads to suboptimal performance of the anaerobic tanks. Additionally, methane-generating archaea and other anaerobic organisms are sensitive to adverse conditions such as low pH, high volatile acids, and variable loading rates. Addressing these challenges requires the supplementation of micronutrients, cofactors, and enzymes to provide essential building blocks for the growth and stabilization of anaerobic bacteria.

Holistic Solution by The Catalysts Group

In this dynamic landscape, The Catalysts Group has positioned itself as a trailblazer by providing state-of-the-art products and solutions. Focused on 'Grain to Ethanol' fermentation, the group has been a leader in the Compressed Biogas (CBG) revolution. The offerings from The Catalysts Group encompass:

- **Innovative Storage Solutions:** Prolonged storage of feedstock can significantly influence its properties, potentially affecting biogas production. The Catalysts Group tackles storage challenges by employing cutting-edge technologies that extend the shelf life of Press mud. This approach guarantees a consistent and reliable supply for biogas production, contributing to the overall efficiency of the process.

- **Advanced feedstock treatment solutions:** Elevating methane yield and optimizing the anaerobic digestion process necessitate strategies for enhancing feedstock quality. The Catalysts Group excels in innovative feedstock improvement techniques, including enzymatic pretreatment and co-digestion. These approaches involve breaking down complex biomolecules into simpler forms, ensuring more efficient utilization of organic materials in anaerobic digestion. As a trailblazer in enzyme-based biotechnological solutions, The Catalysts Group offers a diverse range of enzyme formulations tailored for the treatment of a wide variety of feedstocks.

- **Augmenting Biogas Production:** Nutrition plays a pivotal role in the anaerobic digestion process, and The Catalysts Group excels in providing cutting-edge enzymes, micronutrients, and cofactors. These components serve as essential building blocks necessary for the growth and stabilization of anaerobic bacteria within anaerobic digesters, thereby enhancing the overall biogas production process.

- **Collaborative Industry Engagement:** Through strategic partnerships with global leaders, The Catalysts Group introduces top-tier practices and technologies to Indian industries, fostering the advancement of the Compressed Biogas (CBG) sector.

Conclusion:

In the expansive realm of sustainable initiatives, the Biogas vertical is gaining prominence as an environmentally friendly industry, buoyed by the Biogas blending policy. In the context of sugar and ethanol sectors, press mud and spent wash serve as pivotal elements, contributing significantly. The transformation of these byproducts into biogas, particularly in the Bio-CNG form, not only brings economic benefits but also signifies a transformative shift towards a future where industries harmonize seamlessly with the natural environment.

Determination of methanol, volatile acid and fusel oils in ENA by GC-FID

Pooja Mishra
R&D

Gas Chromatography (GC) is a fundamental technique for compound separation and analysis, widely used in various industries and notably in analyzing alcoholic beverages. This method efficiently separates analytes based on volatility, with less volatile molecules eluting gradually, and more volatile compounds separating rapidly. Using a mobile and stationary phase, GC operates on the principle of partitioning volatile compounds, making it a versatile and crucial tool in analytical processes1.

As the samples are liquids in an alcohol or alcohol/water matrix, tedious sample preparation is often unnecessary. GC meets a key requirement as flavor compounds are naturally volatile. Various detectors hyphenated with GC, such as Flame Ionization Detector (FID), thermal conductivity, nitrogen phosphorous, photo-ionization, electron capture, flame photometric, electrolytic conductivity detector, and mass spectrometer, offer great sensitivity and can identify a wide range of samples not detectable by other chromatographic methods1. Flame Ionisation Detectors (FIDs) are a preferred choice due to their inherent properties, including universal response to organic compounds, low limits of detection (LODs), high acquisition frequency, wide linearity range, limited internal volume, and minimal maintenance requirements. GC proves to be a valuable tool in QA/QC contexts due to its ability to automate analysis2.

By-Products in Alcoholic Fermentation

Beyond ethanol, fermentation can yield aldehydes, organic acids, esters, and carbonyl compounds, broadening the spectrum of compounds associated with this intricate process (Fig 1). The higher alcohols, iso-amyl alcohol, amyl alcohol, iso-butanol, 1-propanol, 1-butanol, and 2-butanol are main components of fusel oil, and have been reported to be derived from specific amino acids3(Fig-2). Byproduct composition and concentration can vary widely. Some molecules occur in high concentrations, while others appear at substantially lower levels.

The presence of certain byproducts like aldehydes, esters and organic acids in alcoholic fermentation can indicate various issues in the fermentation process and affect the quality of the final product. Higher alcohols, aldehydes such as acetaldehyde, organic acids like acetic acid and lactic acid and different types of esters are normally

produced in small amounts during fermentation. But elevated levels of the by-products can suggest issues such as incomplete fermentation or microbial contamination (particularly by bacteria that produce these acids as metabolic byproducts), issues with yeast health, fermentation temperature & pH, or nutrient availability. These issues can occur if the fermentation conditions are not properly controlled. High levels of these by-products can also negatively affect the overall quality and sensory characteristics of the final product, leading to an unpleasant taste and aroma impacting its quality and marketability. In addition, it is known that if fusel oils are consumed in large quantities, they can have adverse consequences on health.

Significance of gas chromatography in alcohol profiling to ensure product quality

Volatile substances like acetaldehyde, methanol, and fusel oils are important indicators of the quality of liquors, thus the accurate determination of these volatiles is of great significance to the industry. To monitor and control these byproducts, it's essential to implement good fermentation practices, including proper temperature control, nutrient management, and sanitation. Regular monitoring of fermentation parameters and the use of appropriate yeast strains can help optimize the process and ensure the production of high-quality alcoholic beverages.

Analytical techniques such as gas chromatography (GC) can be employed to quantitatively assess the levels of specific byproducts during fermentation. GC techniques are often employed to investigate the many characteristics present in ethanol that contribute to flavor and colour which is especially important for monitoring and quality control purposes. It is also important to do profiling of these volatile acid and fusel oil from beginning of fermentation to the final product. As a result, GC analysis assists organizations in ensuring product quality and safety, which contributes to their success in the food and alcohol industry.

To analyze fusel oil levels in ENA, GC equipped with FID has been used by the Alcohol and Tobacco Tax and Trade Bureau (TTB) in the USA and by the Commission of the European Communities in Europe2. In most cases, the major compounds of fusel oil in liquor are 1-propanol, iso-butanol, 1-butanol, 2-butanol, iso-amyl alcohol, and active amyl alcohol3

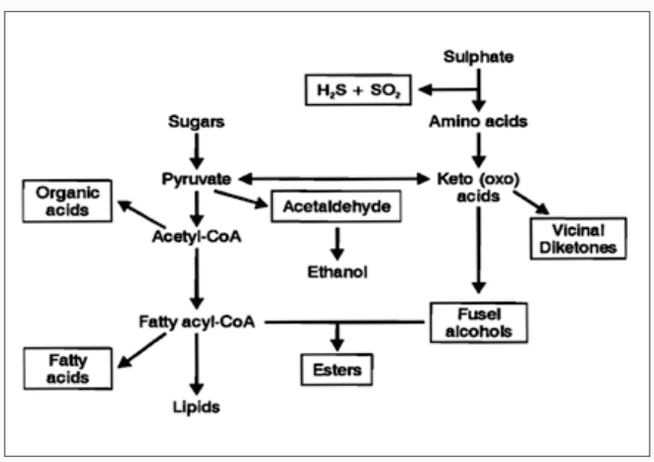


Figure - 1 Major metabolic routes by which yeasts synthesize fusel alcohols, esters, sulphur compounds, VDKs, acetaldehydes and ethanol

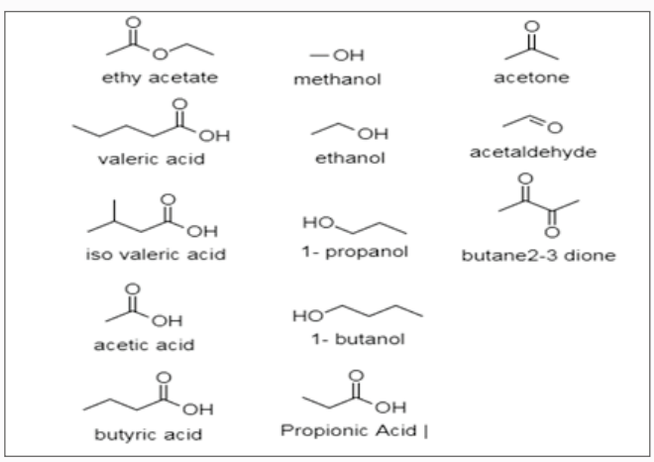


Figure - 2 Volatile acids and fusel oil with their chemical formula

Figure - 3 GC with FID detector

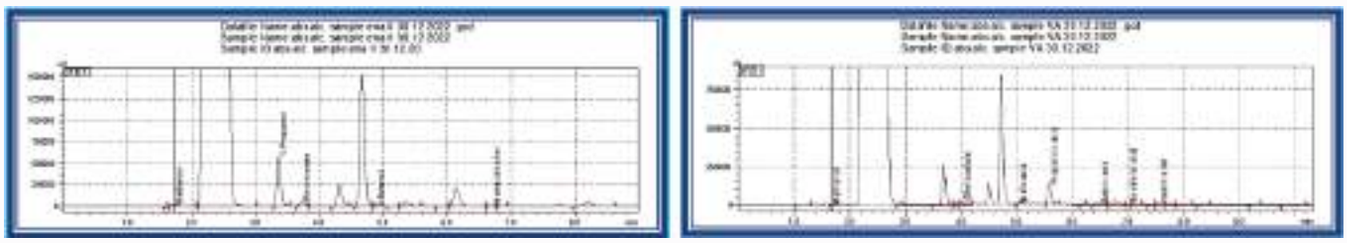


Figure - 4 Chromatogram of ENA analysis by GC- FID showing presence of byproducts

With this method, a small volume of sample was required, and gas chromatography with a flame ionization detector (GC-FID) can be used directly4 and the results are produced in the form for a chromatogram (Fig-4). Since there is no need for the headspace system, distillation, expensive chemicals, or expensive machinery, the commercial viability of such a method is very evident.

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Wheat Beers Questions & Answers

Everything you need to know about SafAle W-68™ & SafAle™ BW-20 By Philippe Janssens

Philippe Janssens
R&D, Fermentis
by Lesaffre

Find out everything you need to know about this innovative fermentation solution by reading our questions & answers with the product R&D Manager, Philippe Janssens.

What does the term 'wheat beer' refer to?

In Flemish and Dutch, Witbier means both “wheat beer” and “white beer.” Similarly, in German, “Weisse” means “white,” and “Weizen” means “wheat.”

This linguistic link might lead one to think that all wheat beers are “white” or at least pale due to their common Germanic roots. However, it's important to note that some wheat beer styles can be notably dark, such as the German Dunkels Weissbier, also known as Dunkelweizen.

So, it's worth mentioning that wheat beers come in various colors.

Why do wheat beers have different colors?

The differing colors of German Wheat Beers are due to the prevalent use of malted wheat, which gives a rich golden hue to the beer. This color can even become darker in styles like Dunkel Weizen or Weizenbock.

In contrast, Belgian-style Witbier is typically made from a blend of malted and non-malted cereals, sometimes incorporating wheat flour, resulting in a much paler appearance.

How do Fermentis' new products meet these specific styles needs?

Fermentis has developed two yeast strains tailored to the diverse world of wheat beer styles. SafAle™ W-68™ and SafAle™ BW-20 are engineered to enhance the distinctive characteristics of these styles while preserving their essence.

SafAle W-68™, a renowned German yeast strain from Weihenstephan, Germany, is ideal for traditional German styles. It offers medium attenuation, a moderate phenolic flavor, and prominent banana and tutti fruti notes.

Besides color, what distinguishes German and Belgian wheat beers?

Both beer styles share the common characteristic of being brewed with wheat, a difference from the usual barley malt. However, they differ significantly beyond this shared trait. German Weizen, or Weissen, follow standards outlined in the German Reinheitsgebot, or purity law, which restricts brewers to four ingredients: malt, hops, yeast, and water. These beers typically contain 40% malted wheat, although this ratio can extend up to 70%. Consequently, their aromas primarily come from the yeast-wheat combination, resulting in robust phenolic, banana, and sweet tutti-frutti notes. German Weizens adhere to these standards, which exclude the addition of extra spices.

Belgian Witbier, in contrast, relies on a lower percentage (not exceeding 40%) of unmalted wheat. The uniqueness of Belgian Witbier comes from the use of added spices like coriander, lavender, or orange zest or peels. Coupled with a less phenolic yeast, the base beer tends to be milder, serving as a canvas for the infusion of additional ingredients.

How do these different strains complement SafAle™ WB-06?

Yes, SafAle™ WB-06 is indeed part of our historic yeast strain offerings. This versatile yeast strain can produce a range of characteristics depending on the conditions applied, including a pronounced phenolic and estery profile with notes of banana and apple, culminating in a typically dry finish. It is suitable for both German and Belgian style wheat beers, often producing highly attenuated, dry beers with a touch of acidity and crispness.

Please note that this is a simplified overview of our yeast strains for wheat-based beers, and we encourage brewers to experiment, as any of the three strains can be used to create exceptional Belgian, German, or other unique wheat beer styles.

Metagenomics: An Advanced Approach for Providing Solutions to Customer

Prerna Srivastava
R&D

The sugar, distillery, and brewing industries face diverse challenges from raw materials, microorganisms during processes, and occasionally, the processes themselves due to their inherent unpredictability. In our research to develop effective solutions, we often encounter samples with bacteria showing antimicrobial resistance, adding complexity. Identifying and isolating such microbial populations is traditionally time-consuming.

To streamline this process and provide precise solutions, we can use metagenomics tools. This molecular biology tool extracts genetic material directly from various samples, eliminating the need to culture each microbe individually. Unlike traditional methods, metagenomics allows us to examine the complete genetic makeup of microbial populations, proving valuable for product design and output enhancement. This contributes to a more efficient and precise resolution of challenges in these dynamic industries.

Metagenomics add values in several ways which are mentioned in subsequent pointers:

1. **Microbial Diversity Analysis:** Molasses and grain is a complex substrate that is high in sugars and can be a rich nutrient source for many microbes. Many microbial species contained in the molasses and grain sample can be identified and measured with the aid of metagenomics. Understanding the composition, dynamics, and possible toxins of the microbial population can be greatly aided by this knowledge.
2. **Identification of Functional Genes:** Metagenomics can shed light on the microbial community in the molasses and grain sample's potential for function. We can find the genes involved in fermentation, sugar metabolism, and other pertinent activities by sequencing the genetic material. Understanding the microbial community's metabolic capacities is possible with the use of this knowledge. Suitable line of treatment can be suggested.
3. **Troubleshooting Microbial Imbalances:** Metagenomics can assist in determining the possible causes of any problems you may be having with

fermentation, contamination, or off-flavors while producing goods produced from molasses and grains (such as alcohol or biofuels). For example, metagenomic analysis can identify any unwanted microbes in the molasses and grain sample and reveal information on their metabolic processes.

4. **Monitoring Microbial Changes:** Continuous tracking of microbial populations in molasses and grain samples can be accomplished through the application of metagenomics. This is crucial in sectors where controlled and reliable fermentation is required, such as biotechnology and biofuels. Monitoring shifts in the make-up of the microbial population allows you to spot changes that could result in process inefficiencies or problems with product quality.
5. **Functional Pathway Analysis:** Troubleshooting and optimisation can be aided by knowledge of the pathways and metabolic activities that the microbial population participates in. The existence and activity of genes involved in important pathways such as the synthesis of ethanol, the utilisation of sugar, and other pertinent processes can be determined by metagenomics.
6. **Microbiome Engineering:** Metagenomics can also help us to create focused interventions if the clients are interested in boosting the production of specific compounds from molasses or grain. The microbial population can be engineered to accomplish particular objectives by either identifying prospective beneficial bacteria or altering already present ones.
7. **Quality Control:** By confirming that the microbial population in your molasses and grain samples satisfies specified requirements, metagenomics can help with quality control. Over time, this may aid in preserving a constant level of product quality.

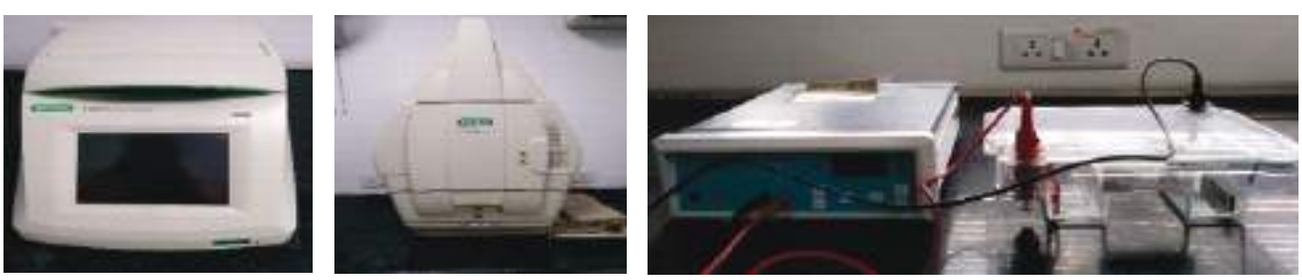

Figure Facilities present in R&D centre at Catalysts Biotechnologies Pvt. Ltd. A. Thermocycler B. Gel documentation system. C. Electrophoresis assembly.

When preparing a sample for microbial investigation, there are various crucial steps involved in metagenomics -

1. **Sample Collection:** The initial phase involves the collection of a representative molasses sample from the production or storage area. Ensuring sterility and aseptic conditions during the sampling process is crucial to prevent any risk of contamination.
2. **Sample Preparation:** The subsequent stage entails the extraction of microbial DNA from the molasses sample. This process involves screening the sample to eliminate larger particles and debris, followed by cell lysis to release DNA from microbial cells.
3. **DNA Extraction:** Following cell lysis, DNA extraction is performed to isolate genetic material from microbial cells. Various techniques exist for DNA extraction, and the chosen method can significantly impact the quantity and quality of the extracted DNA.
4. **DNA Purification:** The extracted DNA undergoes additional purification steps to remove contaminants and impurities that might hinder subsequent analyses, ensuring a clean and optimal sample for further processing.
5. **DNA Quantification and Quality Assessment:** The concentration and quality of the extracted DNA are meticulously assessed to guarantee an ample supply of high-quality DNA for subsequent procedures.

6. **Library Preparation:** Post-purification, DNA libraries are meticulously prepared for sequencing by fragmenting the DNA. Adaptor sequences are added to these fragments to facilitate the sequencing process using next-generation sequencing technology.
7. **Sequencing:** Employing high-throughput sequencing platforms such as Illumina, or others, the prepared DNA libraries undergo sequencing. This process generates substantial volumes of sequencing data, providing a comprehensive genetic profile of every bacterium present in the molasses sample.
8. **Data Analysis:** Bioinformatics pipelines are used to analyse and analyse the raw sequencing data. This consists of a few essential elements:

   - **Sequence Assembly:** In metagenomics, as opposed to whole-genome sequencing, the objective is to put together contigs, or contiguous DNA sequences, rather than entire genomes. This aids in the identification of functional components and genes.
   - **Taxonomic Classification:** To determine whether microorganisms are present in a sample, sequences are compared to databases of known microbial genomes. Specialised metagenomic classifiers or tools like BLAST are employed.
   - **Functional Annotation:** In order to gain understanding of the metabolic capacity of the microbial community, genes and functional elements (such as metabolic pathways and enzyme-encoding genes) are identified through analysis of the sequences.
9. **Microbial community analysis:** The composition, diversity, and functional potential of the sample's microbial community are revealed by the metagenomic analysis findings.
10. **Data Interpretation:** To understand the functions and interactions among diverse microorganisms within the molasses sample, the findings from data analysis are meticulously assessed. Researchers gain insights into the types of microorganisms present, their roles, and identify potential opportunities or challenges related to fermentation and quality control. Using the metagenomic analysis, further investigations and strategic actions, such as fine-tuning fermentation conditions, addressing contamination issues, enhancing yield, or scrutinizing specific metabolic pathways, can be carried out.

This comprehensive approach allows for informed decision-making and the implementation of targeted interventions based on a thorough understanding of the microbial dynamics within the molasses sample. To guarantee accurate and trustworthy results, strict quality control must be maintained throughout the metagenomic analysis process. Working with bioinformaticians and subject matter specialists can also be helpful in interpreting complex metagenomic data and applying it to the distillery and molasses industries.

Recognizing the essential role of metagenomics, The Catalysts Group has proactively established an in-house molecular biology lab equipped with state-of-the-art instrumentation. This facility enables us to conduct advanced techniques such as gel electrophoresis, SDS-PAGE, and PCR. Our dedicated team of researchers is constantly working on providing solutions and making their process robust with greater yield. The successful application of these techniques has consistently delivered outstanding results, earning the satisfaction of our clients.

Role of Stressors on yeast during ethanol fermentation

Dharmender Pathak
Technical Solutions

Majority of yeasts are capable to convert different hexose sugars to ethanol via glycolysis pathway. However, the Saccharomyces cerevisiae, the most used robust yeast strain for alcoholic fermentation due to highly compatible & tolerance capacity. S. cerevisiae has numerous benefits over other yeasts as it is a facultative anaerobe capable of growing under both aerobic and anaerobic conditions with presence of glucose and is tolerant of higher ethanol concentrations. During anaerobic conditions, S. cerevisiae produces acetaldehyde, which is than further reduced to ethanol.

In both the cases of either propagation or fermentation, yeast cells undergo several stress factors. These stressors can be either biological stressor or chemical stressor or physical stressor or combination of multiple stressors, that can severely affect the ethanol yield.

Defined types of Stressors:

- **Biological stressors**
  - Cellular ageing,
  - Microbial competition (microbial contamination)
- **Chemical Stressors**
  - Ethanol and its metabolites toxicity
  - pH
- **Physical stressors**
  - Temperature shock,
  - Osmotic pressure

Stress of yeast cell can result in decreased ethanol production, increased glycerol production, increased mutations, microbial contamination, altered yeast flocculation, and production of undesired compounds such as, flavours and aromatic compounds in fermented beverages. Lower viability and declined fermentation activity due to stress conditions can also cause sluggish or stuck fermentation.

In present days, many methodologies have been developed to reduce these stresses which includes media feeding pattern, tweaking fermentation temperature parallel to yeast pitching rate, nutritional supplementation, and proper aeration.

Various additional factors, includes nutrition imbalances (e.g., nitrogen, vitamins, mineral deficiencies), medium composition (e.g., sugar concentration), and inoculum size. Biological stress factors (e.g., microbial contamination) can severely affect the fermentation efficiency and these factors primarily driven by the presence of contaminating microorganisms, such as lactic acid bacteria. Such LAB (Lactic acid bacteria) can not only compete to utilize the available fermentable sugar, but they also produce the significant amount of lactic acid, and

other metabolites that can suppress the fermentation rate. Naturally antimicrobial compounds called bacteriocins, also produced by these LAB, can suppress the growth of other bacteria by disrupting their transmembrane potential and forming pores in the membranes of sensitive cells, provides LAB a competitive advantage over other bacterial organisms. These highly problematic microbial contamination in an industrial fermentation can cause frequent & extended shutdown of facility operations for CIP before the next fermentation cycle.

Glucose is preferable than fructose for Saccharomyces cerevisiae to utilize, so the presence of such sugars that are slowly metabolized can affect the fermentation ethanol yield and productivity rate. Higher fructose accumulation can also result in stuck or sluggish fermentations. Such high fructose concentrations problem is more common with sugar cane and fruit-based feedstocks, such as in deteriorated syrup/molasses and wine fermentation. To overcome the sluggish or stuck fermentations, reinoculation of suitable yeast which can utilize fructose and tolerating elevated ethanol concentrations is typically used.

Yeasts have ability to developed different survival mechanisms that help them to adapt against chemical and physical stresses. As an example of response against temperature stress, yeast cells initiate the production of the disaccharide trehalose to stabilize their plasma membrane. In excess sugar or high salt environments, yeasts start producing glycerol as an Osmo-protectant, to handle the osmotic stress and to prevent cell lysis. Certain level of glycerol production is also necessary to sustain the balance between the NAD+/NADH ratio during the yeast cell growth. These metabolites production in excess initiates lower ethanol titre, as more time is needed for adaptation to the fermentation media. Therefore, to reduce the adaptation period, and to maximize the ethanol yield proper, suitable broth feeding pattern and essential nutrients play a vital role in enhancing the fermentation efficiency.

By utilizing the proper nutrients by yeast, the concentration of ethanol can increase in medium. This increased level of ethanol sometimes results in physiological impairment based on level of stressors. Excess level of ethanol (>10–20% v/v) can demonstrate reduced cell viability and growth of yeast, resulting in decreased cell concentration. Toxicity of ethanol on yeast is predominantly due to the cell membrane damage, that can also affect the yeast metabolism like stress response proteins production, lowered essential protein levels & denaturation of essential proteins, non-uniform cell structure, and improper membrane function such as loss of electrochemical gradients & inhibition of endocytosis. Though, sustaining an ion balance e.g., magnesium and potassium supports the membrane via protective effects against ethanol toxicity and temperature stress.

One of the major factors, which affects the fermentation efficiency and sometime results in stuck or sluggish fermentations is imbalance in the nutrient and growth factors like, Oxygen, an essential requirement of yeast for the biosynthesis of key membrane constituents such as sterols (e.g., ergosterol) and unsaturated fatty acids (e.g., oleic acid), which helps in stress tolerance. Hence, the lack of oxygen can reduce the ability for yeast to synthesize membrane components, reducing inoculum efficiency and leading to ineffective or inadequate fermentations.

Other characteristic imbalances that can ensue includes Vitamins deficiency, Free amino nitrogen deficiency, and essential minerals deficiency like zinc or magnesium. It has been reported that deficient free amino nitrogen (<150 mg/L) and trace metals (e.g., zinc <0.1 ppm) can lead to sluggish fermentation due to the inadequate action of terminal fermentation enzyme in yeast metabolic pathway, known as alcohol dehydrogenase, is a zinc-dependent enzyme, responsible for reducing acetaldehyde to ethanol during glucose fermentation. Magnesium, another key element required for efficient fermentation. The activation of several enzymes involved in metabolic bioenergetic and biomolecular pathways (e.g., DNA duplication) is dependent on this divalent metal & the deprivation of this metal can also result in undesirable cellular physiological effects like loss of protein

conformation. Cellular structural integrity, heavy-metal detoxification, yeast functionality, and stress protection is also magnesium dependent, and these divalent ions can also improve the cell viability of yeast during the exponential and stationary growth phases under fermentation, by promoting the tolerances to elevated ethanol conditions, heat shock, and dehydration, result from the repression of stress-protein synthesis. Although Mg^{2+} is an essential factor for yeast performance but as an antagonist for Ca^{2+}, can influence and destabilize the calcium complexes.

Few other trace elements like Ba^{2+}, Fe^{3+}, Co^{2+}, Mo^{2+}, Ni^{2+}, and Cu^{2+} are also required in very small amounts (<10 mM), essential for yeast physiology, activation & modulation of several metabolic processes involved in yeast performance and survival. All in all, free amino nitrogen, minerals & trace metal elements, vitamins, and essential growth factors are mandatory for optimizing ethanol fermentation process.

Talent Acquisition- Challenges in Biotech Industry

Archana Kumari
Human Resources

"The biggest innovations of the 21st century will be at the intersection of biology and technology. A new era is beginning."

-Steve Jobs

The biotech industry, marked by rapid advancements and breakthrough discoveries, stands at the forefront of scientific innovation. As it continually pushes the boundaries of what is possible in healthcare, agriculture, and environmental science, the demand for top-tier talent has never been more critical. However, with this demand comes a unique set of challenges that talent acquisition professionals in the biotech sector must navigate.

1. Scarcity of Specialized Talent:

One of the primary challenges in talent acquisition for the biotech industry is the scarcity of individuals with highly specialized skills. Biotech companies often require professionals with deep expertise in molecular biology, genomics, bioinformatics, and other niche areas. Identifying and attracting such talent becomes a competitive endeavor, as these individuals are in high demand across various sectors.

To address this challenge, talent acquisition specialists need to forge strong partnerships with academic institutions, research centers, and industry associations. Building a pipeline of talent through internships, collaborations, and targeted recruitment efforts can help mitigate the scarcity of specialized professionals.

2. Evolving Skill Sets:

The biotech landscape is dynamic, with technologies and methodologies evolving rapidly. This presents a challenge in identifying candidates with the latest skill sets and staying ahead of the curve in terms of workforce capabilities. Traditional recruitment methods may not be sufficient, requiring talent acquisition teams to adopt proactive strategies.

Investing in continuous learning and development programs for existing employees and potential hires can be a game-changer. Additionally, fostering a culture of innovation and adaptability within the organization attracts candidates who are not only well-versed in current technologies but are also eager to embrace emerging trends.

3. Interdisciplinary Collaboration:

Biotech projects often require collaboration between professionals from diverse disciplines, such as biology, chemistry, engineering, and data science. Recruiting individuals who not only excel in their specific fields but also thrive in interdisciplinary environments poses a considerable challenge.

To overcome this, talent acquisition specialists should emphasize the importance of cross-disciplinary collaboration during the recruitment process. Seeking candidates with a track record of successful teamwork and the ability to bridge the gap between different scientific domains is crucial for the seamless functioning of biotech teams.

4. Regulatory Compliance and Talent:

The biotech industry operates within a stringent regulatory framework, and compliance is non-negotiable. Hiring professionals who understand and can navigate the complex regulatory landscape is paramount. However, finding individuals with expertise in both the scientific and regulatory aspects of biotech can be challenging.

Talent acquisition teams should collaborate closely with regulatory affairs departments to identify candidates with a strong understanding of compliance requirements. Incorporating regulatory expertise as a key criterion in the hiring process ensures that the organization remains in adherence to industry standards.

5. Global Talent Acquisition:

The nature of biotech research often requires a global talent pool, as breakthroughs can come from any corner of the world. Navigating international talent acquisition involves addressing visa regulations, cultural differences, and logistical challenges.

Establishing a robust global recruitment strategy is essential. Leveraging technology for virtual interviews, understanding immigration processes, and offering comprehensive relocation support can enhance the organization's ability to attract and retain top-tier global talent.

6. Talent Retention in a Competitive Environment:

The competitiveness of the biotech industry extends beyond recruitment to talent retention. With numerous opportunities for skilled professionals, retaining key personnel becomes a critical aspect of talent acquisition.

Implementing retention strategies such as career development programs, mentorship initiatives, and a supportive work environment can foster a sense of loyalty among employees. Additionally, offering competitive compensation packages and benefits ensures that the organization remains an attractive long-term prospect.

7. Cultural Fit and Innovation:

Biotech companies often thrive on innovation, and maintaining a culture that fosters creativity and risk-taking is vital. Identifying candidates who not only possess the necessary technical skills but also align

with the organization's values and innovation culture is a challenge.

Incorporating behavioral assessments, case studies, and scenario-based interviews can provide valuable insights into a candidate's cultural fit and innovation mindset. Emphasizing the importance of these attributes during the recruitment process helps build a team that contributes to the organization's overarching goals.

Biotech industry has had a compound annual growth rate of ~4% over the past five years and is poised to grow at a CAGR of 8.7% between now and 2030.

Investing in Employee Development

Recruiting talented individuals is only the first step; retaining and developing them is equally crucial. Investing in ongoing employee development helps build a strong, adaptable, and loyal workforce. Here are some strategies to consider:

a. Training and mentorship programs: Provide employees with opportunities for continuous learning and skill enhancement. Organize workshops, seminars, and training sessions to keep them updated with the latest advancements in their respective fields. Pairing new hires with experienced mentors fosters knowledge sharing and accelerates professional growth.

b. Career progression and recognition: Establish clear career paths within the organization, offering employees a sense of purpose and advancement. Recognize and reward outstanding performance to motivate individuals and reinforce a culture of excellence.

c. Work-life balance and well-being initiatives: The biotech industry often demands long hours and intense workloads. Prioritizing work-life balance and well-being initiatives, such as flexible schedules, remote work options, and wellness programs, can enhance employee satisfaction and retention. Consider offerings from errand running services, that include a wide range of options to support your employees in achieving work-life balance and enhancing their overall well-being. Circles can assist with ordering outside meal delivery, take care of external errands, and handle travel and transportation requests.

In the face of a biotech talent shortage, investing in your team is not only a strategic imperative but also a key differentiator in a fiercely competitive market. By implementing effective talent acquisition strategies and fostering a culture of employee development, biotech companies can attract and retain top talent, fuelling innovation and achieving sustainable growth. As the biotech landscape continues to evolve, organizations must recognize that their most valuable asset is their human capital and make concerted efforts to invest in it.

In conclusion, talent acquisition in the biotech industry is a multifaceted challenge that requires a strategic and adaptive approach. Navigating the scarcity of specialized talent, addressing evolving skill sets, promoting interdisciplinary collaboration, ensuring regulatory compliance, managing global talent acquisition, retaining key personnel, and assessing cultural fit are all integral aspects of building a successful workforce in the dynamic landscape of biotechnology. As the industry continues to evolve, talent acquisition specialists must stay agile, leveraging innovative strategies to secure the best talent and drive forward the next wave of scientific breakthroughs.

The Role of Agile Supply Chain Management in B2B Organizations

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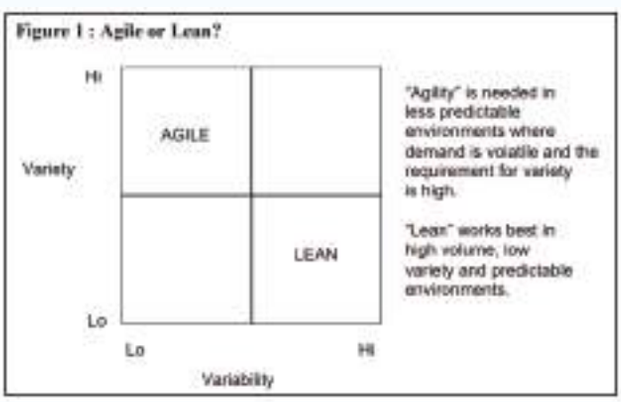
Supply Chain Management

What is Agility?

Agility is a business-wide capability that embraces organisational structures, information systems, logistics processes and, in particular, mindsets. A key characteristic of an agile organisation is flexibility.

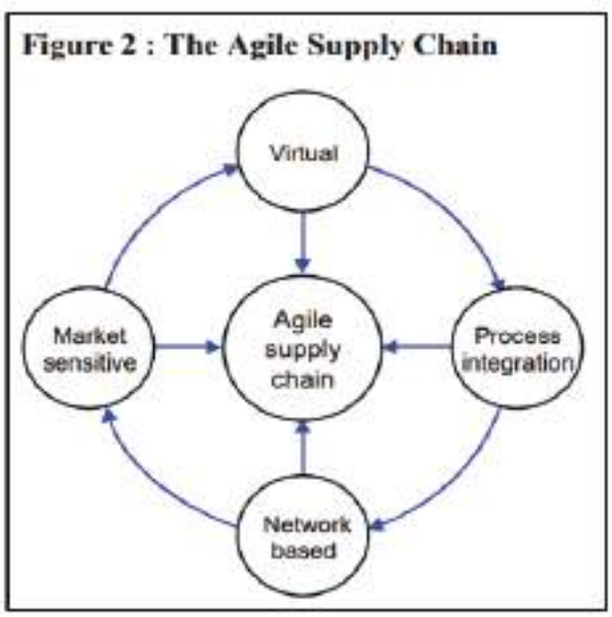
Agility should not be confused with 'leanness'. Lean is about doing more with less. The term is often used in connection with lean manufacturing to imply a 'zero inventory', just-in-time approach. Paradoxically, many companies that have adopted lean manufacturing as a business practice are anything but agile in their supply chain.

Whilst leanness may be an element of agility in certain circumstances, by itself it will not enable the organisation to meet the precise needs of the customer more rapidly. Webster's Dictionary makes the distinction clearly when it defines lean as 'containing little fat' whereas agile is defined as 'nimble'.



In the dynamic landscape of business-to-business (B2B) operations, the traditional supply chain model is undergoing a profound transformation. The advent of globalization, rapid technological advancements, and the ever-changing market demands have necessitated a shift towards more agile supply chain management (SCM) practices. This article explores the crucial role of agile SCM in B2B organizations, emphasizing its advantages and the pivotal role of Enterprise Resource Planning (ERP) systems.

Agile SCM in B2B: Responding to Market Dynamics



In the B2B world, where the intricacies of supply and demand are often complex, agility is paramount. Agile SCM involves the ability to quickly adapt to changes, whether they are in customer demands, market trends, or disruptions in the supply chain. The primary goals of implementing agile SCM in a B2B organization include enhancing responsiveness, reducing lead times, improving collaboration, and ultimately, boosting customer satisfaction.

Enhanced Responsiveness: Traditional supply chains often struggle to respond promptly to shifts in demand or unforeseen disruptions. Agile SCM, on the other hand, emphasizes real-time data analytics, allowing organizations to identify trends and respond swiftly to changes in customer preferences or market conditions.

Reduced Lead Times: Agile practices streamline processes, leading to reduced lead times from order placement to product delivery. This not only enhances customer satisfaction but also enables organizations to operate with leaner inventories, minimizing holding costs.

Improved Collaboration: Agile SCM encourages seamless collaboration between different entities in the supply chain. From suppliers to manufacturers and distributors, real-time information sharing fosters a collaborative environment, reducing the risk of miscommunication or delays.

Customer Satisfaction: Ultimately, the core objective of agile SCM is to enhance customer satisfaction. By ensuring that products are delivered on time, in the right quantity, and meeting quality expectations, organizations can build lasting relationships with their B2B clients.

Data-Driven Decision-Making in Agile SCM

Data is the backbone of agile SCM, providing the necessary insights for informed decision-making. Let's take a glance at some key data points that highlight the impact of agile SCM in B2B organizations:

1. Reduction in Lead Times: Agile SCM practices have been shown to reduce lead times by an average of 15-20%, allowing organizations to fulfil orders more efficiently.

2. Increased On-Time Deliveries: B2B organizations embracing agile SCM report a 25% improvement in on-time deliveries, contributing to enhanced reliability and customer trust.

3. Inventory Optimization: Agile SCM facilitates a 20-30% reduction in excess inventory, helping organizations operate with optimal stock levels and minimizing holding costs.

4. Revenue Growth: B2B organizations with agile SCM practices experience, on average, a 10-15% increase in revenue due to improved customer satisfaction and market responsiveness.

Advantages of ERP in SCM:

Advantage	Description
Centralized Data Hub	ERP systems centralize data related to inventory, orders, and logistics, providing a unified platform for real-time information access.
Enhanced Visibility	Improved visibility across the supply chain allows for better tracking of goods, reducing the risk of errors and delays.
Forecasting Accuracy	ERP's analytical capabilities enhance forecasting accuracy by leveraging historical data and market trends, aiding in inventory planning.
Process Automation	Automation of routine tasks within SCM processes reduces manual errors, speeds up operations, and allows teams to focus on strategic activities.
Collaboration Efficiency	ERP systems facilitate seamless collaboration by enabling multiple stakeholders to access and share information in real time.
Cost Reduction	By optimizing processes, reducing lead times, and minimizing errors, ERP contributes to overall cost reduction in supply chain operations.

Conclusion: Transforming B2B Supply Chains with Agility

In the ever-evolving landscape of B2B commerce, agility in supply chain management has become not just a choice but a necessity. The ability to swiftly respond to market dynamics, collaborate efficiently, and leverage data for informed decision-making is what sets successful B2B organizations apart. Coupled with the advantages of ERP systems, agile SCM becomes a powerful tool in navigating the complexities of modern supply chains, ensuring competitiveness, and driving sustained growth.

Sour Beer - Embracing the Tangy Trend in Craft Brewing

Palak Dave
Brewing

The global Craft Beer market was valued at USD ~68,600 million in 2022 and is projected to grow at a CAGR of 11.2% during the forecast period, reaching USD 129,939 million by 2028. Among the various types of craft beers available in the market, one stands out – Sour Beer. Sour beer is your gateway to an intriguing journey in the world of fermented flavors.

In the kaleidoscopic landscape of craft brewing, where innovation is key, Sour Beer has emerged as a trendsetter, captivating the taste buds of enthusiasts worldwide.

The Sour Beer Renaissance: Sour beer is not a recent discovery; its roots trace back centuries to regions like Belgium, where brewers stumbled upon wild yeast strains and bacteria that gave their brews an unexpected tanginess. Today, sour beer is experiencing a renaissance, with craft breweries worldwide experimenting with various souring techniques and creating a diverse array of sour styles.

The Brewing Process: What sets sour beer apart is its unique fermentation process. While traditional beers rely on specific yeast strains for fermentation, sour beers embrace wild yeasts and bacteria, such as lactobacillus and Brettanomyces. These microorganisms work their magic over an extended period, creating an environment where sourness thrives.

Brewing Techniques: Kettle Sour vs. Barrel Sour

Sour Beer is distinctive for its tangy and tart flavors, achieved through a meticulous brewing process involving the introduction of specific bacteria. There are two primary methods employed by craft brewers to produce Sour Beer: Kettle Sour and Barrel Sour.

1. Kettle Sour: A Controlled Tanginess

In the Kettle Sour method, brewers initiate the souring process during the wort preparation stage. After mashing with malt and wheat, the wort is transferred to the kettle. Instead of adding hops, the temperature is raised to sterilize the wort. Subsequently, the temperature is lowered to around 40 degrees Celsius, and bacteria, such as Lactobacillus, is introduced. This souring process typically lasts 24-48 hours, aiming to achieve a pH level in the mid to low 4 range.

Following the souring stage, the wort is boiled, introducing hops to halt bacterial activity. The wort is

then transferred to a fermenter, where additional ingredients like fruits or flavors are incorporated, adding complexity to the beer.

2. Barrel Sour: Unleashing Wild Fermentation

Barrel Sour, on the other hand, embraces a more traditional approach. Brewers cultivate the necessary bacteria within aged wooden or oak barrels. These barrels become a haven for wild fermentation, fostering unique and subtle flavors. Unlike Kettle Sour, Barrel Sour involves spontaneous fermentation, offering minimal control over the types of bacteria influencing the brewing process.

Noteworthy is the prevalence of Barrel Sour in beer-loving regions like Germany, Belgium, and France. Here, open fermenters are often utilized, accumulating centuries worth of micro-flora that contribute to the distinct character of the beer. The use of open fermenters, once rooted in historical temperature control practices, is experiencing a resurgence among craft brewers.

Charting the Tangy Trajectory: A Tabular Snapshot

Aspect	Kettle Sour	Barrel Sour
Initiation of Souring	Begins during wort preparation in the kettle.	Cultivates bacteria within aged wooden or oak barrels.
Bacterial Involvement	Lactobacillus, Pediococcus, and sometimes	Primarily involves wild Brettanomyces fermentation with minimal control
Control Over Process	Offers more control over the souring process.	Embraces spontaneity, offering minimal control for wild flavors.
Flavor Profile	Cleaner, predictable taste with controlled souring.	Complex, nuanced flavors with unpredictable wild fermentation.
Geographical Prevalence	Global popularity with craft brewers worldwide.	Prominent in beer-loving regions like Germany, Belgium, France.

Tasting the Trend: Flavor Profiles in Sour Beer

Sour Beer enthusiasts are drawn to the diverse flavor profiles this trend offers. The souring agents, often bacteria like Lactobacillus and Pediococcus, along with the infusion of Brettanomyces fungus, contribute to a spectrum of tastes ranging from mildly tangy to intensely sour. The choice between Kettle Sour and Barrel Sour also influences the final flavor, with the controlled environment of Kettle Sour producing a cleaner, more predictable taste, while Barrel Sour embraces the unpredictability of wild fermentation, resulting in complex and nuanced flavors.

Sour Beer Around the Globe

Sour Beer's popularity extends beyond borders, with craft brewers worldwide adopting and adapting these souring techniques. The trend has become particularly pronounced in regions known for their beer culture, like the United States, where craft breweries experiment with unique flavor combinations and aging processes.

Diverse Sour Styles: Sour beer comes in a wide spectrum of styles, each offering a distinct flavor profile. Here are a few to pique your curiosity:

1. Berliner Weisse: A German-style sour wheat beer known for its refreshing and tart character, often enjoyed with flavored syrups like woodruff or raspberry.

2. Gose: Hailing from Leipzig, Germany, Gose features a balanced blend of saltiness, sourness, and hints of coriander. It's a delightful summer sipper.

3. Lambic: Originating in Belgium, Lambics are complex and often aged in wooden barrels. They can be further classified into Gueuze (blended and carbonated) or Fruit Lambics (infused with fruits like cherries or raspberries).

4. American Wild Ale: The U.S. craft beer scene has embraced sour brewing, creating an array of American Wild Ales. These can range from mildly tart to intensely sour, with various fruit or hop additions.

Food Pairing Adventures: Sour beers are incredibly versatile when it comes to food pairings. Their acidity and complexity make them fantastic companions for various dishes. For instance, try a Berliner Weisse with seafood ceviche or pair a Gose with tacos and guacamole. The possibilities are endless, and experimentation is encouraged.

The Craft Beer Revolution: Beyond Tradition

The resurgence of open fermenters and the widespread adoption of Sour Beer represent a departure from conventional brewing practices. Craft brewers are pushing the boundaries of tradition, experimenting with fermentation in open vessels, much like their predecessors in beer-loving countries. This departure from the norm not only pays homage to brewing history but also adds an element of unpredictability and artistry to the process.

Conclusion: Sipping into the Future of Craft Brewing

Sour Beer, with its tangy allure and innovative brewing techniques, stands as a testament to the dynamic nature of the craft brewing industry. Whether enthusiasts are drawn to the controlled precision of Kettle Sour or the wild, untamed flavors of Barrel Sour, one thing is clear: Sour Beer is not just a passing trend but a vibrant and evolving segment within the craft beer revolution. As craft brewers continue to experiment and redefine brewing norms, the future promises even more exciting and diverse offerings for those who savor the zestier side of beer.

Challenges in Urban Wastewater Treatment in 21st century

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R&D

India's population growth has fueled a surge in water demand, particularly in urban areas where the uptick is more pronounced than in rural regions. In 2001, the urban population was 285 million, with an estimated daily domestic water demand of 38,475 million litres based on a supply of 135 litres per capita. By 2011, the urban population reached 377 million, resulting in a water demand of 50,895 MLD. This reflects a considerable increase of 12,420 MLD in urban water demand due to population growth. While a benchmark of 135 LPCD is recommended for domestic water use in urban local bodies, the current average supply, according to the CPHEEO, is only 69.25 LPCD. This glaring disparity highlights a substantial gap between water demand and supply in India's urban areas, exacerbating challenges related to access to safe drinking water and sanitation facilities. Concerns persist, especially

with projections indicating that by 2050, half of India's population will inhabit urban areas, intensifying water-related issues.

Challenges due to urban wastewater in the 21st century

Wastewater from households and industries strains aquatic environments due to substantial organic matter and nutrient content. When released, ammonia and natural processes break down organic matter, depleting oxygen levels in rivers. Excess nutrients like nitrogen and phosphorus lead to plant and algae overgrowth, obstructing light and consuming oxygen. Water purification is crucial due to freshwater depletion, a global issue exacerbated by India's large population and pollution, causing severe scarcity and clarity issues.

Climate change brings heavy rainfall, overwhelming urban sewers and causing overflow at treatment plants. Sustainable urban drainage systems offer a solution, managing runoff sustainably. In addressing water pollution and scarcity, a sustainable approach becomes imperative. Therefore, addressing the critical need for urban wastewater collection and treatment is important for safeguarding public health and the environment. Throughout India, urban wastewater treatment plants grapple with diverse conditions, including sewage composition, population size, receiving water requirements, and local climate, underscoring the complexity of managing this crucial aspect of urban infrastructure.

An image showing extreme growth of plants and algae due to excessive nutrients in waterbodies due to urban wastewater

How does urban waste water treatment work?

The construction of sewage systems is essential for the efficient collection and transportation of wastewater to treatment plants. These facilities offer a multi-step treatment process, typically encompassing:

1. Pre-treatment: This initial phase involves the physical removal of large objects such as rags and plastics, as well as smaller items like grit, from the wastewater. This step safeguards downstream equipment by preventing potential damage.

2. Primary Treatment: Focused on removing fine particles, wastewater undergoes primary treatment in a tank. Heavier solids settle at the tank's bottom, while lighter solids and fat rise to the surface. The separated materials are then isolated, allowing the remaining liquid to proceed to either secondary treatment or be discharged into the environment.

3. Secondary Treatment (Biological Treatment): Also known as biological treatment, this phase targets the removal of residual organic matter, suspended solids, bacteria, viruses, parasites, and, to some extent, nutrients and chemical substances.

4. Advanced Treatment for Sensitive Discharges: In cases where wastewater is discharged into

environmentally sensitive waters, more rigorous treatment measures are applied. This may involve specific techniques like disinfection to further eliminate harmful bacteria, viruses, parasites, and any remaining chemicals or substances detrimental to public health.

These comprehensive treatment steps ensure that wastewater is thoroughly purified before discharge, aligning with stringent environmental standards and safeguarding both public health and ecosystems.

Sludge management

Sewage sludge, a by-product from the breakdown of organic pollutants in wastewater by bacteria, requires effective treatment for safe disposal. Methods like liming, aerobic, and anaerobic digestion stabilize the sludge, reducing odors and pathogens. Anaerobic digestion not only stabilizes but also reduces the sludge volume while producing valuable biogas. Dewatering removes excess water, reducing weight and transportation costs. These processes collectively contribute to environmentally responsible sewage sludge management from wastewater treatment.

Advantages of urban wastewater treatment

The widespread implementation of effective wastewater treatment throughout the 21st century represents a significant milestone. This advancement has not only contributed to enhancing human health but has also markedly improved environmental quality by mitigating the adverse impacts of untreated wastewater on aquatic ecosystems. Some other major advantages are-

1. Energy self sufficiency
2. Reduced floods risks
3. New technologies for resource and nutrient recovery
4. Increasing sustainability
5. Reduced waste accumulation
6. Lower green-house gas emissions

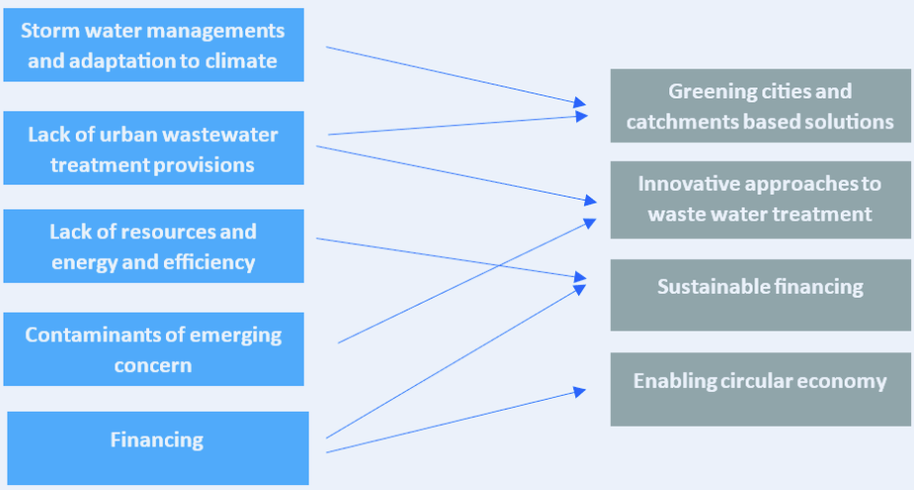

Figure showing various challenges and solutions for promoting urban wastewater treatment

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Importance of proper Tax planning for a Working Individual

Shivoham Tayal
Finance & Accounts

Tax planning is a crucial aspect of financial management, and for a working individual, it serves as a strategic tool to optimize their tax liability within the legal framework. In India, understanding the nuances of income tax laws and implementing effective tax planning can significantly impact an individual's financial well-being. This article explores the importance of proper tax planning, its advantages, disadvantages, and offers insights into the current tax landscape in India.

The Landscape of Income Tax in India: An Overview

India's income tax structure is progressive, with tax rates varying based on income slabs. As of the latest available data, the income tax slabs for individual taxpayers below 60 years are as follows:

Tax Rates for OLD Regime

Income Range (Annual)	Tax Rate
Up to ₹2.5 lakh	Nil
₹2,50,001 to ₹5,00,000	5%
₹5,00,001 to ₹10,00,000	20%
Above ₹10,00,000	30%

Tax Rates for NEW Regime

Income	Tax	Slabs	(Rs)	Income tax rate (%)
From	Upto	₹3.00	Lakhs	**O**
From	3,00,001	to	6,00,000	**5%**
From	6,00,001	to	9,00,000	**10%**
From	9,00,001	to	12,00,000	**15%**
From	12,00,001	to	15,00,000	**20%**
From	15,00,001	and	Above	**30%**

Additionally, a cess of 4% is levied on the total income tax payable, contributing to the overall tax liability in Old Regime as well as New Regime. Further surcharges ranging from 10% to 25% will be applicable for Income having over and above Rs. 50 Lakhs.

OLD Tax Regime vs. NEW Tax Regime

Particulars	Old Tax Regime	New Tax Regime
Tax Slabs	As per the existing income tax slabs.	New tax slabs with lower rates but without deductions.
Standard Deduction	Available	Available
Deductions	Available (e.g., HRA, 80C, 80D)	Not available
Exemptions	Available (e.g., House Rent Allowance)	Not available
Optimal for	Individuals with various deductions and exemptions.	Individuals with a simple financial structure and those preferring lower tax rates.
Analysis	Might be beneficial if one has significant deductions/exemptions.	Beneficial for those aiming for simplicity and lower tax rates.

It is Pertinent to note that an individual once adopted New Regime will not revert back to Old Regime.

Importance of Tax Planning for Working Individuals:

1. **Minimizing Tax Liability:** Effective tax planning allows individuals to minimize their tax liability by taking advantage of exemptions, deductions, and rebates provided under the Income Tax Act. This ensures that a significant portion of income remains in the hands of the taxpayer.
2. **Optimizing Investments:** Tax planning encourages individuals to make strategic investment decisions that align with their financial goals and provide tax benefits. Investments in instruments like Equity-Linked Savings Schemes (ELSS), Public Provident Fund (PPF), and National Pension System (NPS) offer tax deductions.
3. **Ensuring Compliance:** Proper tax planning ensures compliance with tax laws, reducing the risk of legal complications. It involves accurate and timely filing of income tax returns, adhering to disclosure norms, and maintaining financial transparency.
4. **Facilitating Financial Goals:** Tax planning is integral to achieving long-term financial goals. By reducing tax outflows, individuals have more resources to save, invest, and fulfill their aspirations, such as buying a home, funding education, or planning for retirement.
5. **Retirement Planning:** Tax planning plays a crucial role in retirement planning. Investments in tax-saving instruments coupled with a systematic approach to wealth creation can result in a financially secure retirement.

Advantages of Tax Planning:

1. **Wealth Creation:** By strategically channeling funds into tax-efficient investment avenues, individuals can accumulate wealth over time, creating a financial cushion for future needs.
2. **Risk Mitigation:** Tax planning often involves diversifying investments across various asset classes, reducing the overall risk associated with market fluctuations.
3. **Ensured Financial Security:** A well-thought-out tax plan contributes to financial security by aligning investments with long-term goals, such as children's education, homeownership, and retirement.
4. **Increased Disposable Income:** By optimizing tax-saving options, individuals can enhance their

Challenges of Tax Planning:

1. **Complexity:** The Indian tax code is intricate, and navigating through various exemptions and deductions can be complex. Some individuals might find it challenging to grasp the nuances of tax planning.
2. **Changing Tax Laws:** Tax laws are subject to amendments, and what may be a tax-efficient strategy today might not hold true in the future. Adapting to changes in tax laws can pose a challenge.
3. **Overemphasis on Saving Tax:** In some cases, individuals might focus excessively on saving taxes without considering the overall financial picture. This could lead to suboptimal investment decisions.
4. **Lack of Awareness:** Many taxpayers are not fully aware of the available tax-saving options. This lack of awareness may result in missed opportunities to optimize tax liability.

Conclusion:

Proper tax planning is a dynamic and integral component of financial management for working individuals. It goes beyond mere compliance and becomes a strategic approach to wealth creation and financial security. While tax planning offers numerous advantages, individuals must stay informed about changes in tax laws and strike a balance between optimizing tax benefits and making sound investment decisions. In the ever-evolving landscape of taxation, staying proactive and seeking professional advice can empower individuals to navigate the complexities and harness the full potential of tax planning for their financial well-being.

Employee Engagement

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Technical Solutions - Grain
December 2023

Nisha Malhotra
Human Resources
December 2023

Team Celebrations / Trainings

Catalysts Drawing Competition – October 2023

FOSTAC & DOE Training, Technical Centre, Ghaziabad, U.P., - October 2023

Diwali Celebrations at The Catalysts Group – November 2023

Christmas Celebration - December 2023

Training for Leadership Team, Delhi – December 2023

Seminar & Conferences



Drink Technology India Conference & Exhibition, Pragati Maidan, Delhi – October 2023






2nd Catalysts Technical Workshop: Fuelling the Future, Renaissance, Lucknow, Uttar Pradesh – October 2023



International Conference on Sugar Industry, National Sugar Institute, Kanpur, Uttar Pradesh – October 2023

World Biogas Association: India Congress 2023 ,Hyatt Regency, Delhi - October 2023

Brew Asia, Ho Chi Minh City, Vietnam – October 2023

Fermentis APAC CB Distributor Meeting, Ho Chi Minh City, Vietnam – October 2023

x x x x x

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