Catalysts Connect

July, Aug, Sep, 18 Volume 30

- Yeast in Brewing
- Brewing Process Hygiene & Its Control
- Sugarcane and Its Products
- Probiotics & Prebiotics

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COMPLETE ENZYME & ADDITIVES SOLUTION FOR BREWING INDUSTRY

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ENZYMES & ADDITIVES IN BREWING

- Enzymes and Additives in Mashing
- Enzymes and Additives in Fermentation
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- Enzymes and Additives in Maturation

FEATURES

- Customized Solutions
- Trademark Products
- On Demand Analytical Support
- Well Equipped & State-of-Art Labs
- Leaders in Enzyme Solutions for Sugar & Ethanol Industry
- Certified Manufacturing Units
- More than a decade of Excellence
- Qualified Customer Support Teams

ABOUT THE GROUP

The Catalysts Group is among the top 5 Indian biotechnology companies, active in industrial enzymes business segment.

Our 15+ years experience of enzyme application in sugar as well as alcohol industries have given us a distinctive edge in creating customized products. Application of our products not only increases process efficiency, but also results in higher ethanol recovery.

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making things happen...

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MESSAGE FROM THE MANAGING DIRECTOR

Dear Friends

Time really flies! We have already completed the first half of financial year 2018-19. As always it has been an exciting period for the Catalysts Group.Our 'YOY' Growth during this period is more than 35% at the end of the second quarter!

All our verticals viz Sugar and Molasses, Grain and Brewing have clocked good growth. Outlook for next two quarterslooks positive considering recent changes in Ethanol Policy allowing oil companies to procure Ethanol produced from Cane Juice, B-Heavy Molasses and Grain. Sugar season is also getting started and opportunity to export raw sugar due to recent spurt in Global sugar prices may give some much-required relief to this Industry.

The Goal and Path for the second half is clearly defined; all stakeholders including our business partners, channel partners, team members and vendors are geared up to meet all challenges… "Challenges that you face should be looked at as Opportunities to achieve Greatness!"

We are a team of achievers! Each person must monitor his or her own progress, to develop his individual and team's circle of excellence. Enjoy the ride and make your team and family proud.

So friends: Heads down, get set and go!!!

Munish Madaan

MESSAGE FROM THE DIRECTOR

Dear Friends

Wishing you all a very happy festive season !!

Recently we completed first 6 months of current financial year 2018-19. With all your support & wishes we are able to achieve 35% YoY growth. The upcoming last half of the FY 2018-19 is the key season time for molasses distillery, sugar processing and brewery. Based on the trend, products & projects we are not only hopeful but committed to achieve 30% YoY growth for this year.

Recent fuel ethanol policy has given a spur spin to the entire industry. Policy will not just benefit the farmer, sugar mill or molasses distillery but will also encourage grain distilleries to run 100% capacity to complete unmitigated demand of both fuel as well as ENA. This step will take the industry to new horizon of opportunities to enhance process performance and convert every molecule of glucose to alcohol. Companies which are agile will be an active part of this evolution era.

We at Catalysts are ready & well prepared to be part of this change.

- Efficiency booster products for molasses & grain will aspire maximum recoveries in the distilleries.
- Enzymes for sugar & grain processing will make the process reach highest conversion rates.
- High alcohol tolerant yeast gives opportunities to deliver higher alcohol percentages.
- Nutrient products from our basket gives healthy conditions for yeast to perform to its maximum output levels.
- Technically qualified sales & CS team at Catalysts has been professionally trained to help, assist & support the restive process teams to attain highest level of efficiencies.
- Scientists at Catalysts R&D are dedicated to provide specific and optimum solutions to the client needs.

With the changing scenario we are sure that next few years would be the golden years for the industry and would be coined as an Ethanol Era in the history of India. Along with you, Catalysts is also equipped to be a part of this era by "making things happen"

Aditya Malhotra

Offsite Tour, Chail























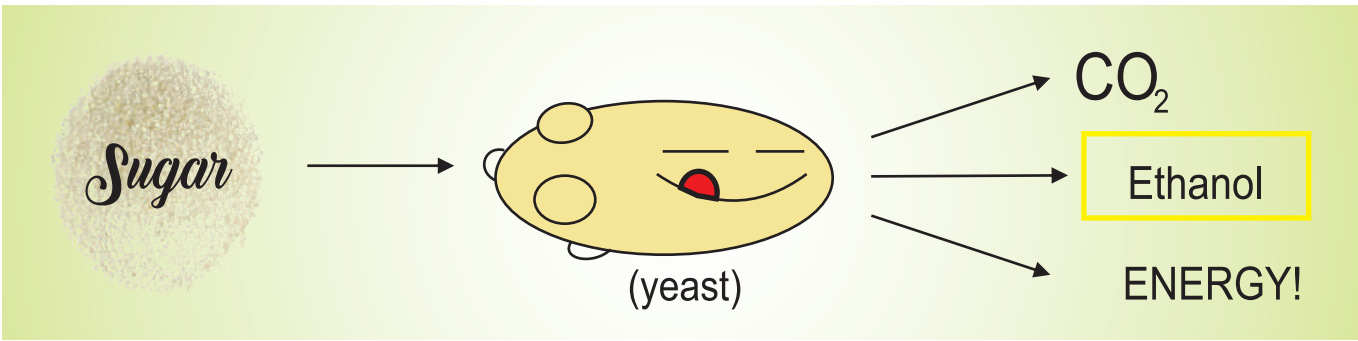



76th Annual Convention and Sugar Expo

Yeast in Brewing

Namrata Tyagi
Research & Development

Yeast are single-celled microorganisms that reproduce by budding. They are biologically classified as fungi and are responsible for converting fermentable sugars into alcohol and other by-products. There are literally hundreds of varieties and strains of yeast. In the past, there were two types of beer yeast: ale yeast (the "top-fermenting" type, Saccharomyces cerevisiae) and lager yeast (the "bottom-fermenting" type, Saccharomyces uvarum, formerly known as Saccharomyces carlsbergensis). Today, as a result of recent reclassification of Saccharomyces species, both ale and lager yeast strains are considered to be members of S. cerevisiae.



Saccharomyces cerevisiae is used in brewing beer, when it is sometimes called a top-fermenting or top-cropping yeast. It is so called because during the fermentation process its hydrophobic surface causes the flocs to adhere to CO2 and rise to the top of the fermentation vessel. Top-fermenting yeasts are fermented at higher temperatures than the lager yeast Saccharomyces pastorianus, and the resulting beers have a different flavour than the same beverage fermented with a lager yeast. "Fruity esters" may be formed if the yeast undergoes temperatures near 21 °C (70 °F), or if the fermentation temperature of the beverage fluctuates during the process. Lager yeast normally ferments at a temperature of approximately 5 °C (41 °F), where Saccharomyces cerevisiae becomes dormant.

Top-Fermenting-Yeast

Ale yeast strains are best used at temperatures ranging from 10 to 25°C, though some strains will not actively ferment below 12°C . Ale yeasts are generally regarded as top-fermenting yeasts since they rise to the surface during fermentation, creating a very thick, rich yeast head. That is why the term "top-fermenting" is associated with ale yeasts. Fermentation by ale yeasts at these relatively warmer temperatures

produces a beer high in esters, which many regard as a distinctive character of ale beers.

Top-fermenting yeasts are used for brewing ales, porters, stouts, Altbier, Kölsch, and wheatbeers.

Bottom-Fermenting-Yeast

Lager yeast strains are best used at temperatures ranging from 7 to 15°C. At these temperatures, lager yeasts grow less rapidly than ale yeasts, and with less surface foam they tend to settle out to the bottom of the fermenter as fermentation nears completion. This is why they are often referred to as "bottom" yeasts. The final flavour of the beer will depend a great deal on the strain of lager yeastand the temperatures at which it was fermented.

Some of the lager styles made from bottom-fermenting yeasts are Pilsners, Dortmunders, Märzen, Bocks, and American malt liquors.

Spontaneous Fermentation

Beer that is exposed to the surrounding open air to allow natural/wild yeast and bacteria to literally infect the beer, are spontaneous fermented beers. One of the typical yeasts is the Brettanomyces Lambicus strain. Beers produced in this fashion are sour, non-filtered and inspired by the traditional lambics of the Zenne-region. This brewing method has been practised for decades in the West Flanders region of Belgium.

Byproducts of Yeast

Yeast impact the flavour and aroma of beer more than you might think. The flavour and aroma of beer is very complex, being derived from a vast array of components that arise from a number of sources. Not only do malt, hops, and water have an impact on flavour, so does the synthesis of yeast, which forms byproducts during fermentation and maturation. The most notable of these byproducts are, of course, ethanol (alcohol) and carbon dioxide (CO2); but in addition, a large number of other flavour compounds are produced such as:

- Acetaldehyde (green apple aroma)
- Diacetyl (taste or aroma of buttery, butterscotch)
- Dimethyl sulfide (DMS) (taste or aroma of sweet corn, cooked veggies)
- Clove (spicy character reminiscent of cloves)
- Fruity / estery (flavour and aroma of bananas, strawberries, apples, or other fruit)
- Medicinal (chemical or phenolic character)
- Phenolic (flavour and aroma of medicine, plastic, Band-Aids, smoke, or cloves)
- Solvent (reminiscent of acetone or lacquer thinner)
- Sulfur (reminiscent of rotten eggs or burnt matches)

There are other yeast byproducts, and some of the listed can be both desired byproducts and/or undesired depending on the beer style or what the brewer was trying to achieve.

Propagation and Fermentation

Ale and lager yeast can grow aerobically and anaerobically. In the presence of oxygen, cells are encouraged to divide and produce biomass instead of alcohol. However, this is only strictly true if the sugar concentration is kept below a level of 0.2 g/L. Once the level of sugar is higher than 0.2 g/L, yeast will produce alcohol regardless of the presence of oxygen—this has been defined as the Crabtree effect. In breweries propagation (biomass production) is usually conducted in low-gravity worts in the presence of oxygen. In sophisticated yeast propagation systems, oxygen will be introduced and sugars will be continuously fed at very low concentrations. Cell division will occur with low alcohol production and prepare the cells for fermentation conditions. During the first few hours of fermentation, when the yeast cells are under aerobic conditions, they divide and produce ethanol simultaneously. Once the oxygen is exhausted, the yeast enters an anaerobic environment and will keep producing ethanol at a slower rate. Beside ethanol, yeast will produce other by-products that will impact on beer flavour and aroma. Higher alcohols, esters, sulfur compounds, or vicinal diketones are all produced as a result of yeast metabolism and their concentration can be modulated by influencing parameters such as temperature, pitching rate, aeration, or pressure.

Yeast Growth

When cells grow, they undergo an asymmetric form of cell division called "budding" and go through a cell cycle to generate a new cell. When the conditions are adequate, a mother cell gives

rise to a daughter cell (called a "virgin" cell) and becomes itself a generation older. This implies that a yeast culture always contain 50% virgin cells, 25% generation 1 cells, 12.5% generation 2 cells, etc. The average age of a yeast culture is therefore very young. This means that theoretically a yeast culture could be used indefinitely. The reality is quite different; despite maintaining a young age status, yeast cells accumulate stress and are exposed to mutations. To avoid genetic and behavioural changes new yeast is usually reintroduced regularly. The form of aging focusing on cell division is referred to as replicative and is not to be confused with chronological aging, which represents the time-related age of a culture (days, weeks, etc.). The age of a culture also refers to the number of times the yeast has been used (repitched) for fermentation.

Yeast Division and Storage

The division of a yeast cell or cell cycle is genetically programmed and influenced by environmental factors. A culture contains cells of different stages of the cell cycle. The first phase of the cycle is a rest phase called G1 where no budding occurs. Toward the end of G1 the keypoint "START" senses that the environment and the cell itself are adequate for division and allow entrance into the reproductive cycle and DNA synthesis. The bud starts to emerge before reaching another rest phase, G2. Past G2, mitosis will then take place and nuclear division will occur.

The last step is the cytokinesis where the daughter and mother cells physically separate. The separation process leaves a bud scar on the mother cell and a birth scar on the daughter cell. Both types of scars are composed of chitin and can be easily visualized using the fluorescent dyes calcofluor or wheat-germ agglutinin in combination with a fluorescent microscope. A single cell is able to accumulate many bud scars on its surface, each the result of the birth of a daughter. Realistically, under brewing conditions a cell is likely to die of stress before it reaches its genetically determined division potential. When cells are dormant (reversible nondividing state or stationary phase), they enter a G0 phase until the conditions are again suitable to pass START. Cells can survive for long periods of time in the G0 state but will deteriorate with time. A yeast culture in G0 phase. When pitched into a new wort for fermentation, the cells will re-enter the cell cycle until a growth-limiting factor will again arrest cell division. When repitching yeast, cells consistently enter and exit the cell cycle; when damages occur as a result of accumulated stress, they may become permanently deactivated and eventually die, hence the need to constantly grow new yeast cultures.

Yeast Maintenance

After a determined number of repitchings, new yeast should be used, either obtained in a dry form or propagated by a third party or in-house. Propagations are typically started from a stock culture. Yeast stocks should be kept at cold temperatures to maintain the integrity of the DNA through time; spontaneous mutations do occur and can affect the characteristics and performance of yeast. To protect yeast strains against mutation for a long period of time, cryopreservation is recommended, with the safest method being storage in the gas phase of liquid nitrogen in a specific container. Working stocks can be maintained frozen at –80°C for long-term storage. Agar slants may be kept at 4°C (39°F); however, this is only for short-term storage because there is a higher risk of mutation and contamination. The number of times a yeast culture can be reused depends on numerous factors; however, it is well documented that cultures should be replaced regularly to ensure fermentation performance and consistency. Although this is the norm, there are exceptions, and some breweries have been reported to have used a single yeast culture for years or even decades without notable mutation of loss of vitality. The genetic stability of the strain used, hygiene process, brewing frequency and schedule, the yeast maintenance program, and type of beer produced will eventually determine how many times a particular yeast culture can be repitched.

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Brewing Process Hygiene & Its Control

Shri Bijay Bahadur Singh, Yuksom Breweries Ltd.

Brewing Process Hygiene:

- Plays a key role in the production of high quality beer
- Knowledge of microorganisms
- Control of microbial fouling
- Essential in the prevention of microbial spoilage of beer

Objectives:

- Ensure product quality
- Minimise contamination risks
- Improve economic efficiency
- To reduce damage to the environment

Microorganisms Related with Brewing Process:

- Absolute beer spoilage organisms: Grow in beer without long adaption and cause off-flavours and turbidity or precipitates
- Potential beer spoilage organisms: Normally do not grow in beer. Beers with high pH, low hop concentration, low degree of fermentation, low alcohol content or high oxygen content may be susceptible
- Indirect beer spoilage organisms: Do not grow in finished beer but they may start to grow at some stages of the process, causing off-flavours in the final beer e.g. pitching yeast or in the beginning of fermentation.
- Indicator organisms: Do not cause spoilage but they appear as a consequence of insufficient cleaning or errors in the brewing process.
- Latent organisms: Which are sporadically encountered in the brewing. This group are common organisms in soil and water and their presence in the brewery is due to contaminated process water or construction work inside the brewery.

Sources of Contaminations:

Primary contaminations, originating from

- Wort
- Yeast
- Fermentation
- Maturation (lagering)
- Soiled equipment

Secondary contaminations, originating from

- Bottle washer due to dripping water
- Bottle inspector
- Airborne contamination during transport of open bottles from the bottle washer to the filler
- Filler
- Crowner
- Environment close to the filler and crowner

Resistance to Microbial Spoilage of Beer:

The most resistant beers are

- Strong beers
- Beers with a pH below 4.3
- All malt beers with pH 4.4 – 4.6
- Beers with a high hop content

Processes for Reduction of Microorganisms:

- Acid washing of pitching yeast
- Cooling
- Filtration
- Pasteurisation
- Aseptic or hygienic packaging

Hygienic Design:

Hygienic design mainly includes suitable choice of

- Equipment
- Materials
- Accessories
- Process layout

Process automation

- All the surfaces in contact with the beverage are easy to clean
- All the beer-contact surfaces should be smooth
- All equipments and pipelines should be self-draining

Foam Cleaning and Disinfection Programme:

The role of cleaning and disinfection for the breweries has grown immensely. Chemical cleaners have been found to be more effective in eliminating attached bacteria from the surfaces than disinfectants.

Mechanical force can be achieved by turbulence flow in the pipelines and spray nozzles in the cylindrical tanks.

The cleaning of open surfaces in the brewery, such as bottle inspectors, fillers and conveyor chains in the bottling hall, is usually performed using low-pressure foam systems or thin film cleaning.

Action	Agent
Prerinsing	Water
Foaming	Foam cleaner
Soak time	Foam cleaner
Spraying	Disinfectant solution
Final rinsing	Water

The purpose of disinfection is to reduce the surface population of viable microorganisms after cleaning and to prevent microbial growth on surfaces during the interproduction time.

In choosing disinfectants for use in brewery, the following characteristics are of importance

- Effective against gram +ve and gram -ve bacteria and against yeasts.
- Effective in the presence of proteins.
- Effective at low temperatures.

  Wetting ability.
- CIP-suitability.
- Environmental aspects (easily rinseable, readily biodegradable).
- Economy (effective at low concentrations, reusable, easily rinseable).
- Health aspects – safe to use.
- Product compatibility – no adverse effects on the product.

The total quality management (TQM) can be divided into 3 processes:

- Quality Control
- Quality Assurance
- Quality Improvement

The Hazard Analysis Critical Control Point (HACCP) system is a safety tool and it can be incorporated into TQM programmes for the following reasons:

- To improve the efficacy of the operations and quality of the products
- To satisfy the requirement of the customers and purchasers
- To prove a due diligence defence in legal actions
- To keep up with the competitors

Conclusions:

Irrespective of how big or small brewery is, one need a system in place for process hygiene that includes.

- Checklists
- Standard operating procedures
- Audit

If the brewery is clean, then the Beer must be Clean too. Cleanliness in the Brewery leads to Clean Tasting Beer.

Sugarcane and Its Products

Joole Chauhan, Research & Development

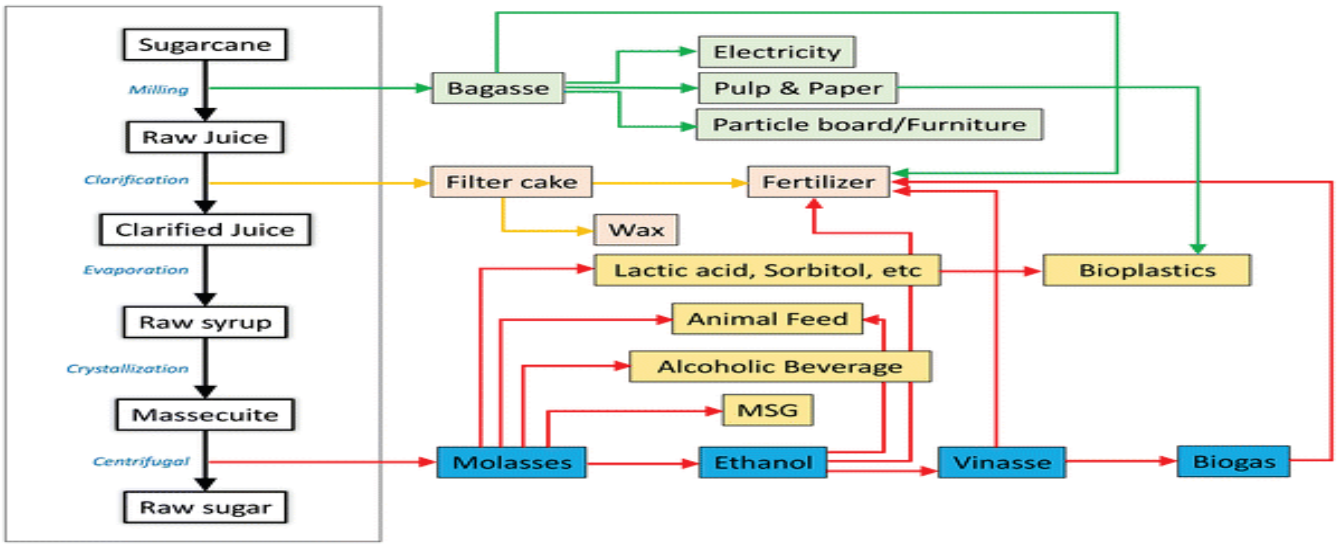
Sugarcane (*Saccharum officinarum L.)* belongs to bamboo family of plants and is indigenous to India. It is the main source of sugar, gur and khandsari. About two-thirds of the total sugarcane produced in India is consumed for making gur and khandsari and only one third of it goes to sugar factories. It also provides raw material for manufacturing alcohol.

For increasing the per acre yield of cane as well as quality of sugarcane, we have been carrying out the Research and Development work in close co-ordination with the U.P. Council of Sugarcane Research, Shahjahanpur in the following specific areas:

- Heat treatment therapy to treat cane seed to make it disease free and get high yield of sugarcane per acre of land.
- Maintenance of nucleus nurseries and three tier seed nurseries to provide new high yielding high sugar content seeds to growers to boost sugarcane production and to get more recovery.
- Biological control through bio-pesticides laboratory to protect and control sugar cane from pests/ disease.
- Ratoon management by managing the ratoon crop of cane to increase yield. The spraying of insecticides on ratoon crop and gap filling of ratoon etc. are being practiced with extension work.
- Seed multiplication through single bud culture of new varieties.
- Collection and analysis of soil samples from different fields for better application of manure.
- Testing promising varieties for their performance through All India & Zonal Varietal Trials.
- Extending the area of early maturing high sugar content sugarcane varieties to get better recovery in early months of cane crushing.
- In house production of Bio-compost, whose application on the fields improves the yield of the crops and reduces the requirement of inorganic nitrogen and other fertilizers including micro nutrients.
- Providing disease free seed of high sugared varieties to the cane growers on credit basis, so that they are encouraged to replace their old rejected variety cane crop with the crop having high sucrose content.
- Transportation of seed having high sucrose content in huge quantities from Punjab and Western U.P. for distribution amongst the cane growers of our area.
- Distribution of urea and pesticides to the
- growers on subsidized rates by the company
- Introduction of efficient harvesting and transport systems so that supply of clean and fresh cane is ensured to our factory, which in turn has drastically reduced the time gap between harvesting and crushing.

Traditionally, sugarcane processing requires two stages.Mills extract raw sugar from freshly harvested cane and "mill-white" sugar is sometimes produced immediately after the first stage at sugar-extraction mills, intended for local consumption. Sugar crystals appear naturally

white in color during the crystallization process. Sulfur dioxide is added to inhibit the formation of color-inducing molecules as well as to stabilize the sugar juices during evaporation. Refineries, often located nearer to consumers in North America, Europe, and Japan, then produce refined white sugar, which is 99 percent sucrose. These two stages are slowly merging. Increasing affluence in the sugar-producing tropics increased demand for refined sugar products, driving a trend toward combined milling and refining.



Milling

Sugarcane Processing Produces Cane Sugar (sucrose) From sugarcane. Other products of the processing include bagasse, molasses, and filter cake.

Bagasse, the residual dry fiber of the cane after cane juice has been extracted, is used for several purposes:

- Fuel for the boilers and kilns,
- Production of paper, paperboard products, and reconstituted panel board,
- Agricultural mulch, and more,
- As a raw material for production of chemicals.

The primary use of bagasse and bagasse residue is as a fuel source for the boilers in the generation of process steam in sugar plants. Dried filter cake is used as an animal feed supplement, fertilizer, and source of sugarcane wax.

Molasses is produced in two forms: Blackstrap, which has a characteristic strong flavor, and a purer molasses syrup. Blackstrap molasses is sold as a food and dietary supplement. It is also a common ingredient in animal feed, is used to produce ethanol and rum, and in the manufacturing of citric acid. Purer molasses syrups are sold as molasses, and may also be blended with maple syrup, invert sugars, or corn syrup. Both forms of molasses are used in baking.

Refining

Sugar refining further purifies the raw sugar. It is first mixed with heavy syrup and then centrifuged in a process called "affination". Its purpose is to wash away the sugar crystals' outer coating, which is less pure than the crystal interior. The remaining sugar is then dissolved to make a syrup, about 60 percent solids by weight. The sugar solution is clarified by the addition of phosphoric acid and calcium hydroxide, which combine to precipitate calcium phosphate. The calcium phosphate particles entrap some impurities and absorb others, and then float to the top of the tank, where they can be skimmed off. An alternative to this "phosphatation" technique is "carbonation", which is similar, but uses carbon dioxide and calcium hydroxide to produce a calcium carbonate precipitate. After filtering any remaining solids, the clarified syrup is decolorized by filtration through activated carbon. Bone char or coal-based activated carbon is traditionally used in this role.[34] Some remaining color-forming impurities are adsorbed by the carbon. The

purified syrup is then concentrated to supersaturation and repeatedly crystallized in a vacuum, to produce white refined sugar. As in a sugar mill, the sugar crystals are separated from the molasses by centrifuging. Additional sugar is recovered by blending the remaining syrup with the washings from affination and again crystallizing to produce brown sugar. When no more sugar can be economically recovered, the final molasses still contains 20–30 percent sucrose and 15–25 percent glucose and fructose. To produce granulated sugar, in which individual grains do not clump, sugar must be dried, first by heating in a rotary dryer, and then by blowing cool air through it for several days.

Sugar

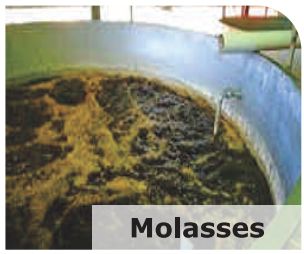
All sugar factories are equipped with the state of the art technology to produce pure white crystal cane sugar of the highest purity. The crop is harvested mechanically or by hand, chopped into lengths and conveyed rapidly to the processing plant. Here it is either milled and the juice extracted with water or the sugar is extracted by diffusion. The juice is then purified with lime and heated to kill enzymes.

The resulting thin syrup is then concentrated in a series of evaporators and then further water is removed by way of evaporation process in vacuum containers The resulting supersaturated solution is seeded with sugar crystals and the sugar crystallizes out and is separated from the fluid and dried. The crystals of raw sugar have a sticky brown coating and can either be used as they are or can be bleached by sulphur dioxide or treated in a carbonation process to produce a whiter product.

Molasses

During the sugar making process, juice extracted from sugarcane or sugar beets is boiled down until the sugars crystallize and precipitate out. The syrup left over after crystallization is referred to as molasses. Typically, sugar cane juice undergoes three cycles of boiling and crystallization to extract as much sugar as possible. With each successive cycle, the leftover molasses contains less sugar.

Molasses is sold both for human consumption, to be used in baking and in the brewing of ale, as



also for industrial use. In India Molasses is used mainly in manufacture of industrial/ potable alcohol, yeast and cattle feed.Nearly 90% of molasses produced is consumed by industrial alcohol manufacturers and remaining 10% for various other uses like potable liquor.

Industrial Alcohol & Ethanol

Ethanol, a type of industrial alcohol, also called ethyl alcohol, pure alcohol, grain alcohol, or drinking alcohol, is a volatile, flammable, colorless liquid derived directly from molasses. Ethanol fuel is the most common biofuel worldwide, particularly in Brazil. Alcohol fuels are produced by fermentation of sugars derived from wheat, corn, sugar beets, sugar cane, molasses and any sugar or starch that alcoholic beverages can be made from (like potato and fruit waste, etc.). The ethanol production methods used are enzyme digestion (to release sugars from stored starches), fermentation of the sugars, distillation and drying. The distillation process requires significant energy input for heat.

Ethanol can be used in petrol engines as a replacement for gasoline; it can be mixed with gasoline to any percentage. Most existing car petrol engines can run on blends of up to 15% bioethanol with petroleum/gasoline. Ethanol is also used to fuel bioethanol fireplaces. As they do not require a chimney and are "flue less", bio ethanol fires are extremely useful for new build homes and apartments without a flue.

One of the most remunerative applications of molasses is in the manufacture of ethanol, an environment friendly fuel. Being an oxygenate it

contains high percentage of oxygen which helps combust fuel more completely and reduces vehicular injurious emission.

Bagasse & Co-Generation Of Renewable Energy

Bagasse is the fibrous matter that remains after sugarcane or sorghum stalks are crushed to extract their juice and is a byproduct generated in the process of manufacture of sugar. It can either be sold or be actively consumed for generation of steam. It is currently used as a biofuel and in the manufacture of pulp and paper products and building materials. The bagasse produced in a sugar factory is however used for generation of steam which in turn is used as a fuel source and the surplus generation is exported to the power grids of state governments.

For each 10 tons of sugarcane crushed, a sugar factory produces nearly 3 tons of wet bagasse. Since bagasse is a by-product of the cane sugar industry, the quantity of production in a country is in line with the quantity of sugarcane produced.

Bagasse when burned in quantity produces sufficient heat energy to supply all the needs of a typical sugar mill, with enough energy to spare. To this end, a secondary use for this waste product is in cogeneration, the use of a fuel source to provide both heat energy, used in the mill and the electricitywhich is typically sold on to the consumer through power grids.

The power produced through co-generation substitutes the conventional thermal alternative and reduces greenhouse gas emissions. In India, interest in high-efficiency bagasse based cogeneration started in the 1980s when electricity supply started falling short of demand. High-efficiency bagasse cogeneration was perceived as an attractive technology both in terms of its potential to produce carbon neutral electricity as well as its economic benefits to the sugar sector. In the present scenario, where fossil fuel prices are shooting up and there is a shortage and non-availability of coal, co-generation appears to be a promising development. The thrust on distributed generation and increasing awareness for cutting greenhouse gas emissions increases the need for cogeneration. Also it helps in controlling pollution from fossil fuels.

India's 527 working sugar mills crush around 240 million tons of cane per year and generate 80 million tons of wet bagasse (50% moisture), of which they consume around 70 million for meeting captive requirements of power and steam. Thus, electricity production through cogeneration in sugar mills in India is an important avenue for supplying low-cost, non-conventional power. Presently, India has around 206 cogeneration units with a cumulative installed exportable capacity of 3,123 MW (peak season). Besides, India has a potential of generating 500 MW of power through bagasse and with modernization of the new and existing sugar mills India has potential to generate surplus power across all sugar factories in India to the extent of 5000 MW in the time to come.

In the last 15 years, 1952.53 MW of bagasse cogeneration projects were commissioned. The states with a leadership position in implementing biomass power projects like bagasse based cogeneration of power are Andhra Pradesh, Karnataka, Tamil Nadu, Chhattisgarh, Maharashtra, Punjab and Rajasthan.

Bio-Compost

Spent wash, an effluent generated from processed molasses is used with press mud for the production of organic fertilizer. The group has installed Bio Compost Plants at Shyamabad near Seohara, Narkatiaganj and Hargaon to produce organic fertilizer which is marketed under the brand name "UttamJaivikKhad", and "Oudh Shakti JaivikKhad".

Some Advantages of Bio-Compost are:

- Mobilizing existing soil nutrients, so that good growth is achieved with lower nutrient densities while wasting less
- Releasing nutrients at a slower, more consistent rate
- Helping to retain soil moisture, reducing the stress due to temporary moisture stress
- Improving the soil structure
- Helping to prevent topsoil erosion
- Organic fertilizers also have the advantage of avoiding certain problems associated with the regular heavy use of artificial fertilizers:

- The necessity of reapplying artificial fertilizers regularly (and perhaps in increasing quantities) to maintain fertility
- Extensive runoff of soluble nitrogen and phosphorus, leading to eutrophication of bodies of water (which causes fish kills)
- Costs are lower for if fertilizer is locally available

SUGARCANE AS FOOD

In most countries where sugarcane is cultivated, there are several foods and popular dishes derived directly from it, such as:

Nutritional value per 28.35 grams

Energy	111.13 kJ (26.56 kcal)
Carbohydrates	27.51 g
Sugars	26.98 g
Minerals	**Quantity**
Calcium	11.23 mg
Iron	0.37 mg
Potassium	41.96 mg
Sodium	17.01 mg

- **Raw sugarcane:** chewed to extract the juice
- **Sayurnganten:** an Indonesian soup made with the stem of trubuk (Saccharum edule), a type of sugarcane.

Sugarcane juice : a combination of fresh juice, extracted by hand or small mills, with a touch of lemon and ice to make a popular drink, known variously as air tebu, usacharass, guarab, guarapa , guarapo, papelón, aseerasab, gannasharbat, mosto, caldo de cana, nướcmiá.

Syrup : a traditional sweetener in soft drinks, now largely supplanted in the US by high fructose corn syrup, which is less expensive because of corn subsidies and sugar tariffs.[50]

Molasses : used as a sweetener and a syrup accompanying other foods, such as cheese or cookies

Jaggery : a solidified molasses, known as gur or gud or gul in India, is traditionally produced by evaporating juice to make a thick sludge, and then cooling and molding it in buckets. Modern production partially freeze dries the juice to reduce caramelization and lighten its color. It is used as sweetener in cooking traditional entrees, sweets and desserts.

Falernum : a sweet, and slightly alcoholic drink made from sugarcane juice

Cachaça : the most popular distilled alcoholic beverage in Brazil, a liquor made of the distillation of sugarcane juice.

Rum: is a liquor made from sugarcane products, typically molasses but sometimes also cane juice. It is most commonly produced in the Caribbean and environs.

Basi : is a fermented alcoholic beverage made from sugarcane juice produced in the Philippines and Guyana.

Panela : solid pieces of sucrose and fructose obtained from the boiling and evaporation of sugarcane juice, a food staple in Colombia and other countries in South and Central America

- **Rapadura:** a sweet flour that is one of the simplest refining's of sugarcane juice, common in Latin American countries such as Brazil, Argentina and Venezuela and the Caribbean.

Rock candy: crystallized cane juice

Probiotics & Prebiotics

Dynamic Duo For A Healthy You

Namrata Tyagi, Research & Development

Probiotics and Prebiotics: What's the Difference?

Probiotics are beneficial bacteria, while **prebiotics** are food for these bacteria.

WHAT ARE PROBIOTICS AND PREBIOTICS?

Probiotics: These are live bacteria found in certain foods or supplements. They can provide numerous health benefits.

Prebiotics: These substances come from types of carbs (mostly fibre) that humans can't digest. The beneficial bacteria in your gut eat this fibre.

PREBIOTIC FIBRE is a **non-digestible part of foods** like bananas, onions and garlic, Jerusalem artichoke, the skin of apples, chicory root, beans, and many others. Prebiotic fibre goes through the small intestine undigested and is fermented when it reaches the large colon.

This fermentation process feeds beneficial bacteria colonies (including probiotic bacteria) and helps to increase the number of desirable bacteria in our digestive systems (also called the gut) that are associated with better health and reduced disease risk.

PROBIOTICS are ***live beneficial bacteria*** that are naturally created by the process of fermentation in foods like yogurt, sauerkraut, miso soup, kimchi, and others.

Probiotics are also available in pill form and as an added ingredient in products like yogurt and health drinks.

While many types of bacteria are classified as probiotics, most come from two groups:

Lactobacillus – the most common probiotic found in yogurt and other fermented foods. Can help with diarrhoea and may help with people who can't digest milk sugar (lactose).

Bifidobacterium – also found in some dairy products. May ease symptoms of irritable bowel syndrome (IBS) and related conditions. Naturally present in the large intestine, bifidobacteria fight harmful bacteria in the intestines, prevent constipation and give the immune system a boost. Furthermore, evidence indicates that bifidobacteria help reduce intestinal concentrations of certain carcinogenic enzymes.
The gut bacteria collectively referred to as the gut flora or gut microbiota, perform many important functions in the body.

Why Are the Gut Bacteria Beneficial?

The good bacteria in your digestive tract help protect you from harmful bacteria and fungi.

They also send signals to your immune system and help regulate inflammation.

Additionally, some of your gut bacteria form vitamin K and short-chain fatty acids.

Short-chain fatty acids are the main nutrient source of the cells lining the colon. They promote a strong gut barrier that helps keep out harmful substances, viruses and bacteria. This also reduces inflammation, and may reduce the risk of cancer.

How Does Food Affect The Gut Microbiota?

The food you eat plays an important role in the balance of good and bad gut bacteria.

For example, a high-sugar and high-fat diet influences the gut bacteria negatively, allowing harmful species to overgrow.

Once you regularly feed the wrong bacteria, they are able to grow faster and colonize more easily, without as many helpful bacteria to prevent them from doing so.

The harmful bacteria may also cause you to absorb more calories than people with a healthy balance of gut bacteria, which tend to be leaner.

Note: Gut bacteria are affected by the foods you eat. Chemical residues and antibiotics may also disrupt balance in the gut bacteria.

Which Foods Are Prebiotic?

- Prebiotics are types of fibre found in vegetables, fruits and legumes.
- These types of fibre are not digestible by humans, but your good gut bacteria can digest them.

Foods that are high in prebiotic fibre include:

- Legumes, beans and peas
- Oats
- Bananas
- Berries
- Jerusalem artichokes (not the same as regular artichokes)
- Asparagus
- Dandelion greens
- Garlic
- Leeks
- Onions

Which Foods are Probiotic?

There are also many probiotic foods that naturally contain helpful bacteria, such as yogurt.

A high-quality, plain yogurt with live cultures can be a fantastic addition to your diet if you want to add beneficial bacteria.

Fermented foods are another great option, as they contain beneficial bacteria that thrive on the naturally occurring sugar or fibre in the food.

Examples of fermented foods include:

- Sauerkraut.
- Kimchi.
- Kombucha tea.
- Kefir (dairy and non-dairy).
- Some types of pickles (non-pasteurized).
- Other pickled vegetables (non-pasteurized).

If you are going to eat fermented foods for their probiotic benefits, make sure they are not pasteurized, as this process kills the bacteria.

NOTE: *Probiotic supplements are designed to deliver very specific species of bacteria to the human gut. However, not all probiotic supplements are of the same quality or contain the same quantity of bacteria.*

WHY TAKE SUPPLEMENTS WHEN WE CAN EAT FIBRE-RICH AND FERMENTED FOODS?

It is clearly vital to nourish a healthy bacterial mix in the colon. We can start with a foundation of healthy eating, focusing on fresh, organic vegetables and fruits, while avoiding processed food products and sugary foods and drinks.

However, it is sometimes difficult with a typical modern diet that includes processed foods and high amounts of sugar and synthetic ingredients to eat enough fermented foods and foods high in fibre. Therefore, adding supplements may be a healthy addition to one's diet.

Eating balanced amounts of both pro- and prebiotics can help ensure that you have the right balance of these bacteria, which should improve your health.

References:
www.healthline.com
www.prebiotin.com

World BIO-FUEL Day

10 August

Amit Ramesh Sinnarkar, Business Development

- Every year 10th August is observed as World Bio-Fuel Day to create awareness about non-fossil fuels (Green Fuels).
- The day highlights the importance of non-fossil fuels as alternative to conventional fossil fuels and highlights the various efforts made by the Government in the bio-fuel sector.
- Biofuels have the benefits of reducing import dependency on crude oil, cleaner environment, and additional income to farmers and employment generation in rural areas.

Significance of Day:

Why is the World Bio-Fuel Day observed on August 10?

- On 10 August 1893, Sir Rudolph Diesel, inventor of the diesel engine, for the first time successfully ran mechanical engine with Peanut Oil.
- His research experiment had predicted that vegetable oil is going to replace the fossil fuels in the next century to fuel different mechanical engines. Thus, to mark this extraordinary achievement, World Bio-fuel Day is observed every year on 10 August.

Celebrations of World Bio-Fuel Day in India

- Prime Minister Narendra Modi addressed a diverse gathering consisting of farmers, scientists, entrepreneurs, students, government officials and legislators in New Delhi to mark the World Biofuel Day 2018.
- For the last three years, the Union Ministry of Petroleum and Natural Gas has been observing the World Bio-fuel Day.
- This year too, the Ministry held the World Bio-fuel Day Programme at Vigyan Bhawan, New Delhi which saw the presence of Prime Minister Narendra Modi as the Chief Guest for the inaugural session.
- The Programme saw participation from sugarcane and other farmers; scientists; entrepreneurs in bio-fuels; students of agriculture, science and engineering streams; Members of Parliament; Ambassadors; officers of Central and State Governments; and companies involved in bio-energy sector.
- There were separate interactive sessions on ethanol, bio-diesel, bio-CNG & 2nd Generation bio-fuels after the inaugural session.
- The biofuels Programme is also in synergy with the Government of India initiatives for ***Make in India, Swachh Bharat*** and enhancing farmers' income.

Initiatives undertaken by India to increase blending of bio-fuels

- Since 2014, the Indian Government has been undertaking a number of initiatives to increase blending of bio-fuels. Some of the major interventions include administrative

Outcome of these initiatives

- price mechanism for ethanol, simplifying the procurement procedures of OMCs, and amending the provisions of Industries (Development & Regulation) Act, 1951.
- Moreover, the Government approved the National Policy on Biofuels-2018 in June 2018. The policy has the objective of reaching 20 percent ethanol-blending and 5 percent biodiesel-blending by the year 2030.
- Ethanol blending in petrol has increased from 38 crore liters in the ethanol supply year 2013-14 to an estimated 141 crore liters in the ethanol supply year 2017-18.
- Bio-diesel blending in the country started from 10th August, 2015 and in the year 2018-19, Oil Marketing Companies have allocated 7.6 crore liters of biodiesel.
- On this occasion four retail outlets of bio fuel blended diesel were launched by Union Petroleum Minister Dharmendra Pradhan. These outlets are located in Delhi, Visakhapatnam, Vijayawada and Haldiya.
- Oil PSUs are also planning to set up 12 Second Generation (2G) Bio-refineries to augment ethanol supply and address environmental issues arising out of burning of agricultural biomass.
- The government is promoting the use of bio-fuel in a big way to cut the crude oil import bill by Rs 12,000 crore over the next four years.

Source : - Internet–
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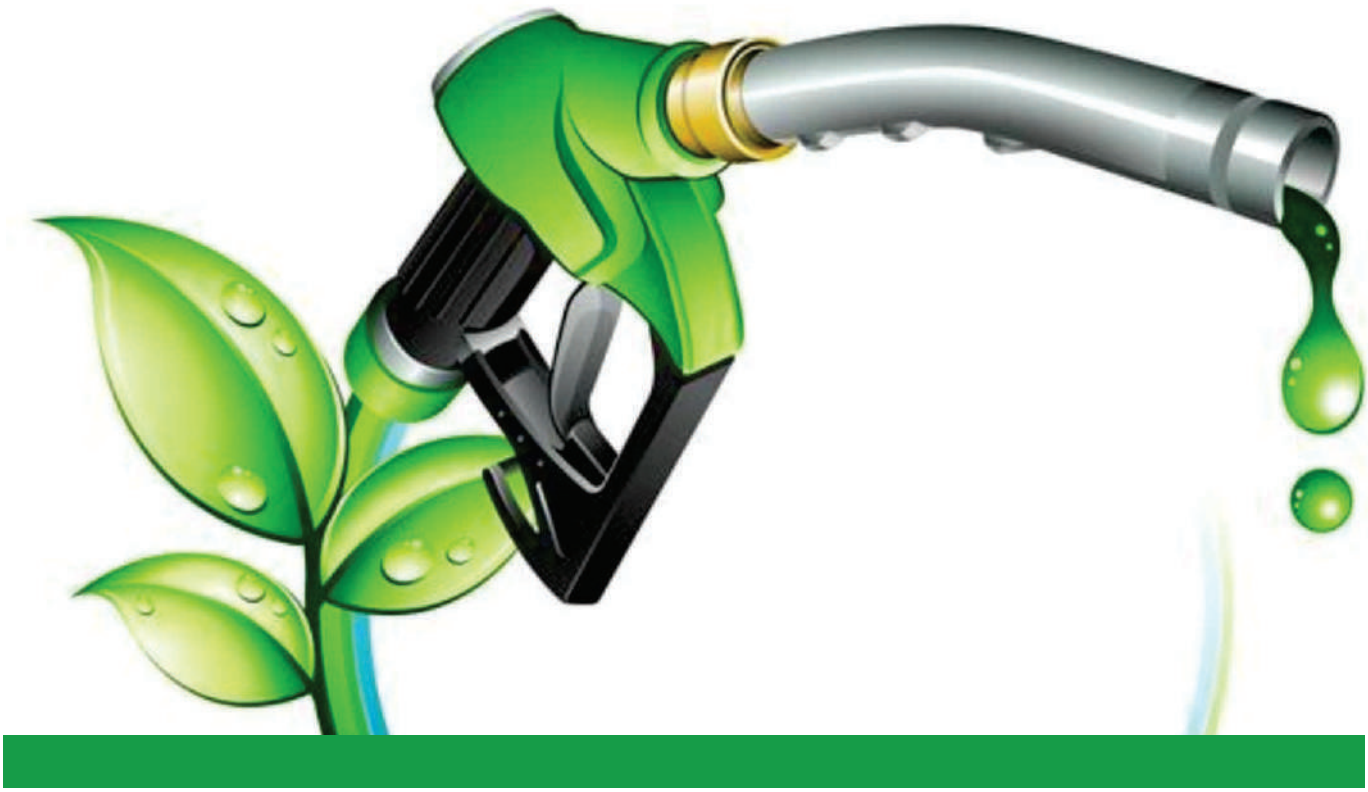

The Soul Communication in Soul Light Era

Mrs. Renuka Malhotra, Management

What is Soul Communication?

Communication is one of the most important aspects of our life, not ony in human life but also in plants and animals. Even we can communicate with inanimate objects like the car you are driving, the company in which you are working, your room, mountains, rivers and even the mother earth communicate. Every thing has a soul. All souls communicate with each other. By opening our spiritual channels our soul can communicate with every soul.

The Soul Light Era

We are at the beginning of Soul Light Era. This Era began on August 8, 2003. Soul over matter is the key for every aspect of life in the soul Light Era. The previous fifteen thousand year era emphasized mind over matter.

In this new era, it is essential to develop soul communication abilities. We must open our soul communication channels more and more fully. This will empower us to participate more completely in the Soul light Era.

As the Soul Light Era continues, the transformation of humanity, Mother Earth and beyond will be profound. As the Soul Light Era progresses everyone and everything will come to realization. That the Soul is incharge. With this realization, will come a change in the ways, things are done. This applies to personal decisions and individual behavior. It is the Soul and not the minds, that leads and make the decisions.

To be in charge of soul, do soul communication. Do it at every opportunity. Whenever we are struggling with a choice or decision, whenever we have a question , whenever we are confused, upset or discouraged, use soul communication.

Benefits of Soul Communication:

Soul Communication can serve you for healing, prevention of sickness and rejuvenation. With soul communication you can receive teachings from the Divine and from the spiritual world. You can receive the benefits of soul communication as naturally or routinely as you sit down to three meals a day and go to sleep at night.

Example1 : Let me give you a few examples of how to use soul communication in daily life n just after waking up and in while sitting in the bed you can do the following communication.

'Dear Divine dear my spiritual guides and teachers in the physical world and spiritual world, I love you . Could you give me guidance and blessing for my work and service today. Please bless me with you love & light'. Give me energy and intelligence to allow me to do a better job of serving humanity **Thank you. Thank you. Thank you.**

The first thank you is to the Divine. The second thank you is to all the souls you have called or wished for. The third thank you is to your own soul. You can pray for any love and anything. Visualize it happening whatever you are praying for.

You have sent your request to heaven. You have expressed your intentions. Your spiritual guides and teachers are delighted to bless your daily life.

Eaxmple 2: When you are going out in a car communicate like this:

'Dear Soul , mind and body of my car, I love you please run normally and give us a safe trip and bless our safety'.

Eaxmple 3: If you are going to drop your children to school do soul communication with your children.

'Dear children , I love you. Dear Divine and all my ancestors, I love you I am very honored to ask Divine and all my ancestors to bless my children. I want them to deal with their classmates with great love and compassion'. I want them to understand their great opportunities to learn knowledge . I am very grateful for their blessings form the Divine and my ancestors. **Thank you. Thank you. Thank you.**

Example 4: As soon as you arrive at your work place, do soul communication before beginning any work. It takes only one minute but this minute will make your life much easier. Communication as follows:-

`Dear Soul, mind and body of my boss and my colleagues, I love you. Let us communicate well in the physical world to accomplish our tasks today. Dear Divine , dear my spiritual fathers and mothers, please bless my work today. Dear soul , mind and body of my computer , telephone and other equipments, I love you. Please function properly to assist me to complete my tasks. I am very grateful. **Thank you. Thank you'.**

This soul communication to your boss, colleagues and equipments will help to create harmonious team work and remove blockages from the functioning of your computer and equipments. Your work environment and relationships and the flow of your work day will be much smoother.

In short , soul communication can benefit every aspect of your life. Pure love is a key for soul communication. Give love care and compassion to everyone and everything.

Soul communication is particularly important during this time of Mother Earth's transition. It is important for healing and rejuvenations. It could transform your entire life quickly and enlighten your soul

.

TABLE TENNIS Tournament 2018

Celebration of Independence Day

TO THE CATALYSTS FAMILY

Name : Mr. Kamlesh Kumar
Department : Business Development
Date of Joining : 01st, August,2018

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Date of Joining : 20th, August, 2018

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Date of Joining : 27th,Sep., 2018

WHO WE ARE

Catalysts was established in 2003. Having its corporate office in Delhi and R&D centre in the largest state of Uttar Pradesh in India and Manufacturing units in the Hill state of Uttrakhand. It is a leading research and quality certified Biotech company. We are engaged in delivering enzyme based eco-friendly solutions to many industry verticals. We are a multilevel quality certified company having certification of ISO 9001:2015, FSSC 22000 and HALAL and Kosher

Our Process expertise based enzyme formulation are a key competitive advantage for Catalysts and thus for our customers. We have a modern fully-equipped technology centre, where application research is done extensively using substrates received from client side.

Our technical team provides real time process and troubleshooting support to various industries like Molasses Ethanol, Grain Ethanol, Carbohydrates processing, Malt extraction, Brewing process and sugarcane juice processing.

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