

" Our Vision

A Globally acclaimed company creating value for all stake-holders by providing innovative and sustainable solutions.









Catalysts making things happen ... ISO 9001:2015 Certified | FSSC 22000 Certified

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"A Globally acclaimed company creating value for all stake-holders by providing innovative and sustainable solutions."

OUR VALUES

C - Customer Oriented A - Adaptability Team-work

A - Ambitious

- Learning Attitude
- Y Yes to Life
- **S** System Driven
- **T** Taking Initiative
- **S** Self-Discipline & Integrity

CORPORATE PROFILE

Founded in 2003 in India, The Catalysts Group is an Indian Biotechnology company, focused on offering wide range of enzyme based eco-friendly solutions to many industry verticals in India and Overseas. The company leverages latest technology trends and disruptive approach to create process-based enzyme formulation. The goal is to provide measurable outcomes to its customers, across industries and sectors by offering a gamut of enzymes solutions, from strategy to execution.

Over 17 years and with more than 140 crores in, Catalysts is well on its way to become a global brand in the Industrial Biotechnology space in this decade. With a reach already spanning 3 continents, 10+ countries and 400+ cities globally and a clientele that's rich in industry-leading companies, the company has traversed the evolution from an Indian to an Asian and soon a Global company. Catalysts is focused on generating employment opportunities through manufacturing and delivering centers across globe and focusing on safeguarding the environment.

Dedicated team consists of highly qualified, dynamic, passionate and experienced research professionals. They have the capability of delivering robust results for customer centric requirements. Catalysts team always strives to use innovative tools and technological advancements to stay abreast with the rapidly changing industry scenarios and to meet the customer's evolving needs. Having acquired quality certifications like ISO9001:2015, FSSC 22000, NABL, HALAL and Kosher, our Research and Development Centre has been recognized by the Department of Scientific and Industrial Research (DSIR).

industrial verticals like:





With real time processes and troubleshooting support, we provide our customized solutions and services to a variety of





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EDITORIAL



MESSAGE FROM THE MANAGING DIRECTOR

Hello Friends,

Welcome to our new edition of Catalysts Connect in Covid times. Here in India, we have started to learn to live with Covid. Most of the economic activities have restarted and positive economic parameters in recent months are indicating a good recovery. Number of active cases are also continuously coming down now since witnessing a peak in mid-September and it seems the curve is bending for the first time in India, but considering changes in weather and approaching festival season nobody is sure how it will behave in the next few months.

We at Catalysts have been very proactive in dealing with this pandemic since its mid-March onset in India. Our client centric approach, values of adaptability, hard work, as well as persistence helped us to handle all the challenges thrown at us by this crisis, really well. We have wiped out all the de-growth in our revenues witnessed during the lockdown period by September end and now we are looking at growth in the next 6 months remaining in this financial year.

Sugar season is approaching and initial estimates are predicting bumper sugarcane crops especially in Maharashtra and North Karnataka. The Government of India since last few years has remained committed to support diversion of excess sugarcane towards Ethanol. The Industry is expecting further improvement in ethanol procurement prices for next season. Producing Ethanol from B-heavy Molasses profitably has been clearly established in the last couple of seasons after initial hiccups. Some factories successfully produced Ethanol from Syrup as well, in the previous season. It is expected that production of Ethanol from B-heavy and Syrup will increase exponentially in this year.

We as Catalysts are aptly geared up to handle technical challenges thrown by this change. We have been closely working with factories who took a lead in this shift and our product based solutions developed by our in-house state of the art R&D facility comprising an experienced technical team have already been successfully established in industry. We look forward to a successful upcoming season for Catalysts and wish the same for all our clients and vendors.

I would like to take this opportunity to wish all of you a very Happy and Prosperous Diwali.

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EATURES



Contributed by: Gautam Kapoor Business Head, Sugar



CONDUCT-O-METRIC STUDIES

CANE SUGAR MANUFACTURE

AND ITS SIGNIFICANCE DURING

Dr. Pradosh Sanyal Retd. Ex faculty -National Sugar Institute Kanpur

Contributed by:

Introduction

The conventional mode of quality and quantity assessment is being attained by way of determining, Brix, Pol, Purity, pH and temperature parameters in sugar manufacturing process. It is evident that these parameters viz Brix and Pol in particular are based on calibration terms. The sugar house products contains non sugar and sugar part but the calibration is done against pure sucrose solution by accounting sugar part only. Consequently it fails to establish any linear relationship between dilution and Brix parameter (Sanyal et al., 2004) of sugar house products for not accounting the non-sugar part. As such the representative Brix and Pol readings of any sugar house products falls under approximation category.

Besides above, it amounts to dilution error as well as time consuming process of parameter determination. These parameters mainly accounts for sugar part of the material under test. On the above aspect, the present study views alternatively i.e. to measure the non sugar part for its control during the sugar manufacturing process at all intermediate steps. In fact, the quality is basic requirement to assess the production, however the input –output balance concerns for the product value in terms of quantity analysis.

The present study inputs technological aspect for controlling the sugar manufacturing process with nonconventional option considering conductivity measurement of non-sugar part and to compare the observation in terms of conventional parameters of sugar house products. The basic theoretical dependability has also been studied for evolving the methodologies.

Conductivity is the ability of material to conduct electrical current. It is evident that chloride, nitrate, sulphate all carry negative charges, while sodium, potassium, magnesium, calcium carry positive charges as available in case of cane juice. These dissolved solids concern the ability to conduct electricity. Other way measuring the conductivity indicates the amount of total dissolved non sugars (TDNS) in the material under test.

Conductivity is probably an equally important metric

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but not less than that of pH value in cane juice processing having around 80% water content. Secondly pH is not having a wide range value output, whereas, conductivity value is much in wider range and thus may prove better controlling parameter.

It is worth mentioning that the activity is a measure of the amount of ions chemically active in a concentration of ions in solution. In fact participation of ion in a chemical reaction is not only determined by the concentration but also the presence of other ions in the solution .In concentrated solution the activity of the ions is considerably less than the total concentration as in the case of syrup to massecuite. Hence the activity coefficient 'F' is the actual measure in terms of ratio between the active concentration and the total concentration (Soand, 2009) i.e.

'F' = Active concentration / Total concentration

Initially way back in 1926 and at later stage studies on ash determinations by conductometric method have been carried out by many workers (Todt, 1926; Prasad et al., 1999), but failed to find out a way for regular or ongoing approach in sugar industry. The literature reveals that conductivity has been the basis of calculation for a few controlling parameters in sugar industry but left half way.

Purity determination of sugar house products like massecuite /molasses in particular have been carried out by many workers (Ziesch,1930, 1931; Doss 1983; Ponant, 1977) and observed encouraging results. In the said approach the refractometric brix has been replaced by conductivity having linear relationship between two with in the ambit of critical temperature and Brix .One of the proposed formulas is given below

YA(100 P)xe cxn

Where x = Brix / (100-Brix) and A, e, and n are constants. Further to this Doss (1983) has given a simpler calculation for purity measurement by observing electrical conductivity with better reproducibility. It is to be pointed out that the conductometric purity is very similar to ordinary purity values but found to be of reproducible nature, significant and precise.

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Discussion

The basic approach of conductivity measurement has been tested for KCl solution. From Fig.1, it is evident that a linear relation always exits for conductivity versus dilution of the KCl solution under test, up to a certain level of concentration. The conductivity increases with higher concentration of KCl. Similarly, data obtained pertains to conductivity versus concentration, with increasing order of cane juice concentration, pure sugar solution and molasses solution concentration, keeping in view the instrumental range for different products. These data are delineated in Fig 2, 3 and 4, respectively. In all cases, relation between conductivity (μ s/cm) versus concentration shows almost a linear nature and the trend follows the standard KCl behavior. This indicates that the sugar house product responds to conductivity parameter with better reproducibility and stability in the manner pure solution like KCl behaves. The reason of emphasis for this behavior, explains that non sugar part of sugar house products shows more indicative than the conventional parameters pertain to sugar part.

Further to this, temperature effect has also been tested by applying basic formula on standard condition of temperature 25° C. When measuring conductivity or total dissolved solids in other than standard conditions, certain corrections for these variations must be accounted for before going on to observe final values. Without applying the requisite correction for standard temperature, conductivity or TDS measurement at various temperature are meaningless because they cannot be compared. This part of consideration has been studied with observed data for implementation. The formula used is;

K25 = Kt / [1+0.02 (t-25)]

Where Kt is the observed conductivity at given temperature 't' to make the conductivity results at par of 25 OC for comparison purpose. The data is given in Table no. 1, wherein the same was got confirmed by using conductivity meter of inbuilt temperature compensation system. This particular exercise has been carried out for cane juice as well as diluted molasses samples. The results are having similar trend with minor and negligible deviations. This clearly indicates that temperature effect can be minimized and able to bring it at par 25 OC for comparison purpose in case of juice and molasses etc. In the present study, the importance of conductivity parameter finds a favour in terms of wide range parameter neglecting the precise effect of temperature for step-to-step process comparison. during sugar manufacture.





Further to this, for practical purpose, the effect of different doses of milk of lime (12 oBe solution) on conductivity of cane juice of 5% solution has been determined by using temperature compensation based conductivity meter. The data has been taken at par of 25 OC. The graphical representation at Fig.5 shows a linear relationship with increasing order of milk of lime dose (Fig.5). Such graphical trend can be evaluated for purposeful practical meaning. However, it is well-established that ionic interaction can alter the linear relationship between conductivity and concentration in some certain level of concentration. (John et al., 2006)

Further observations come out from Fig.6,7 and 8. Wherein Fig.6 shows purity drop in cane juice samples i.e. less than 2 % against keeping time for three parallel sets. Whereas the non sugar plays its own role gets responsible for increases (Fig. 7) in conductivity with wide range around 50 % with respect to time for 20% (v/v) juice solution. The gist of Fig 6 and 7 has been represented in Fig8. The fall in purity is in other way a rise in non sugar i.e. conductivity of the medium. Hence, this clearly favors the conductivity parameter more paramount and informative. In comparison, the observation of purity determination involves instrumental and dilution error as discussed elsewhere (Sanyal et al., 2002).



Fig. 4. Conductivity verses concentration of molasses solution





Juice conductance

S.No.	Temp.t.	Kt conductivity	Conductivity is	Conductivity is
		in_s/cm at	shown by	shown by applying
		corresponding	applying temp.	temp. correction
		temp.	correction using	using Thermo
			TDS Scan-3 at	Orion 555 A at
			25 ^Q C	25 ^Q C
1	43.8	340.0	247.0	250
2	49.4	372.0	250.0	252
3	55.4	392.0	245.0	251
4	72.1	481.0	248.0	249
5	75.6	493.0	245.0	248
Molasses				
1	42.0	1313	980	982
2	47.7	1418	975	980
3	55.4	1579	982	980
4	66.3	1786	978	982
5	72.0	1893	976	980

Table 1. Temperature effect with compensation onconductance of juice and molasses

Other way pH observation has been a point of concern for the reason of temperature effect. An enhancement of temperature can also cause an increase in the number of ions in solution due to the dissociation of molecules. In such change it reflects that conductivity data falls under wide range of deflection for particular case of weak acid / base. But since pH is a measure of the hydrogen ion concentration, a change in the temperature of a solution will be viewed by a subsequent change in pH. The sources of error to be reduced are temperature effects on electrode slope, isothermal point, thermal equilibrium, chemical equilibrium and membrane resistance.

These collective errors can be as high as 1.0 pH unit. Such small range may not provide better provision for overall process control (John et al., 2006).



Fig. 6 Relationship between purity drops of cane juice in different interval of time.



cane juice increases with respect to time.



So far pH versus conductivity measurement are concerned in case of water quality assessment, it is obvious that pH is specific to hydrogen ions and it will not respond to other ions that may be present in the solution under test .For example, if iron sulphate is dissolved, the measurement of pH, the acid concentration would be unaffected. However, because of conductivity responds to all ions present, the measurement of conductivity responds to all ions present in the said solution. The measurement of conductivity will change with change of iron sulphate content, while the acid content remains constant. It is also important to consider that if the concentration of the acid is less than 0.5%, pH or conductivity could be used. But if the acid concentration is greater, conductivity measurement becomes only alternative. It is for the technical reason that the hydrogen sensitive measuring electrode becomes saturated at high concentration of hydrogen ions. At the same time conductivity sensors are not hampered by high concentration of hydrogen ions. (John et al., 2006). With all the above basic technological aspects the control of the process shows a reproducible trend by way of measuring conductivity parameter.

Conclusion

In this presentation certain operating parameters like brix, pol, purity and pH have been critically discussed on, their technical qualities besides the optional parameter i.e. conductivity for regular and ongoing control of sugar manufacturing process. The application of conductivity measurement of sugar house products has been taken in very simple way to evolve quicker and easy method based on reproducible trends showing nature. Further work is in progress and shall be communicated for coming issue.

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FEATURES

GREEN **CHEMISTRY: A BOON TO OUR** SOCIETY



ntributed by: Munish Madaan **Managing Director**

Green chemistry is one of the most explored topics these days. It is one of the newest and rapidly emerging branch of chemistry. Its inception aims to reduce or eradicate the production of harmful by-products and ecologically optimizing the desired product.

Moreover it encompasses anything from reducing waste to even disposing of waste correctly. It aids in the disposal of all chemical waste that can damage or harm the environment and living beings in the best possible manner. Let's have a look as to how it benefits our environment and human health:

- 1. Provides clean air: Less release of hazardous chemicals to air leads to less damage to the lungs.
- 2. Increases environment safety for workers in the chemical industry. Reduction in use of toxic materials reduces the requirement of personal protective equipment and potential for accidents.
- 3. Safer food: Helps in the reduction of toxic chemicals that can enter the food chain through use of safe pesticides that are toxic only for specific pests and degrade rapidly after use.
- 4. Lower potential for global warming, ozone depletion and smog formation.
- 5. Plants and animals suffer less harm from toxic chemicals in the environment with the help of green chemistry.
- 6. Fewer chances of chemical disruption of ecosystems.
- 7. Reduction in use of landfills, especially hazardous waste landfills.

Green chemistry is not only good for life on Earth but also for different businesses too:

- 1. Higher yields for chemical reactions, consuming smaller amounts of feedstock to obtain the similar amount of product output.
- 2. Limited synthetic steps, often allowing faster manufacturing of products, increasing plant capacity and saving energy and water.
- 3. Reducing waste, eliminating hazardous waste disposal and end-of-the-pipe treatments.
- 4. Improving competitiveness of chemical manufacturers and their customers.

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In a nutshell, Green chemistry is at the emerging position. Companies like Catalysts Biotechnologies Pvt. Ltd. and other manufacturing industries are adopting and promoting its philosophy. Catalysts group, maintains a focus on keeping the environment clean by developing sustainable technologies. Catalysts offers its services to the customers in alcohol, sugar, brewing, starch industries to name a few.... to focus on comprehensive water management and recycling of water with an endeavour to attaining zero liquid discharge in line with the regulatory requirement. Under the ambit of wastewater management segment, our scientific research team focuses on the following areas, which have either been developed or are in the advanced stages of development:

- 1. COD removal using biological and chemical agents
- 2. Ammonia, Sulphide removal
- 3. Induction/enhancement in biodegradation (anaerobic and aerobic)
- 4. Resource Recovery
- 5. Recycle & Reuse
- 6. pH Boosters and Buffers

We can safely say that this is an evolution of chemistry that has and will continue to lead to scientific innovations for environmental protection and thereby improvement in quality of life.



BREWING RAW MATERIAL OPTIMIZATION



Contributed by: Bijay Bahadur General Manager -Yuksom Breweries

Introduction:

Beside the major brewing raw materials barley and barley malt, various starch sources like maize (corn), rice, wheat, sorghum, rye and cassava, as well as syrups and sucrose from both sugar cane and sugar beet, are widely used in the brewing industry. Price and availability of the raw materials are greatly influenced by an increasing demand due to the growing population and beer consumption worldwide.

Various crops like barley, rice, wheat, maize and sorghum are mostly limited to specific countries or small regions. The cost pressure has led breweries across the globe to look for alternative brewing materials. Availability, cost and grade, as well as brewer and consumer expectations have always influenced the selection of the brewing raw materials. However, increasing cost pressure has led to further constrained adjustments in beer recipes over the last couple of years, with more focus on cost effective and sustainable alternatives. The Brewery is also challenged by seasonal and regional availability, fluctuation in price and quality caused by climatic conditions during cultivation and harvest. As a consequence, there is generally a need for stronger strategic focus on raw materials sourcing.

Exogenous enzymes have regularly been established to balance processability, increase yield and assure wort and beer specifications. Broadly speaking, even higher flexibility in the raw material sourcing is desirable to compensate for variability as well as fluctuations in the raw materials market and its quality.

Enzymes plays a vital role to work in synergy with the existing enzyme systems in the various grains (barley, barley malt, broken rice etc.) to enable the degradation and utilization of cereals beyond the traditional maltbased enzyme configuration. To ensure optimal processability and fermentability, different enzymes containing glucanases, xylanases, proteases, amylases, pullulanases (limit dextrinase) and lipase activities are optimally combined according to the properties of the relevant raw materials.



Guide for Raw Material Optimization

Table 1.0 shows an overview of recipe opportunities and accordingly select right enzyme with recommended dose to reach standard processability and fermentability. The focus of the enzyme application is to support the cytolytic, amylolytic and proteolytic degradation within an efficient mashing process and without compromising yield.

Barley Malt (% Extract)	Raw Barley (% Extract)	Rice/Maize (Corn) (% Extract)
100	-	-
80	-	20
60	-	40
50	20	30
30	50	20

Table 1.0 Examples of potential recipes in % extract

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Opportunities for Individual Raw Material Optimization

1.Malt-based recipes with minor barley inclusion For recipes containing 100% malt or small replacements by barley up to 20%, the main focus of the enzyme application is on the cyctolytic degradation of cell wall components like β -glucans and arabinoxylans to improve lautering performance and beer filtration also on well-modified malt and to increase the extract yield.

2.Malt-Based Recipes including Rice

Processing high gelatinizing adjuncts like rice in a cereal cooker with an enzyme which provides a fast and effective viscosity break and forms the basis for effective starch saccharification.

Rice is currently the second most-widely used adjunct material. On an extract basis, it is approximately 25% more expensive than corn grits. Brewer's rice is a by-product of the edible rice-milling industry. Rice is preferred by some brewers because of its lower oil content compared to corn grits. Rice has a very neutral aroma and flavor, and when converted properly in the brewhouse, yields a light, clean-tasting beer.

The quality of brewer's rice can be judged by several factors, including cleanliness, gelatinization temperature, mash viscosity, mash aroma, moisture, oil, and ash and protein content. Rice should be free of seeds and extraneous matter. Insect or mold damage should not be tolerated, as these indicate improper storage or handling conditions. It has been reported that rancidity in rice oil can be a problem, but with modern storage techniques this is a negligible factor.

Not all varieties of rice are acceptable brewing varieties. Rice has a relatively high gelatinization temperature and is extremely viscous prior to liquefaction in the cereal cooker. Rice liquefies more easily the finer the particle grind, and particles less than 2 mm are considered adequate. Handling of rice is relatively easy, as the broken contain little dust and flow easily through standard hopper bottoms and conveying equipment. Rice is milled in fixed roller mills. There is no difficulty in making the rice mash slurry at 64 to 76 C, although it is a common practice to mash and hold at 36 to 42 C as a protein rest. As with all cereal cooker operations, whatever the starch source, 5 to 10% of the malt grist is added to the cooker because the malt enzymes (amylases and proteinases) are essential for the partial liquefaction necessary to render the cooker mash fluid enough for pumping. Atmospheric boiling is required for gelatinization.

nitrogen than corn grits.

3. Wheat Malt - Based Recipes including Barley Malt

Wheat malt is used in the production of some special types of beer, in which it may constitute 75% of the grist, but only to a limited extent in ordinary beers. The limited use of wheat malt is mainly due to the difficulty experienced in malting the naked grain without damage to the exposed acrospires. As a result, much of the wheat malt made has been under modified. However, the absence of the husk tends to result in a high extract. Wheat malt gives beer outstandingly good head retention.

to extract losses and poor fermentability.



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If properly converted, rice adjunct usage does not create runoff problems as the extract is slightly lower in soluble

Malt based recipes with high levels of alternative raw materials and adjuncts

Utilizing high amounts of under modified malt, or malt in combination with high portions of barley, rice or maize (corn) can impact sufficient FAN supply for the yeast as well as lead to limited diastatic power during mashing. This would lead

Barley based recipes

Unmalted barley is an adjunct for use in brewing. However, the raw grain is abrasive and difficult to mill, scattering to yield too high % of fine material which gives problems during lautering. These difficulties disappear if the grain is conditioned to 18 to 20% moisture prior to milling although this process has not been widely employed in brewing.

Use of barley leads to a reduction in wort nitrogen content and decreased wort and beer color. Foam stability is usually improved because of lower levels of proteolysis. However, a major difficulty associated with brewing with high levels of unmalted barley can be the increase in wort viscosity and runoff times caused by the incomplete degradation of b-glucans. Hence, it is suggested to pre-treatment of the barley with b-glucanase and the use of a temperature-stable b-glucanase in the mash.

Raw (feed) barley can also be employed as an adjunct, and as high as 50% barley in the grist use of raw barley requires significant modification to the brewing process. This high level of malt replacement usually results in insufficient malt enzymes for the necessary hydrolysis of the starch, protein, and b-glucans. Consequently, a malt replacement enzyme system is employed to compensate for the reduced level of malt enzymes.

In barley brewing, it is possible to approximate the starch hydrolysis profile and the degree of fermentability of 100% malt worts. This is possible by substituting malt with barley at levels of 50% (extract basis) and by controlling the main mash schedule (enzyme concentration, time, and temperature). Barley worts have been found to contain less fructose, sucrose, glucose, and maltotriose but more maltose than malt worts. In general, no significant difference in organoleptic properties between barley beers and 100% malt beers have been observed. A harshness of barley beers can be avoided by lowering the pH of the wort to 4.9 prior to boiling.

Using the full potential of exogenous enzymes, the brewer can create recipes with up to 100% barley. Enzyme activity provided by pullulanase that hydrolyzes (1,6)-alpha-D-glucosidic linkages in pullulan, amylopectin and glycogen enables brewers to brew maltose-based wort with standard fermentability and similar processability compared to using high portions of malt. The present pullulanase, amylase and protease activities ensure sufficient starch and protein degradation in synergy with the β -amylase and peptidases of the barley. The glucanase and xylanase components enable sufficient cell wall degradation and low viscosity. The lipase activity significantly improves the turbidity during lautering.

Using only barley and the enzyme, the brewer can produce a great-tasting beer while maximizing savings in raw material costs, gaining improved productivity, creating new beverages, and reducing the carbon footprint – all in just one simple process.

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Background to application

To seize the cost saving opportunities that come with alternative raw materials and adjuncts in brewing, to drive sustainability in terms of local raw material sourcing, to create specific beer properties by using individual raw materials characteristics, or to level out inconsistencies in the raw material quality (including malt), the traditional enzyme source, malt, and the process that is based on it, can be the limiting factor. Either the enzymes are not sufficient in terms of temperature or pH characteristics, or the amount and function do not support the set-up of a modern raw material agenda.

Conclusion:

The use of unmalted carbohydrates or adjuncts in brewing is widespread and these are usually the cheapest suitable carbon source. The brewing industry employs a wide range of cereals and sugars that have been processed by a number of methods. Although developments in the use of brewing adjuncts have been relatively stable for a number of years, the advent of "new-generation" syrups are currently having a great impact on the brewing industry. At the present time, syrups are available that allow the brewer to introduce at any level without changing the carbohydrate profile of the wort. The future will see the commercial ability to separate and isolate individual sugars according to their molecular weight and, subsequently, produce a blended syrup of any sugar profile.

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IMPORTANCE OF CHEMICAL TREATMENT OF COOLING TOWER WATER

What is a Cooling Tower?

FEATURES

Cooling Towers are heat removal devices used to transfer process waste heat to the atmosphere. Cooling towers may either use the evaporation of water to remove process heat and cool the working fluid to near the wet-bulb air temperature or, in the case of closed circuit dry cooling towers, rely solely on air to cool the working fluid to near the dry-bulb air temperature. (See Figure 1)



TYPES OF COOLING TOWERS

- (1) Natural Draft: Design of cooling tower is such that cold air at the bottom of tower pushes the warmer air out from top.
- (2) Mechanical Draft: It is of two types:
 - (A) Forced Draft: Air is pushed in the tower with a fan at the side.
 - (B) Induced Draft: Air is pulled from cooling tower by a fan at the top. It is of two types- counter flow and cross flow.







Shubham Shrotriya Senior Executive R&D



Many industrial companies use cooling towers in their facilities. These companies use different types of cooling tower water treatment chemistries to ensure smooth processing and a long lifespan of its equipment. Biological growth, chemical residue, sludge, and corrosion can disrupt the functioning of the cooling tower if the water is left untreated for a long time and would ultimately lead to the replacement of equipment.

It requires years of expertise, effective technologies, and thorough knowledge to successfully deal with challenges that disrupt the smooth operation of the cooling tower. A reliable cooling tower water treatment leads to reduced scaling and sediment deposition gets rid of biological fouling and corrosion and prolongs the lifespan of the plant without damaging the environment.

Water treatment forms a crucial part in the processing operation and can be effectively used to reduce the depletion of water, remove minerals like zinc, carbonate, and chromates from the water and to control the growth of microorganisms.

MAJOR COOLING TOWER PROBLEMS

Scale Deposition: Scale deposits form when the solubility of dissolved minerals in the cooling water is exceeded. Scale interferes with heat transfer by forming an insulating barrier on heat exchange surfaces. Scale also promotes corrosion, restricts water flow and increases water consumption. (See Figure 2)



Figure 2 Scaling

Corrosion: It is a natural process that converts a refined metal into a more chemically stable form such as oxide, hydroxide, or sulphide. It is the gradual destruction of materials (usually a metal) by chemical and/or electrochemical reaction with their environment. (See Figure 3)

Corrosion can potentially hamper the productivity of a plant if left unchecked for a long time.



Figure 3 Corrosion

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Figure 4 Microbial Growth in cooling tower

Microbiological Fouling: Microbiological fouling in cooling systems is the result of abundant growth of algae, fungi, and bacteria on surfaces. (See Figure 4)

Biological fouling may severely affect process equipment, leading to a progressive reduction in performance and efficiency.

A number of associated problems can occur due to biological factors in cooling systems, including:

- Reduction of heat transfer in heat exchangers due to slime and bio-film formation
- Restriction of water circulation in condenser tubes
- Plugging tubes in heat exchangers causing frequent shutdowns and loss of production in power utilities
- Clogging of water lines
- Foul smell in the surrounding



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RELIABLE TREATMENT OF COOLING TOWER WATER:

1

Scale Prevention: Effective Scale dispersant/deposit control agent should be used to prevent scaling.

2 used to control corrosion.

BENEFITS OF CHEMICAL TREATMENT OF COOLING TOWER WATER

A reliable cooling tower water treatment is the one that is environment-friendlier, effective at removing slime, bio-films, and microorganisms, and corrosion free. The following are the benefits of treatment of cooling tower using suitable chemicals-

- Optimized management of cooling tower
- Reduced water loss and improves productivity
- Minimized scaling and deposit of sediments
- Reduction in corrosion
- Prolonged lifespan of the cooling tower
- Providing safe water for discharge
- Improved environmental practices
- Supplying reusable processed water
- Reduced cost of operation



Corrosion Control: Effective Corrosion Inhibitors should be

3

Biological Control: Superior disinfection technology to control and prevent the growth of bacteria such as M. Avium, Legionella, Pseudomonas, Salmonella, E. Coli, algae and other microorganisms.

4

Sediment Control: Effective filtration technologies are put to test to remove airborne contaminants like dirt, dust, insects, seeds, and bio-fouling.







Yeast, a single celled fungus which is responsible for some of our important foods and beverages and are predominant in several fermented foods prepared from ingredients of plant as well as animal origin. The diversity of foods in which, yeasts predominate ranges from alcoholic beverages (wine, beer, whisky etc.), cereal based leavened products (sourdough, Kimchi, Tofu, idli etc.), milk products (cheese, Curd, Youghurt) and condiments such as soy sauce and papas.

What is the process by which this tiny microbe can make superfoods?

Fermentation: The science of fermentation is known as zymology. Fermentation is a metabolic process that consumes sugar in the absence of oxygen. The products are organic acids, gases, or alcohol. In microorganisms, fermentation is the primary means of producing ATP by the degradation of organic nutrients anaerobically. Fermentation is one of the oldest methods for preserving foods. It is becoming increasingly popular since the fermentation increases the nutritional value of foods and that consumers perceive it as natural and free of food additives.

What does a yeast cell needs for successful Fermentation and Why?

Yeast nutrition is an essential factor in the overall health and success of fermentation. Managing nutrient requirements not only allows for regular and complete fermentations but enhances sensory quality.

Yeast nutrition is widely divided into three categories (Macronutrients, Micronutrients and energy source) which includes different carbon sources, nitrogen sources, vitamins, trace elements etc. Figure 1.

Some important nutritional elements and their roles are listed below: -

Elements	Function			
Carbon	Contribute in organic cell materials			
Nitrogen	Major part of proteins, nucleic acids and coenzymes			
Oxygen	Electron acceptor in respiration of aerobes			
Sodium	Principal extracellular cation			
Magnesium	Important divalent cellular cation, inorganic cofactor for many enzymatic			
	reactions, incl. those involving ATP; hctions in binding enzymes to substrates			
Phosphorus	Constituent of phospholipids, coenzymes and nucleic acids			
Sulphur	Act as building element for cysteine, cystine, methionine and proteins as well			
	as some coenzymes as CoA and cocarboxylase			
Chlorine	Principal intracellular and extracellular anion			
Potassium	Principal intracellular cation, cofactor for some enzymes			
Calcium	Important cellular cation, cofactor for enzymes as proteinases			
Manganese	Inorganic cofactor cation, cofactor for enzymes as proteinases			
Iron	Constituent of cytochromes and other haem or non-heam proteins, cofactor			
	for a number of enzymes			
Cobalt	Constituent of vitamin B and its coenzyme derivatives			
Zinc	act as a cofactor for many enzymes and also required for the structural			
	stability of zinc finger proteins, many of which exert important controls on			
	cellular metabolic processes			
Molybdenum	Inorganic constituents of special enzymes			

What Happens in Lack of Nutrition?

The problems connected with development and nutrition are numerous and are very important. The requirement of nutrition in these small cells are not lesser than in animals and humans. Deficiency of a single nutrient during the growth phase of the cell may lead to death of the cell and a huge economic loss to the industry. Some of the possibilities which may occur in lack of nutrients are listed below: -

- fermentation) and increase volatile acidity.
- fermentation.
- resistance to ethanol.

Essentially all nutrients can limit the fermentation rate by being present in concentrations that are either too low or too high. At low concentrations, the growth rate is roughly proportional to concentration, but as the concentration increases, the growth rate rises rapidly to a maximum value, which is maintained until the nutrient concentration reaches an inhibitory level, at which point the growth rate begins to fall again and it is very important to keep a check on the availability of nutrient during the fermentation process to avoid any miss function and loss.





Fig. 2.

1.

References

- 2.

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• Deficiency of nutrient may reduce yeast growth, slowdown fermentation and promote the accumulation of pyruvic acid and acetaldehyde, components responsible for oxidation and binding SO2.

• Low levels of sterols, oxygen and/or unsaturated fatty acids may shut down sugar consumption (stuck

• Without proper nutrition introduced at the right stage in their growth cycle, yeast can come under stress and produce undesirable characteristics: off-flavors (hydrogen sulfide, oxidation...), high bound SO2, stuck or sluggish

• Loss of viability during alcoholic fermentation is usually attributed to an insufficient availability of lipids, specifically sterols or unsaturated fatty acids, given that a membrane deficiency in these compounds is thought to alter cell

• Lack of nitrogenous compounds breaks down asparagine with final production of malic acid and this acts as poison, suppressing and finally inhibiting reproduction as soon as its acid concentration reaches certain limit.

• In lack of nutrients cells start to shrink and at the end lose their viability. Figure 2.





(Lack of Nutrient)



Nutritional Requirements in Fermentation Process, Willem H. Kampen. The Development and Nutrition of yeast, Adam Tait, A.I.C., and Louis Fletcher, A.I.C

FEATURES

ETHANOL-PRODUCTION, PURIFICATION **AND ANALYSIS**

Contributed by: Neha Srivastava Associate R&D

1. Ethanol Production

- 1.1. Substrates Substrates are chosen for ethanol production according to regional availability and economic efficiency. Sucrose containing materials (sugar cane, sugar bet, and sugar sorghum), Starch containing materials (Corn, potato, sweet potato, cassava and wheat) are mainly used for ethanol production whereas lignocellulosic biomass (maize silage, barley hull, and paper sludge) is the area of investigation due to some difficulties of using it as a substrate. Poor porosity, high crystallinity, and lignin contents are problem related to lignocellulosic biomass. Different kinds of pretreatment techniques have been investigated, such as steam (Linde et al., 2008), acid (Nichols et al., 2008), and alkali (Hu and Wen, 2008) treatments.
- 1.2 Production process Starch containing materials undergo two major process i.e dry milling and wet milling to convert into ethanol. Dry milling is preferred over wet milling as it produce more alcohol, 2.8 gallons of ethanol per bushel of corn (Rendleman and Shapouri, 2007). Dry milling is shown in (figure a) and wet milling in (figure b).

2. Ethanol Purification

- 2.1. Byproducts of fermentation- Ethanol is produced by yeast fermentation with byproduct formation. Starch and lignin are two byproducts. Starch derived by-products include esters, organic acids, and higher alcohols. Lignin derived by-products include cyclic and heterocyclic compounds.
- 2.2. Purification techniques- Byproducts need to be removed to obtain pure ethanol. Mostly it is removed by the process of distillation. Volatile Byproducts tends to be more in ethanol. However for drinking and pharmaceutical uses we don't need concentrated ethanol so further distillation is of no use therefore an alternative purification is required and studies have been done on it. Adsorption, Ozonation, pervaporation and gas stripping are the other purification methods which comes with their own advantages and disadvantages (Figure c).

3. Ethanol analysis

- 3.1. Gas Chromatography (GC) It is an analytical technique used for the analysis of volatile and semi volatile compounds. Ethanol analysis can be done by GC as ethanol contains mostly volatile impurities and is itself volatile (Hida et al., 2001, Rodrigues et al., 2008). A sample when injected is vaporized at the injection port and sent through the columns having stationary phase (chosen according to our target compound). Gas (N2, He) is used as mobile phase. Each compound in the sample is separated by its physical and chemical property and is detected by the detector. Choice of detector should be in accordance with compound of interest. Gas chromatography in tandem with mass spectrometry (GC-MS) is an integrated system of two analytical equipment's. Mass spectrometry is the detector which identifies target analytes separated by GC. GC-MS accelerates ethanol analysis with its simultaneous separation and identification.
- 3.2. High performance liquid chromatography (HPLC) - It is an analytical technique where liquid mobile phase is used. Nonvolatile or heat sensitive compounds can be analyzed by HPLC as samples are not heated at the injection port. Extensive research in ethanol analysis by researchers have been done (Sen et al., 1995, Yarita et al., 2002, Alcázar et al., 2006). Hplc is more comprehensive than GC in terms of sample limitations and is expensive and less sensitive than GC.
- 3.3. Infrared Spectroscopy- it uses infrared adsorption technique. Infrared at different wavelength is passed through a liquid sample. Samples are detected by comparing infrared absorbability by a compound which differs with other compound. However instrument is cheap and analysis is quick it can be used for quality assurance and classification purpose of alcoholic beverages (Pontes et al., 2006). IR does not have high resolution as GC and HPLC.
- 3.4. Olfactometry- This is a sensory analysis which is usually coupled with GC. It is utilized for alcoholic beverage analysis to develop its flavor. For a typical GC-Olfactometry (GCO) system, a GC column is connected to a separator where analytes are separated to two ways, olfactometry and a detector such as MS Etc. Olfactometry is a simple system which is just an open-end column, and a panelist sniffs analytes coming from the column. The panelist records the odor character and intensity of the analyte which correspond with a peak in chromatogram. Olfactometry provides flavors data rather than stoichiometric chemical data.

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GRAIN

CO₂

FTHANOL

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Dry mill block flow diagram



Figure a



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NH₂ HS



DIGITAL REVOLUTION IN R&D

The merger of physical compounds with cyber space to develop and integrate existing systems more intelligently is crucial in today's biotech industry for acquiring clear results. In this journey, digitisation and technology plays a crucial role by visualizing the big data generated in projects, identifying the processes, and arriving at the conclusions of the research.

Furthermore, with customers demanding their unique value proposition and better custom solutions from their materials suppliers, R&D teams are turning to technology to help navigate these modern requirements. By choosing the right tool and adopting a culture of storing and learning from data across teams, big data analysis provides immediate benefits to R&D labs that impact the bottom line and the future innovation potential of these organizations. The hidden values are:

- Very limited time and lab capacity is wasted in reinventing the wheel.
- The loss of valuable IP is minimal when scientists leave.
- New scientists on-board can quickly identify the trends to full capacity.
- R&D labs can be connected better to the functions, making it easier to optimize around cost implications, supply chain changes, and scale-up procedures.

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Moving ahead, by using the latest tools it becomes easier to accelerate the project execution and the delivery of results also becomes faster. Also, by building on top of a data foundation that is clean and familiar to scientists, it is possible to create early wins in the organisation from advanced analytics while the broader database of experimental data accumulates over time. This can also aid with change management and adoption, as scientists can gather information in the system they are already familiar with working, rather than starting all over again.

Another key aspect that is required for good project execution is digitalisation which is being developed and implemented in R&D functions. It helps in analysing and reviewing data through digital tools which further helps to convince stakeholders both internal and external.

According to a recent PWC report, 55% of R&D executives in their companies are adopting digital solutions. Digitisation makes it possible for companies to combine and integrate data that have not traditionally been combined. Incorporating data-internal data and external data drives R&D management to generate insights to inform R&D activities and decisions.

- Improving scientific decisions in the R&D processes.
- Shifting to the way of working to an informed and predictive approach.
- Supporting the cross-functional activities and decision making.
- Optimising the employee experiences.
- Changing the traditional way of thinking and operating.
- Embedding digital expertise in the company culture.

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In a nutshell, R&D functions in Biotech organisations are continuously working towards disruptive ways to support stakeholders with innovative products and services. Statistical data analysis and Digitisation, both play a key role in to provide clear conclusions from day to day experiments towards project progress and achieving targets with scientific evidence.

Similarly, at the Catalysts Group, R&D team is embracing these digital trends to meet the expectations of stakeholders and customers. By identifying and leveraging these digital solutions and services within the workforce, the organisation is keeping pace with the ever-changing industry requirements and developing quality and relevant products.



IMPORTANCE OF INNOVATION IN INDUSTRIAL ENZYMES

We are at a stage of development where "innovation" is a keystone of extended economic growth and fortune. In layman terms, innovation does not only mean doing different things but it also portrays doing things differently.

Innovation is not limited to the invention of something new, but also offering it in the marketplace. It is more of an organized, human-centered and technological lever for developing innovative culture and the global industry ecosystem.

When it is deeply inherent in the business philosophy, innovation leads to cover the entire business operation of an organization. Furthermore, with a continuous process, it advances creative thinking in every aspect of administration within an organization resulting in progressive approaches.

Significantly, innovation is the only way how a successful business responds to their current customer or organizational necessities.

Similarly, in the field of industrial biotechnology, cutting edge innovation in enzymes market focuses on the leading business trends that are making it possible to face the present and future challenges of the sectors.

The continuous evolution of enzymes is now routinely used to develop new catalysts with various applications, such as in environmental friendly production of chemicals and renewable fuels.

Like for instance, the global enzymes market size was USD 9.9 billion in 2019 and is projected to expand at a CAGR of 7.1%1 from 2020 to 2027. With continuous innovation, there has been increasing demand from end-use industries such as food and beverage, biofuel, animal feed, and home cleaning, which is further projected to drive the market growth over the forecast period.



Increasing investments in research and biotechnology sector for the development of new medicines and diagnostic solutions is one of the key factors driving the global enzymes market.

R&D centers of several companies focus on evaluation, development, upscaling, validation of technologies, and innovative enzyme formulation for commercial processing as well as human welfare.

Enzymes are also witnessing increased demand in paper processing, biofuels, contact lens cleaners, rubber processing, biological detergents, and molecular biology.

In a nutshell, due to constant innovation a significant growth has been observed in the enzyme industries globally which further leads to the development of many small and medium scale industries. However, the search for better enzymes, technological improvement, and an economically sound world population and rising environmental concerns will continuously be the moving force for increasing the global market for industrial enzymes.

Source:

https://www.gminsights.com/industry-analysis/enzymes-market

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Increasing demand for medicinal drugs, strong funding initiatives, and extensive research activities are expected to drive this sector, which, in turn, is likely to fuel the product demand in the coming years.

These research centers have

developed proficiency in the

expression and cloning of industrial

enzymes in safe and suitable

microbial hosts.

Increasing consumer awareness regarding improved food quality, population explosion, and significant consumption of dietary requirements are considered to be the key factors contributing to the enzymes market growth.

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Complete ENZYME SOLUTION For SUGAR & MOLASSES Industries

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COMMUNICATION

IMPORTANCE OF SOCIAL MEDIA FOR BRAND PROMOTION



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ontributed by Purva Senior Associate Corporate Communication

Facebook or LinkedIn... Which one to scroll first? There are times in a day where you pay visit to one of these or several other social networking websites which are growing and evolving at a faster rate.

Due to which, social media is turning out to be one of the most effective tools for marketing the brands and gives the chance to stand out of the crowd. When done correctly, it also helps to connect with the target market in an optimal way.

The two seem to go hand in hand however, question still makes us wonder, why to focus on social media more?

Well, social networks are undeniably one of the fastest growing industries in the world. It forms a natural and essential part of overall marketing efforts on all social media platforms but majorly on Facebook, Twitter and LinkedIn.

Through consistent use with right methods, social media branding helps in engaging the target audience on different platforms. One can also build a robust network of potential customers turning them into loyal ones working towards achieving single aim- to create brand awareness.



1

Create brand awareness: Being one of the most stress free and profitable digital marketing platform, social media helps to increase the brand visibility. By using a social media strategy, it will significantly help to increase your brand recognition. By spending only a few hours per week, over 91% marketers claimed that their social marketing efforts greatly increased their brand visibility and heightened user experience. Undoubtedly, having a social media page for your brand not only benefit the business and with a regular use, it can also produce a wide audience for your business in no time.

Enhance brand loyalty: Social media can be an important medium to connect with customers. When you have a social media presence, you make it easier for your customers to find you and connect with you. By connecting with your customers through social media, you are more probable to increase customer retention and customer loyalty. Also, it is not just limited to introducing ad enhancing your product but it also a leading platform for promotional campaigns. A customer sees these platforms as service channels where they can directly communicate with the business.

5

Increased traffic: Last but not the least, another benefits of Social Media is that it also helps increase your website traffic. By sharing your content on social media, you are giving users a reason to click-through to your website. On your social account, the more quality content you share, the more inbound traffic you will generate while making conversion opportunities.

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There are various other important aspects as well to use social media for brand building perspective. Let's have a look: -

Engage with your customers: Social media is a good way for engaging and interacting customers. The more you communicate with the audience, the more chances you have of lead conversion. Setting up a two-way communication with the target audience so that their needs and demands are known, and their interest is catered with ease. Moreover, communication and engagement with customers can also help to win their attention and convey them your brand message. Thus, your brand will reach more audience in real terms and gets itself established without any hassle.

2

Marketplace awareness- Social media now a days is also one of the best ways to find the needs and wants of your customers instead of directly communicating with them is Marketplace awareness. By monitoring the activities on your profile, you can see customers' interest and opinions that you might not know otherwise if you didn't have a social media presence. As a balancing research tool, social media can help you get information and a better understanding of your industry. Once you get a large following, you can then use additional tools to examine other demographics of your consumers.

To conclude, we can say that there is no denying that Social media marketing has many advantages for startups and established brands. By regular updating the right social media marketing strategy, it will lead to increased traffic, better SEO, improved brand loyalty, healthier customer satisfaction and much more. Your competition is already increasing on social media day by day, so don't let your competitors take your probable customers. The earlier you start, the faster you see the growth in your business.

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HEALTH AND WELLNESS



HEALTH **BENEFITS OF WINE**



Contributed by: Abhijeet Kohok Assistant Manager BMS

Wine is fermented alcoholic beverages made from grapes. Wine has a long history of use as an early form of medication, an antiseptic for treating wounds, a digestive aid, and as a cure for a wide range of ailments including lethargy, Diarrhea, and pain from 2200 BC.

Wine contains mainly Phenol compounds which act as Anti-Oxidants. Wine having several health benefits, so let's put lights on though points. Vicinal Enediol Compounds such as 2, 3 DHB Cyanidin, epicatechin& quercitin is capable of chelating metals particularly transition metals such as iron (Fe). Thus they help as dietary Co-adjutant in the treatment of iron deficiency anaemia; Wine intensifies iron absorption from food.

Antioxidants also help to retain the integrity of the sulphydryl (thiol) group such as glutathione. It helps to prevent diabetes and interfere with the inflammatory response in humans. Salicylic acid and DHB Presents in the wine have powerful antipyretic and analgesic properties.

Wine Contains resveratrol, salicylic acid & DHB's are capable of preventing LDL-oxidation some of there can prevent the formation & deposition of LDLs and their oxidation products on the vascular endothelium. Several types of research also prove that moderate consumption of wine can prevents ulcers and helps in rheumatoid arthritis.

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The World Health Organization (WHO) is one of the world's foremost authorities on the subjects of health and wellbeing. They have released and sponsored studies all over the world to determine the various health ramifications of different actions and, in recent years, have been paying particular attention to wine and how it may be able to positively affect the health of those who drink wine.

We as a CATALYSTS look forward to give the best solution for winemaking in India.



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EMPLOYEE ZONE

Catalysts





Rajat Sharma Sr. Executive Department: **Corporate Communications** DOJ: 02/11/2020



Anuj Kumar Coordinator Department: BD DOJ: 12/10/2020



Divya Sharma Process Coordinator Department: MDO DOJ: 07/09/2020



Mehak Madan Trainee Department: R&D DOJ: 27/08/2020



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Sanjay Kumar Rana Manager Accounts Department: Accounts DOJ: 24/08/2020



Shubham Shrotriya Sr. Executive Department: R&D DOJ: 17/08/2020





A Roem on Gandhiji Rathimeena VII - A

MI-A It was a before and shad nothing to do, I was at home and mummy daddy too; My glance raught a sketch, of an old person; the appeared to be the gentless under the sun; strinkly, different was the expression in his Eyes; studichty sight guilty of all my dies; His lips parted in a smile, so june the left me spellowed that's for sime "his us the one who has set us prec; the is the one who has set us prec; the is the one who has set us prec; the is the one who has set us prec; the is the one who has set us prec; the is the one who has set us prec; the is the one who has set us prec; the is the one who has set us prec; the is the one who has set us prec; the is the one who has set us prec; the is the one who has set us prec; the is the one who has set us prec; the is the one who has set us prec; the is the one who has set us prec; the is the one who has set us of the sec; the is the one who has set us prec; the is the one who has had plotted the ide; the is the one who has set us of the sec; the is the one who has had plotted the ide; the is the one who has set us of the sec; the is the one who has set us of the stree; the is the one who has set us of the sec; the is the one who has ide of enough; Towath and studborn lust never orough; Towath and he would be never would for unbach he fought greating and practises for once unever the isame this deed were worth mome and fame I have never seen a isoul, so tall; 1 have never seen a soul, so tall;

New Pune Office



New Factory Launch at Sahibabad





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Sheetal Nagar Executive Assistant Department: MDO DOJ: 05/08/2020

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Catalysts values are based on belief of collective growth and respect in our internal and external relationships. This value system has facilitated our endeavour to enter into research and scientific collaborations with highly reputed institutes and organizations. We have a well-defined process for developing and launching innovative products based on the collaborative model.



Catalysts have been certified by ISO 9001:2015 ensuring compliance across multiple criteria including effective Quality Management System, efficient management of our processes and continuous improvement of the system.



It has been established under the Food Safety and Standards Act, 2006 which consolidates various acts & orders that have hitherto handled food related issues. FSSAI has been created for laying down science-based standards for articles of food and to regulate their manufacture, storage, distribution, sale, and import to ensure availability of safe and wholesome food for human consumption.



The FSSC 22000 Food Safety Management System provides a framework for effectively managing organization's food safety responsibilities. It is fully recognized by the Global Food Safety Initiative (GFSI) and is based on existing ISO Standards. It demonstrates that the company has a robust Food Safety Management System in place that meets the requirements of customers and consumers.

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PURSUIT OF EXCELLENCE



Research has been the backbone of Catalysts Biotechnologies Pvt. Ltd. since its inception. The research and development division located at 3/1/4, Site IV, Industrial Area, Sahibabad, Ghaziabad is recognized by Department of Scientific and Industrial Research (DSIR), Department of Science & Technology (DST), Ministry of Science & Technology, Govt of India. This recognition has created an enabling environment for development and utilization of new innovations benefit thereof for society and environment.

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Catalysts continuous striving for quality products and services developed with an innovative mindset has been recognized by various institutions. Our quality journey has been further detailed below:

LBD

HALAL

Kosher certification is a standalone international quality standard which is increasingly prevalent in the food ingredients and retail sector. Catalysts Biotechnologies Pvt Ltd is certified from KLBD Kosher agency. As Europe's largest kosher agency KLBD is respected and accepted by all parties worldwide Kosher products require kosher certified ingredients. Ingredient buyers specify kosher knowing that their supplier's manufacturing process has been independently audited.

Halal Certification Services (HCS) is a world-

assessment, auditing, and training services.

wide recognized certification providing

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