Catalysts

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Mar, April, May & June'18 Volume 29

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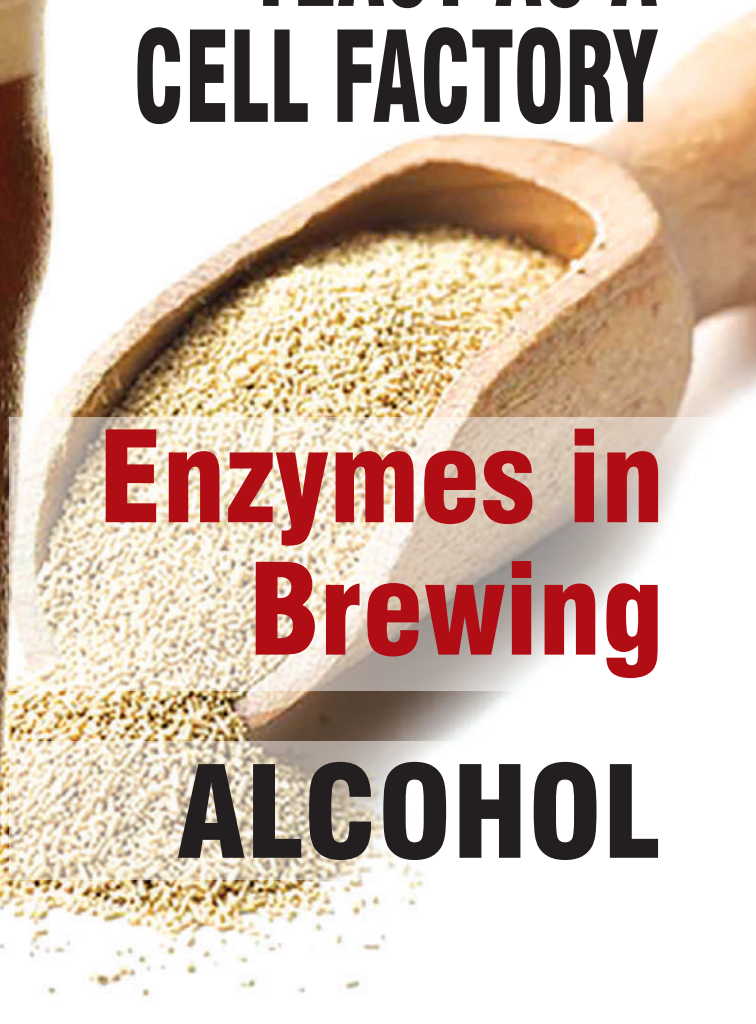
YEAST AS A CELL FACTORY



Enzymes in Brewing

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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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For more information,
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making things happen...

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MESSAGE FROM THE MANAGING DIRECTOR

Dear Friends

Another quarter has come to an end after completion of a wonderful financial year when we have achieved our dream of achieving 100 cr turn-over as a Group. I am exited to observe that we have clocked more than 30% growth in this first quarter of 2018-19. It has been a rollicking start to financial year and considering favorable Ethanol policy backed by good monsoon predictions, outlook for the future look extremely positive for our Organization.

Being true to our Brand name 'Catalysts' and its tag-line "… making things happen' we continue to make things for happen to our Clients - their Products and Processes, Our Principals, Our People and Ourselves.

Values are an integral part of any Organization and it is important that each stakeholder is aware about them and displays the same in its actions on daily basis. We have identified our Organizational Values and I would use this opportunity to share the same.

Customer Centric Approach
Continuous Growth &Progression
Persistence & Hard work
Integrity & Complete Ownership
Humility and Collaborative Approach
Adaptability& Agility
Learning Attitude

The above-identified values are not just statements but are the only reason of our continued success. Now as we have identified them, we should continue to display each one of these in our day-to-day actions and decision-making.

I wish you all a wonderful next quarter…

Munish Madaan

MESSAGE FROM THE DIRECTOR

Dear Friends

Dear Friends...

With the support & guidance of all our industry friends & associates Catalysts Group crossed 100 Crores this year 2017-18. We thank all of you to be part of this journey.

Apart from celebrations, this achievement raises the bar for our next milestone. It gives us responsibility to come up with new products, new technologies & new verticals going forward. We at Catalysts thrive to compete our own past performance & beat our own records year after year.

In the current year you will see Catalysts teams offering you solutions for more healthy & sustainable solutions against urea & liquor ammonia. We are also here to give you world class anti-scalants & de-foamers. Catalysts basket will offer some new yeasts for more enhanced flavours for your beer. Some pathbreaking technologies too are expected to be launch commercially in this year which will change a lot of dynamics in the market place.

One of the key core values of Catalysts has always been knowledge & learning. To continue the trend forward this year we plan to add dimension of spiritualism & self development with all our team members. As someone said " As a leader, your every thought, emotion, and action impacts many lives. It's extremely important to work on how you are within yourself ". Thus this year apart from skill sets will be focusing more in the inner potential of the team.

Aditya Malhotra

TEAM 100 Crore

2017-2018

Catalysts

making things happen...

naturegen

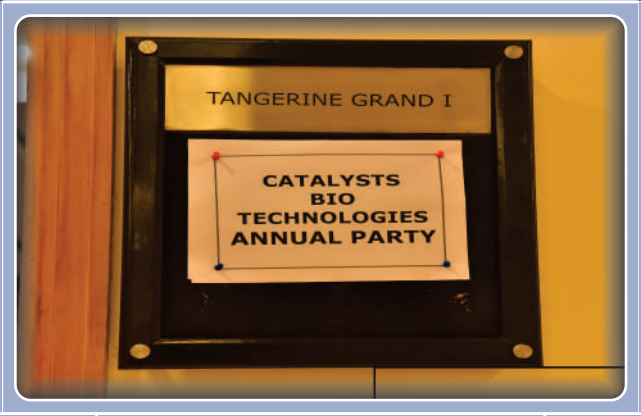
In sync with nature.

Annual Party Celebration














Yeast as a cell factory: Current state and perspective

Dr. Archana Prakash - R&D Department

The yeast Saccharomyces cerevisiae is the most intensively studied unicellular eukaryote and one of the main industrial microorganisms used in the production of biochemicals. Apart from traditional applications in alcohol fermentations, baking processes and bioethanol production, S. cerevisiae is being used for the production of many industrially relevant biochemicals and for heterologous expression of proteins. Saccharomyces cerevisiae is a best production host for biotechnological process and there are two basic strategies for developing this production host. In the first, a suitable host can be selected from a large number of species based on its performance regarding parameters such as product yield, productivity, and tolerance to the product or other environmental stressors (e.g. pH, temperature, salt). In many cases, targeted optimization of such a host is not possible because the tools for genetic analysis and engineering in that species are not available, leaving only evolutionary optimization or random mutagenesis to produce optimized strains. The second possible strategy is to start with a well known species such as S. cerevisiae and optimize it for the desired product and required bioprocess conditions. Many examples for this strategy exist, but species specific traits often hinder the development of hosts with high productivity and yields close to theoretical limits. Nevertheless, S. cerevisiae is the host of choice in many cases, due to the vast array of tools for genetic engineering and to the immense range of knowledge about all aspects of yeast biology.

Development of genome editing tools

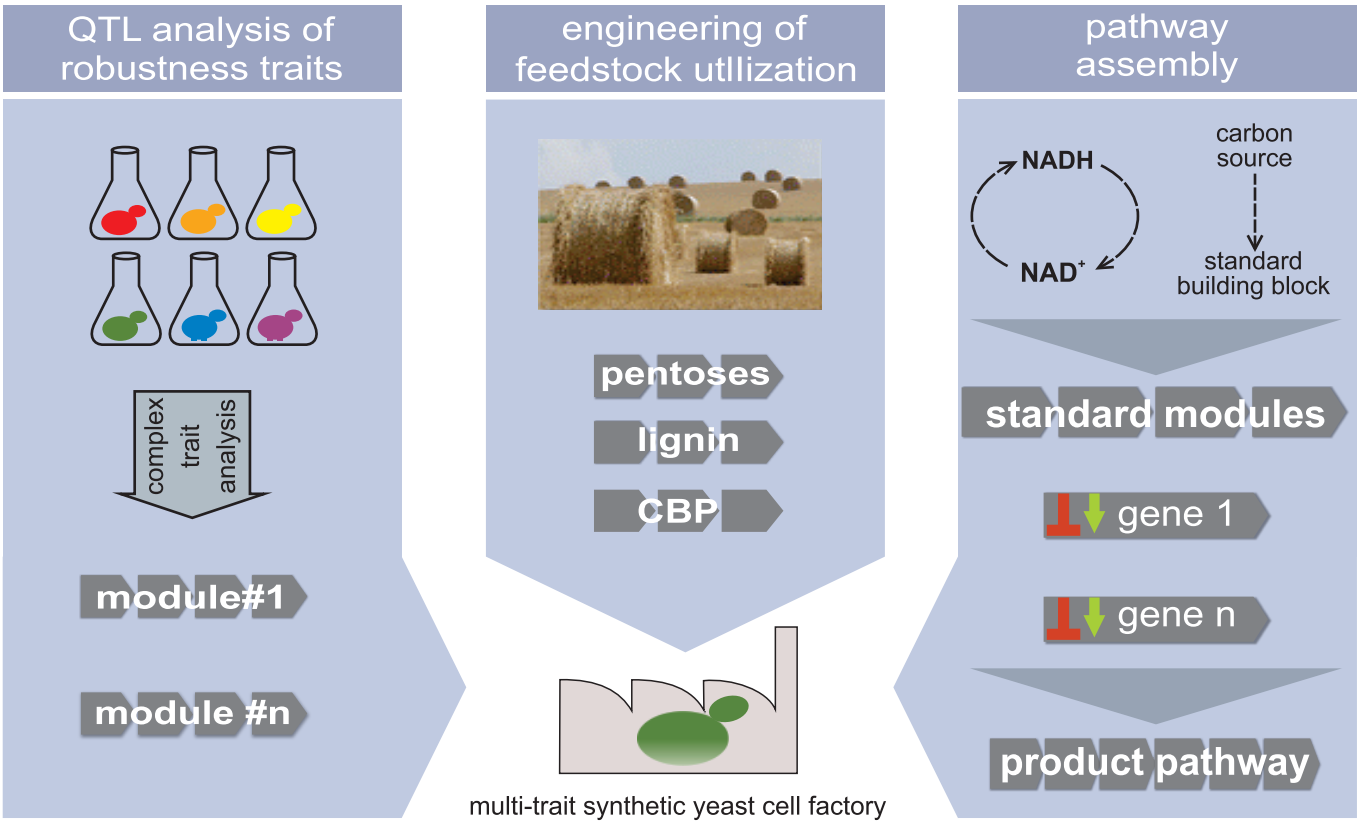
Traditional DNA editing techniques, such as transformation and deletion of genes by homologous recombination, have been readily feasible for many years in *S.* cerevisiae.The use of Cre recombinase or other recombination based approaches, like the 50:50 method, allow for marker recycling and performing delitti perfetti, leaving no foreign DNA in the yeast genome. Although such techniques are currently an important tool for synthetic biology, they are relatively time consuming and therefore not suitable for the introduction of whole heterologous metabolic pathways or deletions of several genes in a reasonably short time. In the last few years, new approaches like Zinc finger nucleases, Yeast Oligo-Mediated Genome Engineering (YOGE), transcription activator like (TAL) effector nucleasesand the CRISPR-Cas system (clustered regularly interspaced short palindromic repeats) have been developed for deleting or inserting genes and for controlling gene expression. The main advantages of these tools over traditional techniques lie in their efficiency, accuracy and speed. The use of CRISPR, together with the site specific Cas9 endonuclease, appears as the most promising tool for editing a genome at any number of different loci in a short time. Another approaches make use of the high recombination efficiency of S. cerevisiae by simultaneous transformation of a recipient strain with several different integration cassettes. An alternative approach, the DNA assembler technique, is based on the in vivo recombination of overlapping DNA sequences. All genes of a pathway together with a marker were amplified by PCR with extension primers that resulted in overlapping sequences at the 3′-end of one gene and the 5′-end of the next one. The 5′-end of the first and the 3′-end of the last cassette bore sequences homologous to sequences in the chromosomal δ sites.

The currently most ambitious project in yeast synthetic biology is the complete de novo synthesis of all 16 chromosomes, Sc2.0. In this effort, all nonessential genes will be flanked by *loxP* sites, allowing for random deletion of genes upon expression of Cre recombinase and on screening for viable strains with improved

characteristics for a selectable trait. Furthermore, one of the three stop codons will be eliminated from the genome in this project. In the future, an orthogonal codon could be used for the targeted incorporation of an alternative amino acid, thereby altering protein properties. Such a recoded genome will also enable the development of efficient biocontainment strategies as the free codon can be used to engineer orthogonal auxotrophies in cell factories to minimize risk in the case of accidental release and allow for processes to be carried out in open bioreactors. Although this project is at its very beginning, with one synthetic chromosome completed, the consortium plans to finish all additional chromosomes until 2019. It is thus not yet clear whether replacement of all chromosomes with their synthetic analogues will be possible, but Sc2.0 will certainly provide new knowledge about the genetics of yeast and genome editing.

Development of orthogonal systems

One of the central aims of synthetic biology is to apply classical engineering principles to the development of strains. This includes the concept of orthogonality that requires a biological system to be divisible into modules that are independent from each other and can therefore be engineered individually, without consideration of other modules and with predictable outcome. In contrast, systemwide approaches like systems biology and the various omics techniques teach us that virtually each part of a biological system could be responding to changes in another part, with spatial, temporal or functional causalities that are often difficult or impossible to predict with our current knowledge. Hence, absolute orthogonality may, in the near future at least, not be achievable for biological devices.



Approaches in this field that go beyond theoretical considerations include the synthetic yeast strain with an orthogonal codon on the DNA level, the engineering of aminoacyl-tRNA synthetases, riboregulators, and orthogonal ribosomes on the translational level, and enzymes with specificity for orthogonal co-factors like xanthosine 5′-triphosphateon the level of enzyme activity. Such studies will undoubtedly contribute considerably to the implementation of orthogonality in synthetic biological systems. Transcriptional controlorthogonality is the most common and promising because it regulates the flux through a pathway and examples for transcriptional orthogonality are the estradiolinducible chimeric TF, the retinoid X receptor, and the bacterial quorum sensing TF luxR, which has not yet been tested in

Predicting improved robustness and stress tolerance

Biotechnological processes often require strains that are tolerant to one or several stress conditions from a broad spectrum, like extreme pH, high temperature, osmotic pressure, shearing forces, organic acids and toxic substances. Most of these properties are complex traits, encoded by several genes. Basic genetic analysis methods therefore fail to characterize the underlying genetic network, and efforts to optimize one of these traits traditionally rely on adaptive evolution or breeding strategies. The possibilities of whole genome sequencing at low cost and in a comparably short time have now opened the way for the use of advanced genome analysis tools like quantitative trait loci (QTL) analysis to identify, at least under some conditions, all causative genes for a certain traitor even several different genetic combinations giving rise to the same phenotype. Extreme QTL (X-QTL) analysis and intercross QTL (iQTL), which have recently been improved greatly, provide sensitivity and detection of even modest changes in a trait to a single gene or even nucleotide level, simultaneously covering all causal loci contributing to heritability of the trait.
The aforementioned methods enable integration of data on mutations, environmental conditions and strain efficiency. As such, they will aid in the discovery of promising combinations of genetic manipulations, strains and environmental conditions to achieve multiple engineering objectives such as yield or breeding efficiency, as well as meeting productivity, efficiency or robustness constraints. Combining the knowledge of causative gene networks and metabolic models, it is possible to predict side effects and other trade-offs associated with manipulations. The main consequence of applying integrative mathematical modelling is, and will remain, the significant speedup gained by informed manipulations comparing over the traditional trialanderror approach.

Improvement of the substrate spectrum

The metabolism of *S. cerevisiae* is specialized for the utilization of glucose, fructose and its disaccharide sucrose. In the emerging era of bioeconomy, however, microbial cell factories will have to efficiently utilize more sustainable, cheaper and generally available carbon sources, especially lignocellulose. *S. cerevisiae* cannot directly utilize cellulose and therefore pretreatment is required to release glucose. The second most abundant monosaccharide in plant biomass is xylose, but the rate of xylose metabolism in currently used laboratory and industrial yeast strains is too slow to be of use in a biotechnological process, especially because of too low xylitol dehydrogenase (XDH) activity. Adaptive evolution experiments resulted in strains with increased XDH activity and significantly shorter doubling times on xylose as the sole carbon source. Moreover, several wine strains have been found that harbour in their genomes a previously unknown XDHencoding gene named *XDH1*, indicating that it may be possible in the future to engineer an efficient endogenous xylose utilization pathway. Still, currently the most efficient utilization of xylose as the carbon source requires introduction of heterologous pathways, most often bacterial xylose isomerase. To construct the currently most efficient pentose fermenting strain published, a cassette of 13 genes, coding for enzymes of the xylose and arabinose utilization pathways and of the pentose phosphate pathway, was inserted into the genome of an industrial strain. Together with mutagenesis, genome shuffling and evolutionary engineering, the authors obtained a strain that produced 32% more ethanol from lignocellulosic hydrolysates than the parent strain. Although at lower consumption rates than for glucose, this synthetic strain fermented xylose to ethanol with yields close to the theoretical maximum.

Since direct utilization of lignocellulosic material as a feedstock for yeast is not yet possible, thermal, chemical and/or enzymatic pretreatments are required to separate the polymers that constitute lignocellulose and release the sugar monomers. Subsequent detoxification is often necessary to remove pretreatment derived inhibitory substances- especially acetic acid, formic acid, furan derivatives and phenolic compounds. Mechanisms conferring tolerance to such inhibitory substances can be predicted and engineered in yeast, but development in this field has until now brought only limited success, although with promising predictions for the future. Therefore, despite the lower costs of the raw materials, the second generation biofuels are currently still more expensive than the bioethanol produced from corn or sugar cane. To

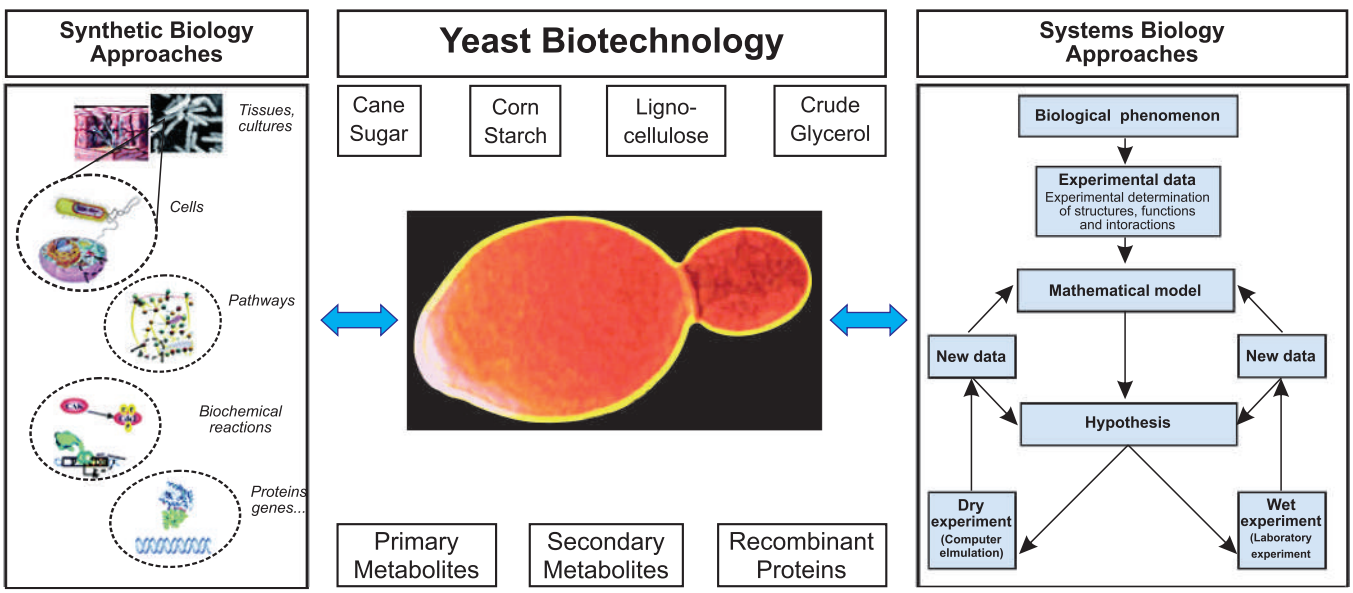
pave the way for the use of lignocellulose as raw material also for other biotechnological processes, novel solutions will be required. The most promising ones aim at so-called third generation processes, enabled by consolidated bioprocessing (CBP). CBP requires a single organism capable of biomass hydrolysis and bio-product production. In terms of scientific approaches, development of such strains calls for merging of the fields of heterologous expression of cellulases and xylose fermentation.

Enhancement of the product spectrum

The specialization of *S. cerevisiae* on fast fermentation of sugars is the basis for its use in the production of alcoholic beverages and biofuel and in the baking industry. At the same time, aerobic ethanol fermentation (also called the Crabtree effect) is one of the main obstacles to obtaining high yields in processes aimed at producing bulk products other than ethanol. Indeed, sustainable and costeffective production of many commercially important metabolites cannot be achieved in *S. cerevisiae* as long as most of the carbon source is converted to ethanol. Hence, a stable conversion of *S. cerevisiae*physiology to respiration in the presence of high sugar levels, allowing efficient use of the substrate, is an important prerequisite for its use in high yield production processes. Most attempts to eliminate the Crabtree effect in *S. cerevisiae* focus mainly on a reduction of the normally high glycolytic flux, because it is assumed that the degree of fermentative activity is a function of the rate of glucose catabolism. A promising approach towards this aim is deletion of the seven major hexose transporters and their replacement with a chimeric transporter. These modifications result in reduced growth rates, but increased biomass yields and absence of ethanol production at moderate glucose concentrations. Whether this strain is sufficiently robust to be used in biotechnological processes remains to be shown but its superior properties in heterologous protein production have already been demonstrated in the production of 2,3-butanediol or lactate.

Perspective: combining polygenic trait analysis with synthetic biology

Several genetic modules show that mutations in genes encoding regulatory proteins enable expression of the studied trait. Using synthetic biology tools to engineer traitspecific genetic modules can thus be seen as a step towards synthetic regulatory circuits with the ability to drastically increase the productivity of yeast strains.Productive combination of genetic modules for tolerance to several stress factors will likewise remove some of the current bottlenecks in the development of new and more sophisticated cell factorybased processes.



Improved substrate spectrum, enhanced product spectrum and increased stress tolerance and robustness are the main demands for the future cell factories that will be used in biorefineries and these traits are almost exclusively polygenic. Recently developed polygenic trait analysis methods, such as X-QTL and iQTL, enable identification of complete sets of causal alleles, i.e. genetic modules, for the desired traits. These traits are present in natural strains, and yeast biodiversity is therefore an attractive genetic pool for bioeconomy. The development of synthetic biology toolboxes, on the other hand, enables genetic modules to be inserted into platform strains. We foresee an approach in which the latest developments in complex genetics are combined with expertise in synthetic biology, with the aim of combining several genetic modules in single strains. This new approach will make it possible to combine multiple beneficial traits within a single organism, which is not possible in the current stateoftheart. Specific combinations of traits could result in strains custom-made for requirements of specific processes. Such cell factories should have a big potential for future biorefineries where several sources of feedstock and several different products will be used/produced within a relatively short time intervals. It is the ability to transform different molecules into pre-defined end products which makes the multitrait cell factories important within the value chain concept of bioeconomy. In addition, as multitrait cell factories will contain genetic modules comprising heterologous genes, the gap between biotechnological exploitation of *S. cerevisiae* and so-called non-conventional species will be diminished, since we can envision that some cell factories could make use of *S. cerevisiae* only as a chassis, whereas the specific biotechnologically relevant traits will come from a number of different organisms.New technologies for the analysis of whole genomes and for large scale DNA editing have the potential to revolutionize biotechnology. The engineering of production strains will no longer be restricted by the length or complexity of a pathway and the use of computational and omics tools will enable more accurate prediction and prevention of undesirable side effects in the design phase. Awelldeveloped toolbox for the analysis of yeast, both on the single gene level and in omics and systems biology techniques, is an important advantage of this organism. Combination of the recent developments in the fields of synthetic biology with polygenic trait analysis provides a means to engineer traits for increased stress tolerance and robustness, improved substrate spectrum, and enhanced product spectrum.

Source: Kavscek et al. Microbial Cell Factory

New Products for Water Treatment and Recycling in Molasses Based Distilleries

Dr. B Chandrashekhar-(R&D Dept.)

Molasses-based fermentation industry produces very large quantity of spent wash as waste which is a major concern for distillery industries who want to realize the concept ofZero-Liquid Discharge (ZLD). The spent wash is generally treated by multiple effective evaporation (MEE) process using either raw spent wash or bio-methanated spent wash. However, the condensate generated from raw spent wash consists of high concentration of volatile acids and other volatile compounds such as phenolics and sulphides. Similarly, condensate generated from bio-methanated spent wash also consists of high concentration of ammonia and other volatile compounds. This makes the condensate unfit for complete recycle to the fermentation process, due to the high toxicity offered by volatile acids, phenolics, sulphides and ammonia to the yeast. The standard tolerable limits for these compounds in the water used for fermentation are as follows -

Water Parameter	Standard tolerable limit for fermentation water
Ammoniacal Nitrogen	300 mg/L
Sulphides	20 mg/L
Phenolics	0.001 mg/L
Volatile Acids	2000 mg/L

Therefore, it has become very necessary to further treat the condensate waterin order to make it more recyclable to the fermentation process and also to increase the fermentation efficiency in the presence of such toxic compounds. Among the various processes available for condensate treatment, the common processes currently being used are – air stripping and condensate polishing unit. In air stripping process, condensate and air are brought into contact with each other with the purpose of transferring ammonia and sulphides from the condensate to air. However, the stripping process is severely affected by pH and temperature fluctuation and requires higher maintenance and power requirements. Ammonia discharged into the atmosphere may be non-compliant with prevailing air quality regulations in some locations, as air pollution problems may result from ammonia and sulfur dioxide reactions. Addition of lime to control pH in the air stripping process may createoperation and maintenance concerns. Further, the loud noise produced by the stripping plant may also be a problem within the industry.

The condensate polishing unit (CPU) is a combination of multiple stages such as pH adjustment, anaerobic-aerobic biological treatment followed by chemical flocculation and filtration to reduce the volatile organic content (COD) in the MEE condensate generated from raw spent wash. However, due to high fluctuation in the condensate properties, this technology has failed to provide a sustainable solutionfor treatment of MEE condensate in many distilleries. Catalysts Biotechnologies R&D Centre has developed simple and unique solutions to overcome the toxicity problems due by ammonia, phenolics, sulphides and volatile acids present in the condensate and hence to improve the recycle ratio of the condensate to fermentation processes. The following section provides a brief introduction of these products and technologies.

1. Spar Treat

This innovative process removes ammonia from the MEE condensate obtained from biomethanated distillery spent wash generated from molasses-based ethanol fermentation industry. In this process, ammonia is reacted with

our unique product combination, so that ammonia precipitates in the form of crystals which can be easily separated from the condensate and used a potential nitrogenous fertilizer, while the treated condensate is suitable for complete and safe recycle to fermentation. The process also amends the condensate water with yeast nutrients at a concentration which is suitable for ethanol fermentation after its dilution with molasses. Therefore, by recycling the condensate treated by SparTreat process increases the fermentation efficiency also.

2. Con Ferm

ConFerm is a series of products formulated using unique oxidizing agents based on trioxide radicals and other nutritional compounds. It has been designed and developed for application in MEE condensate having volatile acids,spent lees and CPU outlet water for improvement of the water recycle ratio for molasses dilution and for higher alcohol yield in the conventional batch process of molasses fermentation. ConFerm recharges the water with molecular oxygen and low concentration of anionic radical ions which helps to control bacterial contamination and increase yeast metabolism during fermentation. The product can be directly mixed with the water to be treated and must be properly dissolved in the water before using it for molasses dilution and fermentation. The typical dosage of ConFerm is 20 - 40 ppm, which can be further optimized according to the water and other parameters.

3. HaloTreat

HaloTreat is a formulation based onhalogenated organic oxidizing agents. It has been designed and developed for treatment of MEE condensate, spent lees and process water for toxic phenolics, sulphides and odor removal. Presence of phenolics in water inhibits yeast growth. HaloTreat undergoes rapid dissociation and association reactions in the water, to release ions which HaloTreat directly acts on phenolic compounds present in water and kills the bacteria present in water. The typical dosage of HaloTreat is 20 - 50 ppm in water, which can be customized according to the process requirement and for better performance. HaloTreat can be directly mixed with the water having phenolics and sulphides upto 25 ppm. The mixed water must be retained for at least 15 to 20 minutes before using it for molasses dilution and fermentation for best outcomes.

4. SulfoTreat

SulfoTreat effectively removes reduced species such as sulphides from wastewater. The unique formula of SulfoTreat undergoes rapid dissociation reactions in the water, to release ions which act as powerful bleaching and disinfecting agents. SulfoTreat also helps to neutralize the pH of alkaline water. SulfoTreat formula can be customized according to the process requirement and for better performance. The product has no negative impact on fermentation and helps to improve the recycling of condensate or any other water having sulphide problem. The product is suitable for treatment of MEE condensate, spent lees, CPU outletwater in molasses-based ethanol distilleries. Dosage values depends on the concentration of sulfides compounds in the water and other parameters such as pH. Typical dosage for MEE condensate ranges between 20 to 100 ppm and the mixed water must be retained for at least 15 to 20 minutes before use.

Enzymes in Brewing

Sh. Bijay Bahadur - GM, Yuksom Brewery

Why and when to use exogenous enzymes in the brewing?

Most of the enzymes which are available on the market are natural products as malt enzymes are. Commercial enzymes are mainly produced by fermentation.

The enzymes are quite simply proteins which have, in addition to their catalytic activity, structures and biochemical properties similar to other commonly known proteins. They are used in many food processes. The quantities used in the production of foodstuffs are always very low and their catalytic activities are inactivated during different successive stages of manufacture. For these reasons, the European Legislation classifies enzymes as processing aids and not as food additives.

The use of exogenous enzymes in brewery must be considered on the basis of some quite precise criteria:

1. **Increase of raw materials extracts yields**
2. **Time saving and thus**
3. **Greater productivity**
4. **Maintenance or improvement of the quality of produced beer**
5. **Adaptation of the manufacturing process**
   - **To produce a new product.**
   - **To the use of new raw materials.**

Enzymes in brewing boost flexibility and performance as well as reduce costs, accelerate production processes and achieve consistently high beer quality while combining profitability with sustainability.

By enabling flexible raw material use and lowering energy consumption, enzymes are a tool for breweries to reach their strategic business goals. Enzymes in brewing offer new opportunities to secure processes that are right the first time, that enable the creation of tasty and inviting brews for beer lovers around the world, all while sourcing raw materials locally and reducing costs.

Enzymes support to optimize products, processes and profits and also help secure right-first-time processes with a variety of raw materials and ensure the most profitable route to high-quality beer.

Throughout the brewing process there are many opportunities to optimize without compromising quality. Enzymes ensure brewing processes are right and ways to utilize the capacity. At the same time, save energy and water – no matter which raw materials are being used.

Enzymes are much more than a process aid and can also become a strategic tool. For example, enzymes make it possible to utilize local raw materials, which can not only reduce input costs but can also support the local economy. Enzymes give you the flexibility to rethink the brewing process, including in regions where alternative local raw materials present tough processing challenges.

Enzymes make it possible to efficiently produce a variety of great-tasting beers and other cereal-based beverages.

What are enzymes?

Enzymes have been used for hundreds of years, and today the use of them is almost without limits - find out what enzymes are and how they work.

Enzymes are the tools of nature

Enzymes cut and paste products such as nutrients. They speed up all vital biological processes. The enzymes in the stomach, for instance, ensure that food is cut into tiny particles that can be converted into energy in the body. Wherever one substance needs to be transformed into another, nature uses enzymes to speed up the process.

Enzymes break down our food

Enzymes are the workhorses of the body. When you eat, enzymes break down the food into tiny particles which can be converted into energy in the body. The process starts in the mouth, where an enzyme called amylase attacks all incoming food particles. Like a well-drilled team of engineers, different enzymes continue to break down the food all the way to the stomach and intestines.

The breakdown of food is an essential part of the conversion of food into energy. Undigested food is unable to pass on the energy stored within it. The enzymes involved in the digestion process carry out the final cutting of the food particles so that they can be easily converted into the essential

energy needed by all parts of our body. Without enzymes you would die from starvation, even sitting in the middle of a restaurant waving your gold card.

Enzymes are the body's own set of tools

Whenever a substance needs to be transformed into another substance, the body uses its own engineers - enzymes. Enzymes can cut biological materials into smaller pieces and paste them together again. They thus break down or build up all life-essential substances within our body.

Enzymes are catalysts. This means that they make biochemical reactions happen faster than they would otherwise. Sometimes the essential reactions would not happen at all without the help of enzymes. Being catalysts also means that enzymes are not part of the final product. They make things happen. When the job is done, enzymes are ready to catalyse a new biochemical reaction.

Every enzyme has a specific function

One of the unique things about enzymes is that they have one function and one function only. Every function or substrate in an organism has its own unique enzyme. The substrate which is to be transformed fits the enzyme like a key in a lock. Only when the right enzyme finds the right substrate can biochemical reactions occur.

The correlation between enzyme and substrate means that you never have to worry about what will happen when enzymes are added to an industrial process. If you are using chemicals as a catalyst, you have to put up with a bundle of side effects because chemicals are non-specific. The chemicals will do their thing to whatever they come across. When an enzyme does the job, there are no side effects. For instance, when enzymes transform starch into sugar, you can be sure that that is all that will happen. No other material or process will be altered or affected.

Enzymes are stable and work in mild conditions

Enzymes are far more stable catalysts than other chemicals or biological molecules. At the same time, enzymes also work at low temperature and moderate pH. This is not the case for most chemicals which perform the same processes. For this reason, enzymes are the environmentally friendly solution to industrial problems.

Enzymes are not living organisms; they are simply biological molecules. They do not therefore live or die. They just keep on working until they are dissolved, usually by other enzymes.

That enzymes are catalysts also means that they do not become part of the final product of the biochemical reaction which they are catalysing. When the biochemical reaction is over, the product of the reaction leaves the enzyme. The enzyme is then ready to affect the same reaction on another molecule again and again. Given the right conditions to function, the enzyme can go on and on for as long as needed.

Enzymes are fully biodegradable

Most industries have production waste. When using chemicals, these present a threat to nature. Enzymes can do the same job cheaper and do not threaten the environment. Enzymes are a part of nature and are therefore fully biodegradable. When industrial enzymes have done their job, they leave the production plant with the waste water. The retired enzymes do not last long in the surrounding environment; nature has many microorganisms which easily break down enzymes into single amino acids, which are used to build up life around us. The fact that there are no hazardous waste products makes industrial enzymes the most environmentally friendly solution to most industrial problems.

Proteins are the building blocks of our body

Every part of the human body is built of proteins. Even the largest muscle or the smallest hormone, nerve fibre or enzyme is made up of small protein molecules.

Proteins hence constitute about 80% of the dry weight of muscle, 70% of the dry weight of skin and 90% of the dry weight of blood.

Proteins are the building blocks of all living organisms. Humans, animals, plants and microorganisms are all made up of proteins. In the body, proteins are vital to many cell functions: by way of example, they are responsible for transporting all molecules into and out of cells.

Enzymes are proteins

There are many different kinds of protein, which can basically be split into two groups. The first group covers the structural proteins, which are the main constituents of our bodies. Well-known structural proteins are collagen, which is the protein of bones, tendons and ligaments, and keratin, the protein of nails, hair and feathers.

The second large group of proteins covers the biologically active proteins. Most of these catalyse biochemical reactions in cells. These are enzymes, the heart of Novozymes' business.

All known enzymes are proteins and can occur in the body in very small amounts. All the same, enzymes catalyse all processes in the body, enabling organisms to build up chemical substances such as other proteins, carbohydrates or fats that are necessary for life. In short, all enzymes are proteins, but not all proteins are enzymes. If a protein can catalyse a biochemical reaction, it is an enzyme.

Enzymes consist of long strings of amino acids

Like all other proteins, enzymes are made of amino acids. Each enzyme is made of between a hundred and upwards of a million amino acids placed like pearls on a string. Each amino acid is bonded to the next by chemical bonds. The vast majority of enzymes are made of only 20 different kinds of amino acid. The structure and function of the enzyme is determined by the order of the amino acids. No two enzymes are alike. Each enzyme has its own unique sequence of amino acids, which is determined by the genes in the cells.

Enzymes have a three-dimensional structure

Enzymes consist of millions of amino acids placed one after the other like pearls on a long string. Most enzymes, however, do not look like a long string of amino acids. In most enzymes the string is coiled and folded thousands of times to form a highly complex three-dimensional structure. It is the chemical interactions between the amino acids that force the enzymes into their three-dimensional structure, which is held together by the many different links between the different amino acids.

The arrangement of amino acids determines the enzyme's function

Each enzyme has its own unique three-dimensional structure that determines the function of the enzyme. The three-dimensional structure of enzymes is determined by the order of the amino acids in the coiled string. Even slight changes in the sequence of the amino acids on the string have a huge impact on the structure of the protein. With just one or perhaps a few amino acids replaced or switched, an enzyme may not only look different, but also act different. With only a slight change in the sequence of the amino acids, an enzyme may be converted into working on other biological molecules or treating them differently.

Enzymes have active sites

Enzymes are large molecules with hundreds of amino acids. Only a small part of the enzyme participates in the catalysis of biochemical reactions: this is called the active site. The three-dimensional structure of the enzyme determines the appearance of the active site. The active site accommodates the shape of the biological substrate that requires transformation. They fit like a key in a lock. This is what makes enzymes specific in their actions. Only substances of the right shape will be transformed.

Conclusion

The purpose of this article is to support brewing process to improve wort quality to improving the production economy, process control or beer quality.

It is belief that quality output requires quality inputs. In line with globalization and the trend, the demand for enzymes is steadily growing to meet the needs of the brewing industry.

INDIA PALE ALE

Akshat Jain, Business Development

The story of India pale ale (IPA) is one of the most romantic in the history of beer. At the height of its empire, Britain had emigrants, sailors and troops all around the world—with India being one of its most important outposts. All demanded beer, but India itself was too warm for brewing. To meet that need, London brewers who supplied ale learned through experience that the voyage to India could be tough on perishable beers. George Hodgson, a London brewer in the late 1700s, used his connections to the East India Co. to dominate the export market to the colony. Among other beers, Hodgson exported a strong pale ale. It was probably brewed with extra additions of hops and at higher alcohol levels, both of which act as preservatives. The long voyage transformed the beer into a wonderful drink.

But Hodgson overreached, and that opened the door to the brewers of Burton-on-Trent, in the English Midlands. The pale ale coming from the Trent valley tasted far better than London brews, because its hard water produced a brighter ale—one with a pleasant and refreshing hop character.

Burton brewmaster Samuel Allsop succeeded in brewing one of exceptional quality. It displaced the London beers to become the preferred export to the English colonies. This came to be called India pale ale, or IPA.

Crossing the Atlantic

Throughout the latter half of the 19th century, fashionable continental pale lagers chipped away at pale ale's rightful place in English pubs. This phenomenon was even more pronounced abroad. Britain exported ales to the United States, following the original wave of immigrants. But, as

in Europe, lagers took over, and ale production dwindled. Then Prohibition essentially wiped out ale brewing in the United States.

But IPAs were about to enter their second chapter. As microbreweries cropped up in the 1970s, long-forgotten ale styles began to reappear. The use of American ingredients, especially hops, were an eye-opener to those who tasted these beers for the first time.

New Albion Brewing in Sonoma, CA, was one of the first to venture into this frontier. Though they lasted only a few years, they helped sow the seeds of the American craft brewing revolution.

San Francisco's Anchor Brewery was rescued from closure in the 1960s. In 1975, it released what is now known as Liberty Ale, originally calling it "Our Special Ale." An instant classic, it was made with American ingredients and qualifies as the first modern American IPA.

Over the next decade or so, IPAs grew in popularity until they became the best-selling craft style. Nearly every brewery made one. After years of drinking bland lagers, it seemed that American beer lovers could not get enough hops. The enthusiasm for aromatic, strong IPAs rolled unfettered through the 1980s and into the '90s.

Over time, as palates acclimated, and brewers looked for something new, a natural progression happened. Brewers started demonstrating their skill with bigger and bigger beers, fortified with massive doses of hops. There was little reason to hold back, as America had lost its brewing personality 50 years earlier and was essentially reinventing itself. There were no guidelines to follow and no traditionalists to answer to. The brewers themselves were making (and breaking) the rules, restrained only by the limits of their own creativity.

IPA was a natural target for that take-no-prisoners attitude. Soon enough, hops won the battle for supremacy. The United States, primarily in the Pacific Northwest, grows a greater variety of hops than anywhere else. American hops run the gamut from soft and citrusy, to rough and resiny and even fruity. In proper combination, they can produce an IPA with an unimaginable hop profile.

Eventually, the biggest of these new IPAs grew so strong and hoppy that there were questions about whether they were IPAs at all. And so a new beer style was born: the double or imperial IPA. This brash new style symbolizes the rambunctious, independent nature of American microbrewers. It's even spawned a movement of its own, with the "imperialization" of other styles becoming more common. As traditional as it, the world of beer never stands still.

http://allaboutbeer.com/beer_style/india-pale-ale/
All about Beer.com

Alcohol

(If you choose to drink, keep it moderate)

Joole Chauhan, Research & Development

It sounds like a mixed message: Drinking alcohol may offer some health benefits, especially for your heart. On the other hand, too much alcohol may increase your risk of health problems and damage your heart.

When it comes to alcohol, the key is moderation. Certainly, you don't have to drink any alcohol, and if you currently don't drink, don't start drinking for the possible health benefits. In some cases, it's safest to avoid alcohol entirely — the possible benefits don't outweigh the risks.

Here's a closer look at the connection between alcohol and your health.

Possible health benefits of moderate alcohol use

Moderate alcohol consumption may provide some health benefits, such as:

- Reduce your risk of developing and dying from heart disease
- Possibly reduce your risk of ischemic stroke (when the arteries to your brain become narrowed or blocked, causing severely reduced blood flow)
- Possibly reduce your risk of diabetes Even so, the evidence about the health benefits of alcohol isn't certain, and alcohol may not benefit everyone who drinks.

Guidelines for moderate alcohol use

Moderate alcohol use for healthy adults means up to one drink a day for women of all ages and men older than age 65, and up to two drinks a day for men age 65 and younger.

Examples of one drink include:

- Beer: 12 fluid ounces (355 millilitres)
- Wine: 5 fluid ounces (148 millilitres)
- Distilled spirits (80 proof): 1.5 fluid ounces (44 millilitres)

Moderate alcohol use may be of most benefit if you have existing risk factors for heart disease. However, you can take other steps to improve your heart health besides drinking — eating a healthy diet and exercising, for example, which have more robust research behind them. Keep in mind that even moderate use isn't risk-free. For example, drinking and driving is never a good idea.

When to avoid alcohol use

In certain situations, the risks of alcohol may outweigh the possible health benefits. For example, talk to your doctor about alcohol use if:

- You're pregnant or trying to become pregnant
- You've been diagnosed with alcoholism or alcohol abuse, or you have a strong family history of alcoholism
- You have liver or pancreatic disease
- You have heart failure or you've been told you have a weak heart
- You take prescription or over-the-counter medications that can interact with alcohol
- You've had a hemorrhagic stroke (when a blood vessel in your brain leaks or ruptures)

The risks of heavy alcohol use

Heavy drinking is defined as more than three drinks on any day or more than seven drinks a week for women and for men older than age 65, and more than four drinks on any day or more than 14 drinks a week for men age 65 and younger.

Binge drinking is defined as four or more drinks within two hours for women and five or more drinks within two hours for men.

While moderate alcohol use may offer some health benefits, heavy drinking - including binge drinking- has no health benefits. Excessive drinking can increase your risk of serious health problems, including:

- Certain cancers, including breast cancer and cancers of the mouth, throat and esophagus
- Pancreatitis
- Heart muscle damage (alcoholic cardiomyopathy) leading to heart failure
- Stroke
- High blood pressure
- Liver disease
- Suicide
- Accidental serious injury or death
- Brain damage and other problems in an unborn child
- Alcohol withdrawal syndrome
- Sudden death if you already have cardiovascular disease

Drink alcohol only in moderation - or not at all

The latest dietary guidelines make it clear that no one should begin drinking or drink more frequently on the basis of potential health benefits. So don't feel pressured to drink alcohol. However, if you do drink alcohol and you're healthy, there's probably no need to stop as long as you drink responsibly and in moderation.

In moderation, alcohol can actually offer up some notable health benefits You've heard over & over just how much of a downer drinking alcohol can be for your health, weight loss, and attitude. But

some studies have also shown that boozing on occasion has some perks. And we agree—as you keep your imbibing under control and sipping in moderation.

Category 1: Wine

"Red wine, you make be feel so fine." Turns out a bottle of red can help with heart disease, immunity, and more.

Red Wine Can Actually Burn Fat

It's true: A glass of red could help you with your weight loss efforts. A study from Oregon State University revealed that the dark red grapes found in some types of red wine can help people manage obesity and a metabolic fatty liver, due to a chemical called ellagic acid. This chemical slows down the growth of fat cells and stops new ones from being created, which boosts the metabolism of fatty acids in liver cells.

Alcohol Can Help Fight Colds

We're not giving the okay to drink *during* a cold, but getting in the habit of drinking moderately can help prevent one. Two past studies found that the antioxidants in red wine can help you reduce your risk of a cold by a shocking 60 percent.

Red Wine is Beneficial to Your Heart

Previous research has proved that wine is great for heart health, but a recent study that compared pinot noir to vodka found that red wins. Researchers fed vodka and wine to two out of three groups of pigs along with a high fat diet for seven weeks. And while both groups that had vodka and wine both saw cardiovascular benefits, pinot noir's antioxidants, high resveratrol content, and pro-angiogenic and anti-inflammatory properties made the alcoholic beverage the winner in this study.

Red Wine Can Boost Your Memory:

Ever notice how wine nights with your friends always end with a trip down memory lane? Well, this study could shed some light on that scenario. A 2015 study done by Texas A&M University found resveratrol, a compound found in the skin of red grapes, can improve memory and cognitive function in rats.

Beer Helps Protect the Brain

Cheers for beer! In 2015, the *Journal of Agricultural and Food Chemistry* reported that a compound found in beer called xanthohumol could protect brain cells from damaging, thus slowing down the progression of Alzheimer's and Parkinson's Disease.

Beer Can Strengthen Your Bones

Beer's high source of silicon content is what's responsible for an increase in bone density, according to a recent study. Moderate beer drinkers who consume 1-2 glasses a day are more likely to have that effect, but surprisingly, its women who reap the most benefits. The study reported that women who had two drinks per day saw their bone density increase up to 8.3 percent! Now, that's a great excuse to hit the bar after work.

Beer Lowers Heart Attack Risks in Women

The accolades for the cold brew just keep on comin'. A Swedish study that was 32 years in the making confirmed that women who drink 1-2 brew skis per week have a 30 percent lower risk of a heart attack than those who drank heavily or none at all.

Beer Helps Your Kidneys

A study from the *Clinical Journal of American Society of Nephrology* found that a bottle of beer can help you reduce the risk of kidney stones by 30 percent according to a study from Finland.

Category 3: Liquor and Other Spirits

If you're one who prefers the harder stuff, then you're in luck! While gin, tequila, and other spirits are known to be stronger in alcohol, sipping on these liquors can help with weight loss, diseases, and even a sore throat.

Like Wine, Vodka Is Also Heart-Friendly

As mentioned before, vodka can improve blood circulation, but the study above mentions that it helps the heart differently from vino. Vodka helps more collateral vessels to develop, which helps connect the heart to the lungs.

Tequila Can Help You Lose Weight

Sounds crazy, but we have the science to prove it. Research suggests that the agavins (natural sugar) found in this Mexican liquor are better than artificial sweeteners at helping you shed the

pounds. After scientists had given a group of mice agavins into their water, they reported that the mice had lower glucose levels and were fuller longer.

Cranberry and Vodka Can Boost Your Creativity

Next time you're stumped at a project, grab a cocktail. Cranberry and vodka can help get your creative juices flowing according to a study from *Consciousness and Cognition*. Researchers gave a group of men cranberry and vodka until their blood alcohol content reached 0.75 percent while the other group stayed sober and then asked them to complete a verbal puzzle while watching a movie. The men who boozed won the game! They solved the puzzle in 11.5 seconds while the teetotalers finished in 15.2 seconds.

Alcohol Can Soothe Sore Muscles

Whether your choice of beverage is wine or bourbon, it can help soothe your muscles, according to a study published in the *International Journal of Kinesiology & Sports Science*. The study had male participants go through two rounds of exercise and then consume a small amount of an alcoholic beverage or placebo beverage. The results concluded that those who drank the booze reported less muscle soreness after recovery than those who consumed a placebo.

Whisky Can Help a Sore Throat

While wine can reportedly help prevent a cold, this quick fix might help if one still strikes you down. Mix whisky with warm water and honey, and you'll find temporary relief to a sore throat.

Why A Fruit Diet is Good For You & the Planet

our psychological situation can be influenced by what we eat. Medical science is talking about how a fruit diet promotes psychological wellness. Is there any significance to this? And is a predominantly fruit diet okay for people in regular situations involving work, family or lots of physical activity?

In any machine, with any kind of fuel that we use, the efficacy of the fuel essentially depends on how easily it burns. For example, the kind of gasoline you use for a regular automobile is different from what you use in a race car or an airplane because of how easily it burns. You might have seen the octane levels in gas stations – eighty-seven, eighty-nine, ninety, ninety-one, ninety-three, ninety-six. When we were riding motorcycles, we would pay three times and buy hundred octane because suddenly the motorcycle performs in a way that others cannot.

Fruit Diets Are Easy on Digestion

Similarly, the most easily digestible food is fruit. Digestion means jataragni – the digestive fires. If these fires have to burn most effectively, fruit is definitely the best thing. Unfortunately, a lot of people enjoy lethargy and inertia. Life has not touched them so they enjoy a part of them being dead. Sleep, intoxication, overeating and just lying down feels better than being alive, active and dynamic. Fruit may be a problem only for s still be normal?

such a person because it will keep you alert and awake. It does not keep you intoxicated, unless it ferments of course! And one can know an extreme sense of joy, intoxication and a deep pleasure out of heightened levels of awareness also. But now the question is, can I eat fruit and still be normal?

A simple answer is in your general practice of life itself. Suppose you are ill in a hospital bed, no one will bring you chicken biryani. They will bring fruits because your friends and relatives understand, "You got sick eating all that. At least now, eat sensibly."

You know, even Adam started with a fruit. Fruit is one aspect that nature itself intends to be food. The seed is the important part of the mango. The flesh is only a draw, a lure so that animals and birds will go for it and carry the seed somewhere far away.

Seasonally, there are a variety of fruits. It is incredible that those kinds of fruits which the land produces at a certain time are most suitable for the system. There has been a lot of study about this – how for those seasons when it is cold, when it is hot, when the moisture is very high, then the

right kind of fruit comes out of the earth if you are eating from that area. But now you are eating fruit that comes from New Zealand. This is another matter. If you are eating from the land around you, you will see that the right kind of fruit is coming to you at the right season. It is the best thing to eat at that time.

Precautions When You Go On a Fruit Diet

Fruit can do miraculous things to the body. One can become very alive and active, no matter what your lifestyle is. But if you are in a very physically-demanding kind of job – for example, if you are digging outside every day, not with a machine but physically, and doing very hard work – then you may find yourself getting hungry every two hours. There is only that much volume of fruit you can eat, but it gets digested so rapidly that your stomach may feel empty.

Whether you want to use your brainpower or be engaged in physical activity, fruit will work perfectly well.

If you go on a total fruit diet, you may have to spend a little more time at lunch and eat slowly, so that you ingest enough fruit. You may feel full even with a little fruit because it is generally sweet, so you have to wait and slowly eat. There is also a bio-clock within us. Let us say you were taking ten to twelve minutes to eat your normal cooked meal. Even if you eat fruit, when you reach ten to twelve minutes, your body will say you have eaten enough. So you have to consciously eat more because the body is not looking at the fill, it is just timing you.

If you are only on fruit diet and physically very active, you may need to bring three meals into your day. If you are sleeping six or eight hours, for the remaining sixteen to eighteen hours, eating three times is more than enough if you are eating fruit. But the stomach will feel empty within two hours, so you must get used to hanging on with high energy but an empty stomach. This is the time your brain works best and you as a human being function best.

Whether you want to use your brainpower or be engaged in physical activity, fruit will work perfectly well. But you do not know what the fruit that you get in the market today is filled with. That is a little bit of a problem. I clearly notice this: the kind of country fruits that we used to eat when we were young are not the same as the farm-grown fruits that are coming to us today. They are much bigger, rounder and better-looking, but this is like Botox!

I can clearly feel it does not have the same level of strength and aliveness in it. These fruits are essentially made for the market, not for the man. This does not mean that they are totally a waste, but they do not have the same nutrient that they used to have, so we may have to fortify it with some amount of other food.

A Fruit Diet is Good for the Planet

Above all, it is ecologically a very sensible way to eat. Everyone should turn at least thirty percent fruity – that is, at least thirty percent of your diet should become fruit. If thirty percent of your food comes from trees, not from ploughed land and crop, ecologically it will make a huge difference for the world.

If you are trying to shift from heavy meat eating to fruit, then you may find it is like you have eaten nothing because you are used to being pulled down to the earth by eating very heavy food. You will anyway be pulled down to the earth when you die. But right now, we call it life when we spring out as if we do not belong to the earth. Even the bird that soars is made of earth, but when it is soaring up there it does not look like earth. Every life, when it springs out, it should not look like earth, though we are of the earth.

If we want to spring up, the fuel that we consume must be that which burns quickly and is very easily flammable. That is the best food. In our stomach, without doubt, fruit is what burns up quickest. This means it has the least amount of residue and puts the least amount of tax and stress on the system.

That's CATALYSTS is all About

A family full of life, A family filled in light,
A nurturing ground, Always ready to profound
An Aspiring Mind, An aspiring Soul, A beautiful heart, That too of Gold That's what one can find here, That's Catalysts is all about dear

Two Awesome souls, One setting the target, other clearing the field One Motivating towards the target other being the feed Both are the guardian angels of this small world and the primary essence to this Gold
That's what one can find here, That's Catalysts is all about dear

It started as a Seed, Germinated to be a Tree,
This tree is expanding its branches And, following its motto of reaching at the highest

Blue is the color of Sky & Sea Signifying the Openness and the Sensitivity, So is blue color of this seed Nurturing the Imagination and Faithfulness in its Team

This seed has grown so far Outshining in the path of its ambition, Today it has sown 100Cr. more seeds Oh My God that's its first goal's succeed

Employees are its strength Deputed at its length
Relations are all grown And is forever sown

All are equal here All are balanced
No disparity No Unevenness

One will always feel privileged to be its part
As it takes care of you as its heart
So, is what I felt here
Thanks a ton for that lift dear

-Florencia Joseph
HR Dept.

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Women's Day Celebration






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Yoga Day Celebration

Name : Mr. Arun Kumar
Department : Sr. Associate – C.S
Date of Joining : 12th March 2018

Name : Mr. Kuldeep Joshi
Department : Sr. Associate–Supply Chain
Date of Joining : 21st March 2018

Name : Mr. Abhijeet Sudhir Kohok
Department : Sr. Associate – C.S
Date of Joining : 19th March 2018

WHO WE ARE

Catalysts was established in 2003. Having its corporate office in Delhi & R&D Centrethe 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 9001:2008, FSSC 22000 and Halal

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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