

March / April 2007

ENZYME WORLD



ECOFRIENDLY
SOLUTIONS
TO EVERY
INDUSTRY



In Technical collaboration with



Specially Enzymes and Biochemicals Co.

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ADVANCED
ENZYME TECHNOLOGIES LTD

Where ENZYME is Life



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THE EDITORIAL *Team*

The Enzyme World Team

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For your valued
inputs/feedback/queries/news,
We will be glad to assist you,
on
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ADVANCED
ENZYME TECHNOLOGIES LTD
Where ENZYME is Life

FROM THE DESK OF THE MANAGING DIRECTOR

Dear Friends,

JAI GURUDEV

Bio-ethanol is a major agenda world over. In recent meeting of Mexican and American Presidents this was main Agenda.

India has been dependant on imported oil for it's power needs. Sugar cane is one of the key important Agro output and almost 2.3 million MT of Mollasses is being produced annually. Current alcohol yields are between 220 to 260 ltrs per MT of mollasses. Using our new technology, every plant can reach upto 290 to 300 ltr per ton with no added investment! With bare 30 ltr per MT extra my company can help to generate over 70 million MT of alcohol worth over Rs. 1,400,000 million. **AETL** is actively also working on bio-ethanol from cellulosic waste.

Garment washing and particularly Denim washing involves almost 6 wash cycles and consumes lot of water, energy and time. Our scientists have developed single bath desizer and worn out fashionable look using multi-enzyme system.

Over 80 percent people suffer with 'gassing" due to present day fast food. HemSeb is great side-effect free solution.

My team of dedicated scientists are working relentlessly on helping the.Humanity with great solutions.

Several international companies applauded our this effort of education and requested me to make Enzyme World a true international bi-monthly. From next issue, we will be attempting to accomodate this request and hence there shall be several changes.

Enzyme World is your own bi-monthly. You are invited to contribute in every possible fashion.

Best regards and JAI GURUDEV

Chandrakant Rathi





MOLSEB & M-BOOST

(Molasses Alcohol Yield Enhancer)

INTRODUCTION:

Molasses based distilleries are present in abundance in India as well as several other countries. These distilleries use either compressed yeast or culture yeast to ferment molasses into alcohol.

Theoretically, 100 kg of glucose, upon fermentation, should give 51.11 kg of ethanol and 48.89 kg of carbon dioxide. However, it is virtually impossible to obtain more than 95% of the maximum yield. This holds true in the case of molasses, which has a maximum possible fermentation efficiency of 90% and maximum distillation efficiency is 95% to 98%. The reality is that these levels are rarely achieved. The variation in distillation efficiency depends on various factors including molasses quality, conditions and time of storage, the type of mill and quality of fermentation facilities.

A change in the quality of molasses can directly affect the yield of alcohol. This is considered a major problem in Molasses based distilleries since even a small decrease in alcohol yield results in a very large difference in the material to cost ratio.

Advanced Enzyme Technologies' R&D department



has conducted extensive research aimed at improving alcohol yield in molasses based distilleries. As a result, Advanced Enzyme Technologies Ltd is proud to announce the launch of a unique proprietary combination of **MOLSEB** and **M-BOOST**. The combination works synergistically to provide a maximum yield of alcohol consistently, even from different sources of molasses. This powerful combination can increase alcohol production by 15-40% per ton of molasses.

Yeast cells and their actions:

Yeast cells used in distillation are designed to provide uniform, rapid fermentation with maximum alcohol yields under a wide range of temperatures and pH conditions. The time required for fermentation varies with temperature, though typically it takes 48 to 72 hours at room temperature (26 to 28°C).

The Yield of alcohol is affected by many different factors. Variables that affect production efficiency include molasses quality, length and conditions of storage for molasses and the quality of the facilities in mills. Very important as well is the stress on yeast cells. Nonmicrobial stresses include



Stresses on Yeast



Non-Microbial Factors
Sugar Content, Sulfate, Temperature, Sodium, CIP Chemicals

Nutritional Factors
Lack of : Sterols, Nitrogen, Oxygen, UFA, Minerals/Vitamins

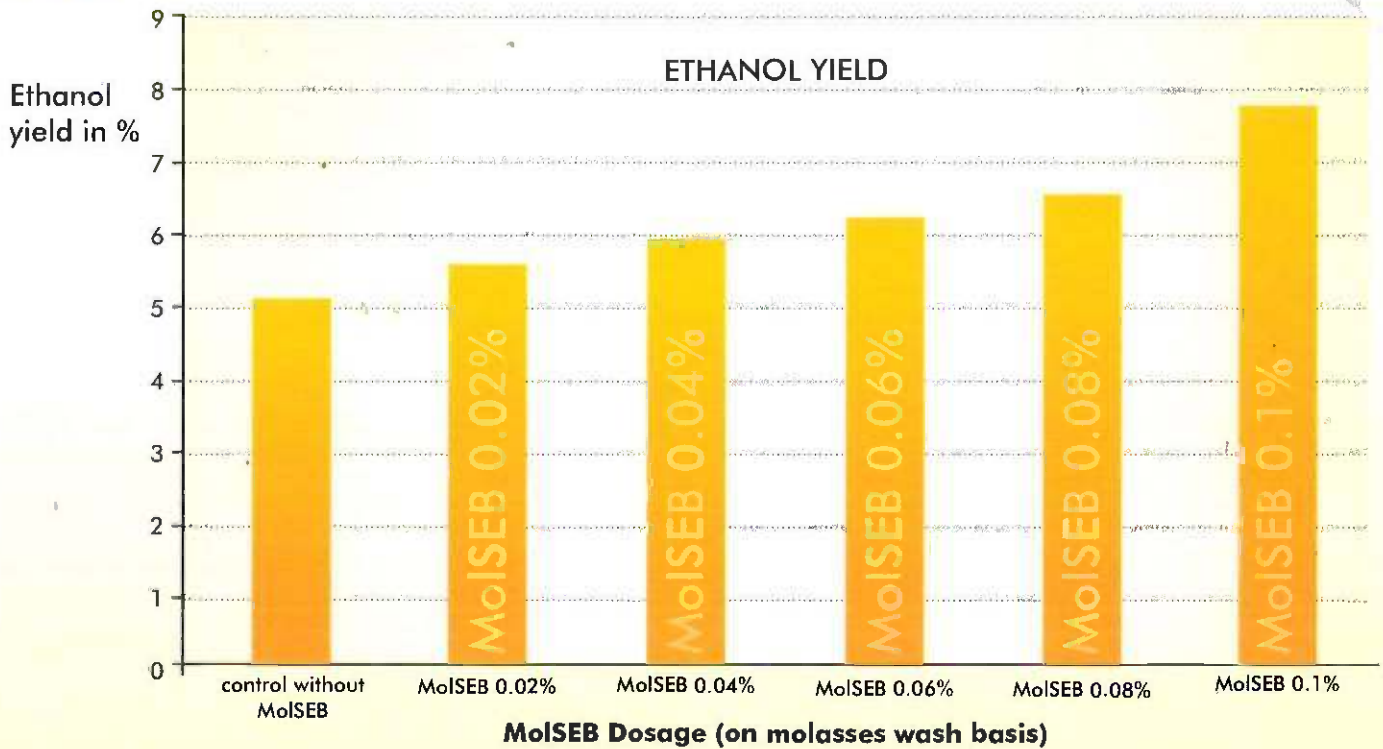
Microbial Factors
Chemical : Acetic Acid, Ethanol, Lactic Acid, pH, Mycotoxins Competition Nutrient Depletion

factors like sugar content, sulfites, temperature, sodium and CIP chemicals. Microbial stresses from acetic acid, and lactic acid producing bacteria significantly reduce pH and in turn ethanol production. Mycotoxins from various wild fungi can also reduce production. Nutritional stresses may include a lack of sterols, nitrogen, oxygen, UFA's, minerals and vitamins.



APPLICATION PROCESS :

| Process | Normal and conventional method | MOLSEB AND MOLSEB BOOSTER technology |
|--|--|--|
| Initial start up process in pre fermentor: | <p>Initial start up process is carried out in pre-fermenter where initial Yeast growth takes place.</p> <p>The pre-fermenter contains about 40,000 ltrs wash of 12.5 Brix (specific gravity 1.089-1.09). Compressed yeast and urea are then added.</p> <p>The batch is kept for fermentation until viscosity falls to 10.5 brix. It generally takes 12 hours for the batch to fall from 12.5 brix to 10.5 brix.</p> | <p>Initial start up process is carried out in pre-fermenter where initial Yeast growth takes place. The pre-fermenter contains about 40000 ltrs of wash at 12.5 Brix (specific gravity 1.089-1.09). Compressed yeast and 10 ppm of MOLSEB BOOSTER are then added. After 5 to 6 hrs of fermentation, add 0.04% MOLSEB (on molasses wash basis). The batch is kept for fermentation until viscosity falls to 10.5 brix. It generally takes 12 hours for batch to fall from 12.5 brix to 10.5 brix.</p> |
| Feeding (Loading) | <p>Once 10.5 brix is achieved, the fermenter is loaded with another 140,000 ltrs of wash of 24 Brix. It takes approx two hours for this loading. The batch is then kept until it reaches 7.5 brix. Foaming takes place at this stage and temperature rises to about 35oc. It takes about 24 hours for the batch to go from 24 Brix to 7.5 brix. After it reaches 7.5 brix, there is generally no yeast activity seen in the fermenter and the fermenter is now ready for distillation.</p> | <p>Once 10.5 brix is achieved, the fermenter is loaded with another 140,000 ltrs of wash of 24 Brix. Another dose of 0.05% MOLSEB (on molasses wash basis) is added. It takes approx two hours for this loading. The batch is then kept until it reaches 7.5 brix. Foaming takes place at this stage and temperature rises to about 35oc. It takes about 19 to 21 hours for the batch to go from 24 Brix to 7.5 brix. With the addition of MOLSEB and M-BOOST there is a reduction of 2 to 3 hr in fermentation time. Yeast activity has ceased and the fermenter is now ready for distillation.</p> |



sanitation and a clean-in-place strategy. Identifying yeasts can be difficult because they are all eukaryotes (organisms with nucleated cells). Morphology, carbohydrate profile, and DNA analysis are expensive techniques, but the only way to accurately identify species.

Advanced Enzyme Technologies Ltd has developed an extraordinary combination called **MOLSEB** and **M-BOOST** that work in synergy to provide an increase in alcohol yield with a reduction in fermentation time.

Distillation:

The fermented wash is now fractionally distilled. Generally a four-column distillation takes place producing three distillates as follows:

- 1) Rectified Spirit (R.S.)
- 2) Impure Spirit (Low Volatile Components like aldehyde, methanol, etc.)
- 3) Fusel oils (High Boiling components like 1 propanol, butanol, furfural, etc.)

ETHANOL GRADING

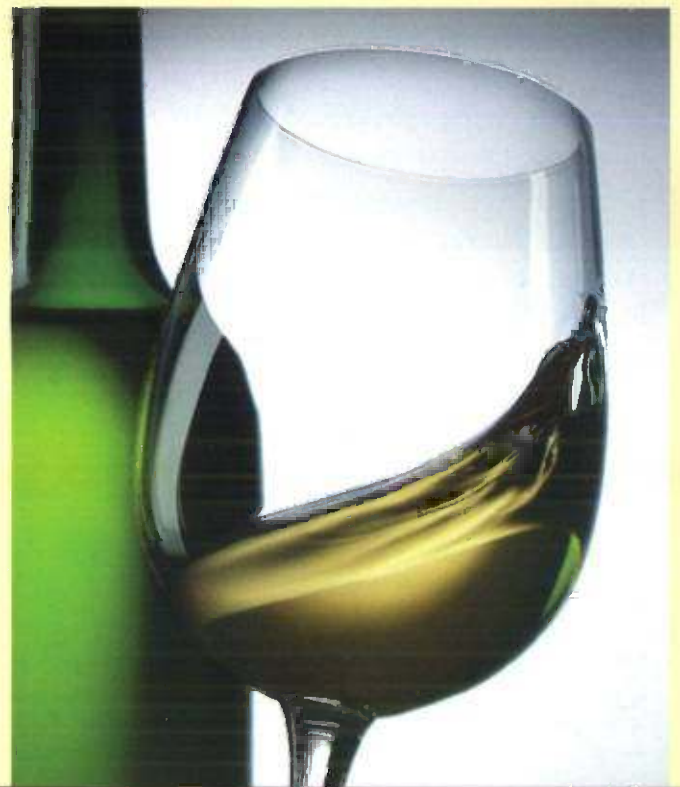
Value-Added Advantages with **MOLSEB** and **M-BOOST**:

- 1) Extra yield of at least 20 liters per ton of

- molasses is easily possible
- 2) Fermentation time reduced 3 to 4 hrs.
- 3) Technology is easily adapted to an existing system.
- 4) No extra labor required.

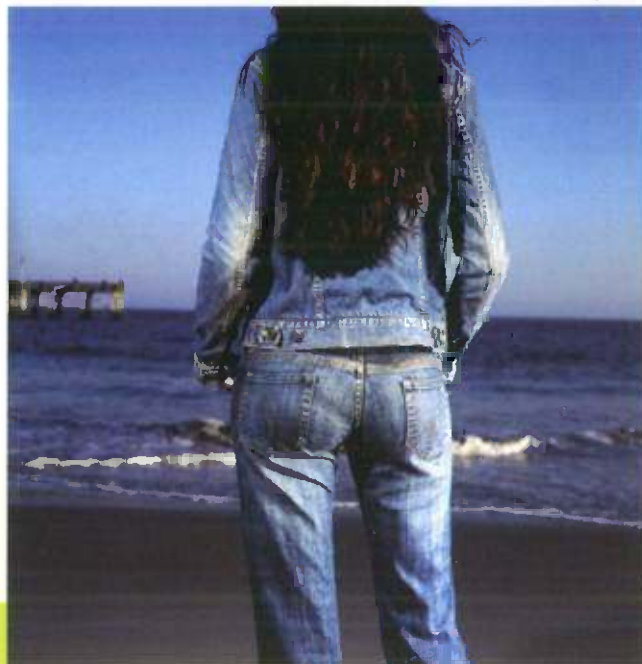
-Saylee Pradhan

Head of Non-pharma Research



FADEX HB 2M

ONE STEP DESIZING AND DENIM STONEWASHING



During the weaving of cotton textiles, the threads are exposed to considerable mechanical strain. Prior to weaving on mechanical looms, warp yarns are often coated with size starch, starch derivatives or CMC / PVA / PAA in order to increase their tensile strength and prevent breaking. Cotton wax and other lubricants can be applied to yarns in order to increase the speed of cotton weaving. Today, waxes of higher melting points are being introduced to further enhance production efficiency. Wax lubricants are predominantly triglyceride ester based lubricants.

Conventional Process:

In general, after textiles are woven, the fabric proceeds to a desizing stage, followed by one or more additional fabric processing steps. Desizing is the act of removing size starch from textiles and is the heart of textile processing. After weaving, the size coating must be removed before further processing of the fabric. This ensures a homogeneous and wash-proof result. The preferred method of desizing is enzymatic hydrolysis of the size coating by the action of enzymes. In general, processing temperatures range from 45 to 90°C with a pH of 6 to 8. Depending on the type of desizing enzyme used, the processing time normally ranges from 20 minutes to one hour.

For the manufacture of denim clothes, the fabric is cut and sewn into garments and finished afterwards. Different enzymatic finishing methods have been developed especially for denim garment manufacturing. Finishing denim garments normally begins with an enzymatic desizing step, during which garments are subjected to the action of enzymes in order to remove sizing components. Done properly, this step softens the fabric making the cotton more accessible to subsequent enzymatic finishing steps. However, after most desizing procedures, the wax typically remains or is redeposits on the fabric. As a result, the fabric darkens, has glossy spots and becomes stiff. A quality enzyme based desizing product should remove these waxy components completely.

After desizing, denim garments are subjected to various finishes using a variety of methods. For many years, denim jeans manufacturers have washed their garments in a finishing laundry with pumice stones to achieve a soft-hand as well as a desirable and fashionable "stone-washed" look. This abrasion effect is obtained by locally removing the surface-bound dyestuff. More recently, cellulase enzymes have been introduced into the finishing process, turning the stonewashing process into a "bio-stoning process". The goal of a bio-stoning process is to



obtain a distinct, but homogeneous abrasion of the garments (stone-washing appearance). Bio-stoning is done at pH 5 to 7 and a temperature range of 35 to 60°C, with processing time varying from 30 minutes to two hours depending on process suitability and effects desired. However, uneven stonewashing ("streaks" and "creases") occurs frequently. As a consequence, repair work ("after-painting") is needed on a major portion (up to about 80%) of the stonewashed jeans that have been processed in laundries. Split stage finishing requires high water consumption, increased processing time, less production and at times uneven results with streak marks.

FADEX HB 2M Process:

Advanced Enzyme Technologies Ltd has developed both the product and process that overcomes all



these challenges. **FADEX HB 2M** provides an excellent one-step process for enzymatically desizing and stonewashing dyed denim. The process requires washing denim garments in only ONE BATH, saving water, time and energy. The end result is a finish equal or better than any current method available. The ingredients in **FADEX HB 2M** include amylase and a SPECIAL streak-reducing cellulase.

The **FADEX HB 2M** process may be carried out in the presence of conventional textile finishing agents, including wetting agents, polymeric agents, dispersing agents, etc. Conventional wetting agents may be used to improve the contact between the substrate and the enzymes used in the process. The dispersing agent may suitably be selected from nonionic, anionic, cationic, ampholytic or zwitterionic surfactants.

Conventional finishing agents that may be used in the process include, but are not limited to, pumice stones and perlite. Perlite is a naturally occurring volcanic rock. Preferably, heat expanded perlite may be used. Heat expanded perlite may be present in an amount of 20-95 w/w % based on the total weight of the composition.



Example:

The following example illustrates the effect of adding **FADEX HB 2M** with its streak-reducing Cellulase for a one-step desizing-abrasion process. **FADEX HB 2M** will reduce the number of streaks on denim jeans or other denim garments resulting in a uniformly localized color variation. It does this with a reduction in process time and reduced water consumption.

Laboratory scale wash trials were carried out with **FADEX HB 2M** and the conventional process of two-stage desizing and cellulase treatment. **FADEX HB 2M** was treated under the following conditions:

Denim: 14.5 Oz Arvind Denim, 10 legs of approx 100gms each

Product : **FADEX HB 2M**

Trial A : Comparison of **FADEX HB 2M**

Trial B : Conventional Two-Stage Process

MLR : 1:10, Dose: 2 gpl, Time 60 90 Min

Washing was carried out in rotary drum washer of 5 Kg capacity.

Drying : The samples were dried in IFB tumble-dryer.

Evaluation:

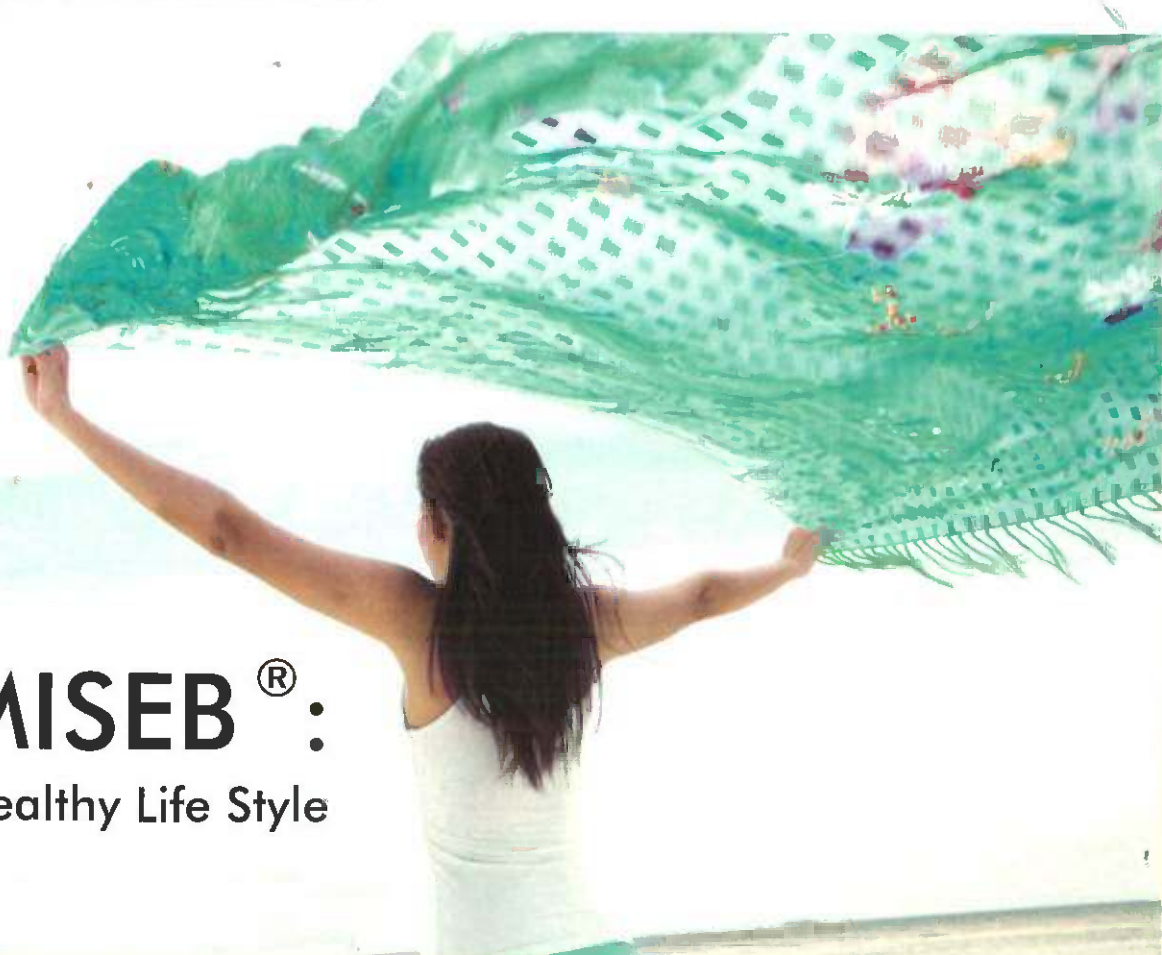
5 persons skilled in the art of evaluating denim were asked to grade the denim legs (two legs from each trial, leg "1" and "3" from Trial B of split process, leg "2" and "4" from Trial A of **FADEX HB 2M**). It was found that the results of **FADEX HB 2M** were comparable of better over the split process. No issues / problems of streak marks were observed. Moreover, the **FADEX HB 2M** process showed considerable water and time saving. The development of **AETL's FADEX HB 2M** has lead to an economical process that is far more advantageous in today's environment where water and power are in short supply. More innovative products are under development at **AETL** with a goal of providing **COST SAVING, ECOFRIENDLY** solutions to business.

-Mr. Dipak Roda

GM Marketing



Most successful men have not achieved their distinction by having some new talent or opportunity presented to them. They have developed the opportunity that was at hand.



HEMISEB[®] :

Key to Healthy Life Style

Healthy living begins with a balanced diet and healthy digestion. Unfortunately, our modern lifestyle tends to promote unhealthy eating habits. Given the hectic pace of modern life, we tend to eat fast food, high calorie food and food with questionable nutritional value. The result is not only poor nutrition, but an entire array of potential digestive disorders.

Gastrointestinal symptoms such as flatulence, gaseous distension, epigastric pain, abdominal fullness, trapped air, heartburn and hyperacidity are common. In fact, these symptoms account for 30 to 50% of all referrals to gastroenterologists. Commonly encountered causes include dietary and nutritional factors, food allergies, enzyme deficiencies, viral and bacterial infections and stress. As a result of our focused research, Advanced Enzyme Technologies Ltd (AETL) has introduced HEMISEB[®], a complete enzyme solution for these symptoms.

Why HEMISEB[®] ?

At times, everyone has gas and its elimination can be both uncomfortable and embarrassing. In some cases, people think their gaseousness is abnormal, but then, what is normal. Most people produce about 1 to 4 pints of gas a day and eliminate portions of this gas about 14 times a day. Gas is made primarily of odorless vapors carbon dioxide, oxygen, nitrogen, hydrogen and sometimes methane. Any unpleasant odor comes from bacteria in the large intestine that releases small amounts of sulfur-containing gases.

Gas in the digestive tract comes from two sources, swallowed air and the breakdown of undigested food in the small intestine. The latter often occurs due to a shortage or absence of certain enzymes. This undigested food then passes from the small intestine into the large intestine, where harmless bacteria break down food, producing hydrogen,



carbon dioxide, and in about one-third of all people, methane.

Foods that contain carbohydrates and fiber frequently cause gas, especially legumes. In contrast, fats and proteins cause relatively little gas. HEMISEB® is scientifically designed to focus on those foods responsible for gas formation.

What is HEMISEB® ?

HEMISEB® is a unique enzyme blend that is scientifically formulated as an anti-gas supplement. It is completely derived from non-animal sources. More specifically, it comes from specialized fungal, bacterial and botanical cultures.

HEMISEB® has a unique anti-gas action that also stimulates digestion. Pre-clinical pharmacological studies have confirmed the effectiveness of HEMISEB® as a potent carminative (anti-gas ingredient) and digestive stimulant.

In vivo studies in laboratory animals conclude that HEMISEB® is effective as a digestive stimulant and anti-gas supplement. In one study, HEMISEB® was shown to reduce the output of feces, indicating an increase in digestion. At the same time, feed intake remained the same, thus inferring stimulation of digestion. Both these properties were highest at day 15, indicating rapid improvement.

How HEMISEB® works ?

HEMISEB® is capable of breaking the 1-6 carbon bonds found in legume sugars, called oligosaccharides. These relatively small sugars (2 to 10 saccharide units) are not digestible in the small intestine. They in turn pass from the small intestine into the large intestine where fermentation by microbial flora produces gas as a byproduct. HEMISEB® consists of a blend of the hemicellulase enzymes, xylanase and beta-glucanase, as well as pectinase, cellulase and phytase. This combination effectively digests hemicellulose, pectin, cellulose, beta-glucan, etc. Most vegetarian diets contain legumes as well as fiber from wheat, rice and other plant sources. The inherent residues trapped in these plant foods can be released with the addition of HEMISEB®, making these valuable nutrients more readily available to the body. In a recent study, HEMISEB® was evaluated in 80 patients with gastrointestinal symptoms listed in table 1. Subjective improvement was judged as excellent, very good, good and poor depending on the relief of symptoms measured as a percent. The effect of HEMISEB® studied in eighty cases of various types was found to be effective in 75.25% of cases. The percent relief is as shown in Table II.

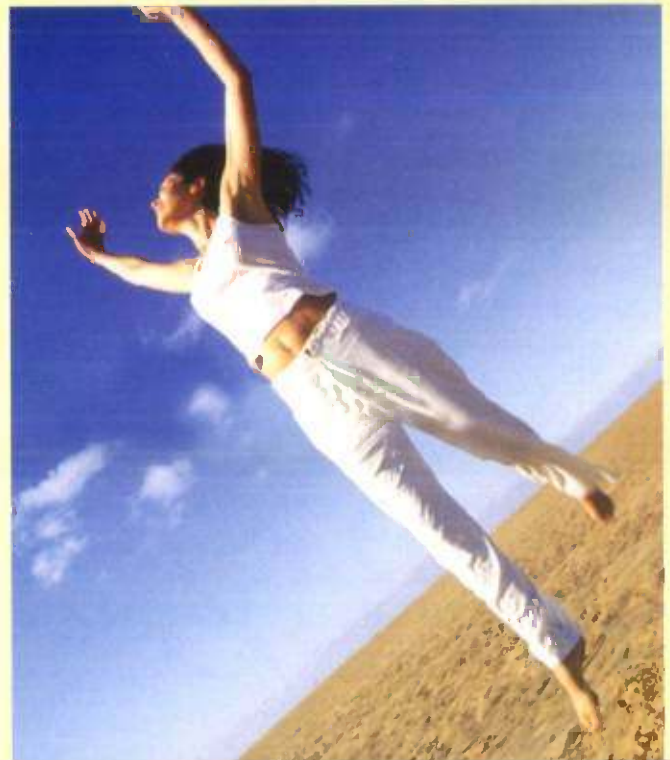


Table 1: showing symptom-wise relief in eighty patients on **HEMISEB®**

| Symptoms | No. of Cases | No. of Cases relieved |
|------------------------------------|--------------|-----------------------|
| Belching | 65 | 57(87.7%) |
| Abdominal fullness | 47 | 39(83.0%) |
| Epigastric burning | 15 | 10(66.67%) |
| Unsatisfactory evacuation of bowel | 35 | 28(80%) |
| Abdominal pain | 56 | 48(85.71%) |
| Nausea | 25 | 20(80%) |

Table 2: showing overall therapeutic response to **HEMISEB®** in eighty cases

| Result | Range of Relief | No. of cases | Response in % |
|-----------|-----------------|--------------|---------------|
| Excellent | More than 80% | 13 | 16.25 |
| very Good | 60 to 80% | 30 | 37.5 |
| good | 40 to 60% | 25 | 31.25 |
| Poor | Less than 40% | 12 | 15 |

Benefits:

- A Natural anti-gas supplement.
- Food-grade ingredients. Safe for oral administration.
- No known toxic effects.
- Digestive aid for people with common digestive discomfort.
- Digestive aid for geriatrics.
- Regulates gut motility.
- Helps modulate peristalsis.
- Promotes healthy circulation and immune systems by maintaining the body's natural enzyme levels.

INDICATIONS:

As a dietary supplement, HEMISEB® is useful in various gastrointestinal disorders, from simple heartburn and bloating to more persistent problems, such as chronic indigestion and other GI disorders. It acts as a digestive aid for those

difficult to digest or gas producing foods, such as legumes. HEMISEB® benefits patients when taken daily helping to maintain peak digestive performance.

Specifically, HEMISEB® supplements may help reduce:

- Belching and Flatulence
- Abdominal Bloating
- Abdominal Pain and Discomfort
- Indigestion
- Gaseousness
- Nausea and hyperacidity.

-Shilpa

Head of Pharma R&D

JOKE

Customer : Waiter, do you serve pigs?
 Waiter : Please sit down sir, we serve everyone.

Lady : Is this my train?
 Station Master : No, it belongs to the Railway Company.
 Lady : Don't try to be funny. I mean to ask if I can take this train to New Delhi.
 Station Master : No Madam, I'm afraid it's too heavy.





MEDIA BUZZ ON AETL

AETL to set up 3 biotech facilities

P B JAYAKUMAR
Mumbai, 14 March

Mumbai-based Advanced Enzyme Technologies Ltd (AETL), the largest manufacturer of enzymes in the country, will invest Rs 115 crore to set up three biotech production facilities.

Among the plants, a 100 per cent export oriented plant, with an investment of Rs 40 crore, would start in two months at the special economic zone in Indore.

Other Rs 35 crore plant at Jalna in Maharashtra would manufacture enzymes for agricultural, animal health and food industries. The third plant at Shahapur near Mumbai, within two years, would manufacture industrial enzymes for textile and leather industries, said C L Rathi, managing director, AETL.

Two of our existing plants at Nashik have

tification as per pharmaceutical manufacturing standards. Production parameters are different for enzymes required for other industries and the new plants will solve this issue. We are planning to fund the expansion through internal accruals and term loans. If required, we will go public to raise funds," he said.

Currently, AETL manufactures about 400 types of enzymes for various industrial applications, including anti-inflammatory, digestive, cardiac care, probiotics and prebiotic enzymes for the pharmaceutical industry. It also manufactures nutraceutical and animal healthcare enzymes. The company has two research and development (R&D) centres employing about 70 scientists and will soon spend another Rs 20 crore to scale up its

BUSINESS STANDARD
Edition : Mumbai
Date : 15th March 2007
Page No.: 6

Advanced Enzyme Tech gets process patent for leather

GT NEWSROOM: Advanced Enzyme Technologies Limited (AETL), manufacturer of enzymes and probiotics, has received a process patent for leather manufacturing. Far superior to the conventional procedure used to process hides, this process will now allow better quality of leather in terms of its grain structure. The name given to the patented leather process is 'Eco-Friendly WET Blue Manufacturing'. This comes as a relief to the leather industry as there has been a major cause of concern, resulting in a clampdown on many units by the PCB.

The conventional processing of leather is done using heavy toxic chemicals like lime, sulphide, emulsifiers and salts which lead to health issues of the operators, users and also causes ecological imbalances.

Due to this reason the European, Indian and Chinese governments are laying strict regulations for use of eco-friendly products. Hence there is a need for the industry to look at eco-friendly solutions, and enzymes effectively address the issue. Presently tanneries are also under tremendous pressure to deal with these issues including pressure on meeting processing cost. CL Rathi, Managing Director, AETL said, "The global Indian market for leather is valued at \$98 billion and India has close to 2.5% share in the world market which amounts to around \$2.25 billion.

However the Indian leather market is expected to double by year 2010. In India it is rapidly growing and producing high quality leather. The value of this process and technology transfer to the plant scale has taken over 2 years.

GOMANTAK TIMES
Edition : Panaji
Date : 21st Feb 2007
Page No : 9

HERALD
Edition : Panaji
Date : 22nd Feb 2007
Page No.: 13

AETL bags process patent for leather

PANJIM (HND) — Advanced Enzyme Technologies Limited (AETL), India's largest manufacturer of enzymes and probiotics, has received a process patent for leather manufacturing.

Far superior to the conventional procedure used to process hides, this process will now allow for better quality of leather in terms of its grain structure.

The name given to the patented leather process is 'Eco-Friendly Wet Blue Manufacturing'. This comes as a relief to the leather industry as there has been a major cause of concern, resulting in a clampdown on many units by the PCB.

The conventional processing of leather is done using heavy toxic chemicals like lime, sulphide, emulsifiers and salts which lead to health issues of the operators, users and also causes ecological imbalances. Due to this reason the European, Indian and Chinese governments are laying strict regulations for use of eco-friendly products. Hence there is a need for the industry to look at eco-friendly solutions, and enzymes effectively address the issue. Presently tanneries are also under tremendous pressure to deal with these issues including pressure on meeting processing cost.

The value of the patented process is over USD 200 Million and is purely based on the developed technology. The development of this process and technology including the transfer to the plant scale has taken over 2 years.

Advanced Enzyme Technologies Ltd, receives Process Patent for Leather

MUMBAI, FEB 21— Advanced Enzyme Technologies Limited (AETL), India's largest manufacturer of enzymes and probiotics, has received a process patent for leather manufacturing. Far superior to the conventional procedure used to process hides, this process will now allow for better quality of leather in terms of its grain structure. The name given to the patented leather process is 'Eco-Friendly WET Blue Manufacturing'. This comes as a relief to the leather industry as there has been a major cause of concern, resulting in a clampdown on many units by the PCB.

The conventional processing of leather is done using heavy toxic chemicals like lime, sulphide, emulsifiers and salts which lead to health issues of the operators, users

and also causes ecological imbalances. Due to this reason the European, Indian and Chinese governments are laying strict regulations for use of eco-friendly products. Hence there is a need for the industry to look at eco-friendly solutions, and enzymes effectively address the issue. Presently tanneries are also under tremendous pressure to deal with these issues including pressure on meeting processing cost.

Mr. C L Rathi, Managing Director, AETL said, "The global Indian market for leather is valued at 98 Billion USD and India has close to 2.5% share in the world market which amounts to around 2.25 Billion USD. However the Indian leather market is expected to double by year 2010 to 4.5 - 5.0 Billion USD. This is because leather technology in India is rapidly

evolving to produce high quality leather using eco friendly processes and AETL is proud to be contributing to this technology" Mr. Dipak Roda, General Manager - Marketing added, "AETL has also made a foray into China as well as Bangladesh in addition to India. We will be focusing on the leather industry for the next two years. The process will provide a relief to the company in the leather market. AETL plans to take its success in American and European countries as well".

The value of the patented process is over USD 200 Million and is purely based on the developed technology. The development of this process and technology including the transfer to the plant scale has taken over 2 years.

THE LATEST
Edition : Jammu
Date : 22nd Feb 2007
Page No : 9

QUIZ????????????????

1 Which of the following enzymes would digest a fat?

- a Sucrase
- b fatase
- c protease
- d lipase

2 At high temperatures, the rate of enzyme action decreases because the increased heat

- a changes the pH of the system
- b alters the active site of the enzyme
- c neutralizes the acids and bases in the system
- d increases the concentration of the enzyme

3 Enzymes influence chemical reactions in living systems by

- a providing the substrate required for the reaction to occur
- b affecting the rate at which reactions occur
- c absorbing water released when polymers are formed
- d combining with excess hydrogen to form gaseous wastes

4 Which group of organic compounds includes the enzymes?

- a Proteins
- b starches
- c carbohydrates
- d lipids

5 The "lock and key hypothesis" attempts to explain the mechanism of

- a vacuole formation
- b pinocytosis
- c sharing of electrons
- d enzyme specificity

6 Any substance that is acted upon by an enzyme is called a (n)

- a coenzyme
- b substrate
- c vitamin
- d polypeptide

7 An enzyme that hydrolyzes protein will not act upon starch. This fact is an indication

that enzymes are

- a hydrolytic
- b specific
- c catalytic
- d synthetic

8 At 25 C. the optimum reaction rate of a certain enzyme occurs at a pH of 7. A greater reaction rate could probably be attained by

- a increasing the temperature to 35 C and keeping the pH at 7
- b increasing both the temperature and the pH
- c decreasing the pH and increasing the temperature
- d increasing the pH and keeping the temperature at 25 C.

9 At about 0 C., most enzymes are

- a inactive
- b active
- c destroyed
- d replicated

10 Vitamins are essential to the survival of organisms because vitamins usually function as

- a substrates
- b nucleic acids
- c coenzymes
- d nucleotides

Please send in your answers at ritu@enzymeindia.com, info@enzymeindia.com
The Lucky Winner would be entitled for the prize.



In Technical collaboration with



Specially Enzymes and Biochemicals Co.

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• WHO cGMP Certified Production Plant

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