
# RAMPUR DISTILLERY: A UNIT OF RADICO KHAITAN

## Rampur UP

IN PLANT TRAINING REPORT ON

RAMPUR DISTILLERY

UNDER THE GUIDENCE OF

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# Acknowledgement

I am highly indebted to Radico khaitan for their guidance and constant supervision as well as for providing necessary information regarding the project & also for their support in completing the project.
I would like to express my gratitude thanks towards member of Radico khaitan for their kind co-operation and encouragement which help me in completion of this project.
I would like to express my special gratitude and thanks to industry persons for giving me such attention and time.

At the outset, I would like to thank Devendra Singh **(**senior president**), & Mr. Satish Tomar** for giving me the approval to this project in the organization. I wish to acknowledge the entire HR Team at **Radico Khaitan Ltd.** Special appreciation extended to **Mr. Sant singh (HR)** who helped me to shape the direction of my research work. This project would not have been possible without his help.
A heartfelt thanks to the respondents surveyed whose ideas, critical insights and suggestions have been invaluable in the preparation of this report.

# Introduction

***Radico Khaitan Ltd. (RKL)**, formerly **Rampur Distillery & Chemical Company Ltd.**, is an Indian company that manufactures industrial alcohol, Indian Made Foreign Liquor (IMFL), country liquor and fertilizers.[1] It is the fourth largest Indian liquor company, .[5] Radico brands are sold in more than 85 countries,[6] including USA, Canada, South America, Africa, Europe, South East Asia, Australia, New Zealand and the Middle East.[7]*

# *History*

*Radico Khaitan Ltd. was established as Rampur Distillery & Chemical Company Ltd. in 1943 at Rampur, Uttar Pradesh. The distillery in Rampur initially produced extra neutral alcohol (ENA) and supplied bulk alcohol for several liquor companies[8][9][10] such as Shaw Wallace, Mohan Meakin and the United Breweries Group. It had a turnover of ₹ 6.5 million in 1979.[11] It was only in 1999 that the company commenced production of its own brands.[8][9][10] Lalit Khaitan's father, G. N. Khaitan, bought out the loss-making Rampur Distillery from Vishnu Hari Dalmia for ₹ 1.6 million in 1972. According to Lalit Khaitan, his father was a teetotaler throughout his life, and even Khaitan himself had never tasted alcohol until his father bought the distillery. G. N. Khaitan divided the family business (which included construction, real estate, liquor industries and others) among his 4 sons in 1995, and Lalit Khaitan inherited the relatively small liquor division.[12] Prior to that the distillery was run by Lalit's cousin and others.[5] In 1991, Radico set up a malt spirit plant with an installed capacity of 460 KL per annum; a soya oil/rapeseed extraction plant with an installed capacity of 300 tpd based on soyabean seeds & 350 tpd based on rapeseed oil cake at Ratlam, Madhya Pradesh and a biogas cogeneration and secondary treatment plant. The company also modernized the distillery unit by installing new copper distillation plant and a fully automatic bottling line. It also balanced its Single Superphosphate (SSP) plant by putting equipment like a ball mill and a scrubbing system. The entire modernisation-cum-expansion programme cost the company ₹ 365 million.[13] The company undertook a major expansion of its solvent extraction plant to increase the capacity from 300 tpd to 600 tpd in 1994, and launched Contessa Rum, Contessa Whisky and a few other products in CMI markets in 1995.[13] Contessa Rum is mainly sold to the Canteen Stores Department (CSD).[14] Radico entered into a joint venture with Whyte & Mackay Group plc. in the same year, and launched Scotch whisky brands 15 YO, Findlater and WMSR in India.[13]*

*While planning to launch a new brand in 1996, Khaitan and his son Abhishek, who had joined the company recently, found that more Scotch was consumed in India than was bottled in Scotland, and there was no Scotch blended whisky brand available in India in the lower price range at that time. The Khaitans intended to launch a brand to target that segment, but had low finances, which was compounded by the entry of MNCs into the Indian liquor industry.[5] The first Radico Khaitan IMFL brand was 8 PM whisky, launched in 1999,[15] and currently Radico's flagship brand.[16][17] According to Abhishek Khaitan, the name was chosen as the company felt that "8 was the simplest thing to depict", and also because "people usually start drinking at 8 pm." in India. The TV advert for the whisky was in black-and-white, and depicted opposing soldiers bonding over 8 PM whisky at an international border.[5] Radico announced in May 1999 that it had submitted a proposal to set up a distillery in Kyrgyzstan, which had been and it had been accepted by Kyrgyzstan government.[18]*

*RKL created an international division, called Radico International, in 2003. Radico International introduced brands such as Beck's beer and wines from E&J Gallo in the Indian market.[19] On 14 January 2003, RKL*

*president (finance) RK Mehrotra announced that the company was planning to set up a bottling facility in Mauritius for their 8PM brand through a tie-up with a local company.[20] In July 2003, Radico announced the installation of an ENA deluxe plant at its Rampur Distillery at a cost of ₹ 200 million. The company would use some of the ENA for its own IMFL brands, while the rest is sold in India and exported to liquor majors in Europe and the Commonwealth of Independent States (CIS) .[21] Radico purchased Bacardi's 51% stake in Whytehall India for over ₹ 300 million in 2004, gaining control of the Whytehall brand.[12] In a press release on 7 April 2004, Radico announced that it had acquired Anab-e-Shahi, a bottling plant in Andhra Pradesh. This was the company's first acquisition in South India.[22]*

*Radico entered the vodka market in November 2005,[23] with the launch of the grain-based[24] Magic Moments vodka. Although Magic Moments was not an instant success like 8 PM, it earns Radico more revenue than 8 PM.[14] In 2005, the company set up a grain-based distillery plant in Uttar Pradesh at a cost of ₹ 850 million.[24]*

*In May 2006, Radico announced that it had entered into two overseas joint ventures in the United Kingdom and western Africa, becoming the first Indian liquor company to have overseas production lines. The joint ventures are intended to help Radico launch its brands in the UK and African markets. Radico handles sales, marketing and distribution functions, while manufacturing is outsourced to the local partner. The whiskies Radico sells outside India are grain-based, while its whiskies in India are made from molasses.[25] In August 2006, Diageo and Radico Khaitan announced a 50:50 JV called Diaego Radico Distilleries Pvt Ltd[26] in the Indian spirits market, with the latter handling distribution and manufacturing base and former providing marketing. The move marked Diageo's return to the IMFL market, which it had previously exited in 2001.[27] Diageo Radico launched Masterstroke Deluxe Whisky in the premium segment in March 2007.[26] However, the joint venture did not launch any new brands following that. Diageo instead developed its own marketing and distribution machinery to strengthen its presence in India. In 2011, Diageo announced its intention to buy half of Radico's stake in the JV.[28] In October 2007, Radico entered into a tripartite joint venture with NV Distillers and Ridhi Sidhi Pvt Ltd to set up a greenfield distillery in Aurangabad, Maharashtra with a combined investment of ₹ 1.60 billion. Radico would have a 36% stake in Radico NV Distilleries Maharashtra Ltd, which would manufacture ENA, IMFL and ethanol, and also have a bottling facility. The distillery is Radico's second, after the Rampur Distillery[29]*

*Morpheus brandy was launched in May 2009.[30][31][32] Its largest markets are Tamil Nadu, Andhra Pradesh, Kerala and Karnataka.[33][34] The company named the brandy after Morpheus, the Greek god of dreams, in order to "convey a sense of softness with a European touch".[35] Radico launched Carlo Rossi wine in Mumbai in April 2009, through its joint venture with E&J Gallo, which owns the brand. Radico had already been selling other E&J Gallo brands such as André, Wine Cellars, Sonoma County and Turning Leaf in India.[30]*

*Radico announced on 7 April 2011 that it had entered into an agreement with Japanese firm Suntory Liquors Ltd to market and distribute the latter's Yamazaki single malt and Hibiki blended whiskies in India.[36] Radico launched After Dark, a 100% grain-based whisky manufactured at its Rampur distillery,[37][38] in September 2011.*

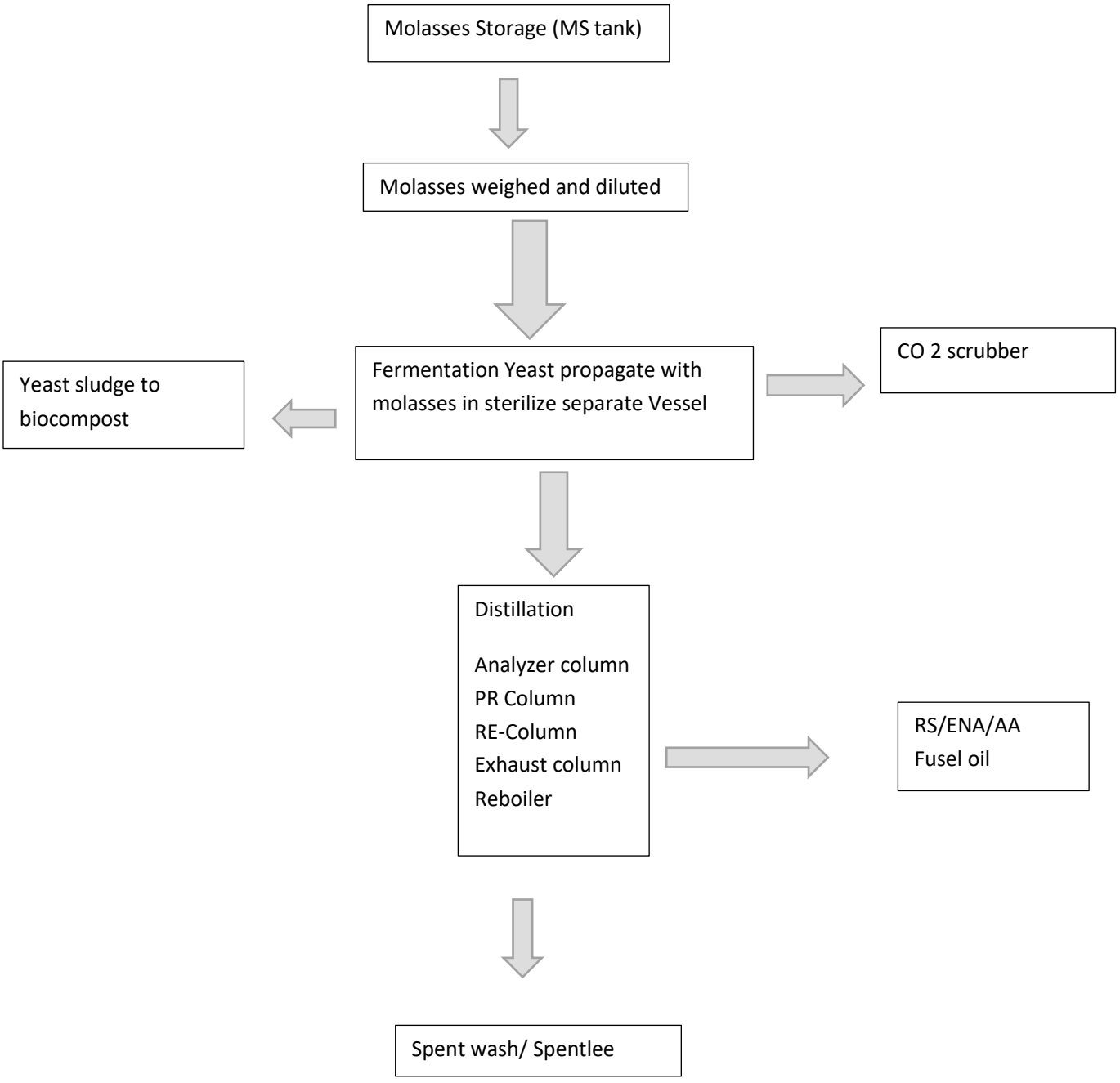
# RAMPUR DISTILLERY

Rampur distillery retrieve ENA from 3 type plant

1. MOLASSES BASED PLANT
2. GRAIN BASED PLANT
3. MALT BASED PLANT.

## MOLASSES BASED PLANT

## Flow chart :-



## *Raw material*

For the production of alcohol ,material containing sustaining amount of glucose Content can be used as a raw material. But for commercial production, common raw materials used are as follows:

1. *Molasses*
2. *Cane Juice (Sugar cane)*

## *Some general theory ::*

Production of alcohol comprises and broadly disposal 2 sections, viz .

- Fermentation.
- Distillation

# 1. The fermentation consists of following steps

- *Molasses weighing* :-Weighment of molasses will be carried out either through a load cell based system or through a direct flow meter system both with totalizing provisions.
- Dilution :- The first operation, which is carried out on molasses is dilution. In dilution operation molasses, from the storage tank is diluted with raw water. The diluted molasses is used for subsequent unit operations i.e. yeast propagation & fermentation. The dilution ratios required for yeast propagation and fermentation are different. For requirement of yeast propagation, molasses is diluted to keep the sugar percentage of 8 – 9% while for fermentation molasses is diluted to keep the sugar 16-18%.

- Yeast Propagation :- *Saccharomyces cerevisiae* sp is the yeast used for molasses fermentation. Yeast is unicellular living organism. The growth of yeast takes place by division of one cell into two, two cells into four and so on, if sugar solution is provided for its growth. Two types of fermentation process are generally observed during fermentation.

Aerobic fermentation:-

Aerobic fermentation takes place in presence of excess oxygen and in this process, the yeast growth remains optimum. Ethyl Alcohol production is less, because most of the sugar gets converted into water, carbon dioxide and yeast during fermentation. Aerobic fermentation is suitable for yeast propagation, with the main objective to achieve the growth of yeast cells.

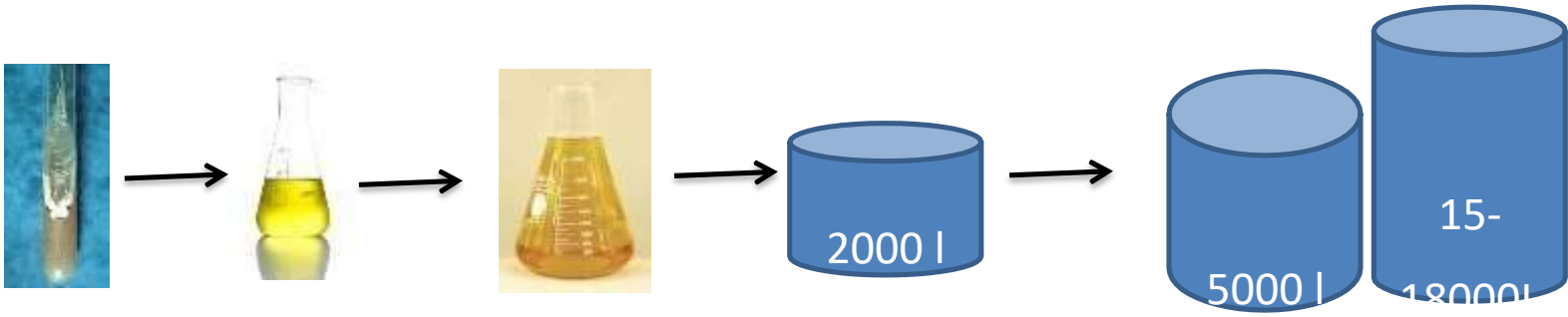
Anaerobic fermentation

Anaerobic fermentation occurs in absence of Oxygen. Under anaerobic condition the sugar gets converted into ethyl alcohol and carbon dioxide. Yeast growth is less in the anaerobic process. Hence, this process is suitable for ethyl alcohol production, but not yeast propagation.

Yeast propagation is being done in aerobic condition and it is slated in the laboratory strictly under hygienic conditions. To start with, a few yeast cells are added to the sterilized diluted molasses the entire sugar contain in solution is exhausted. The contents of test tube are then transferred to a volumetric flask and made up to 250 ml with sterilized diluted molasses. The solution is left for further growth of yeast. After yeast growth is achieved in 250 ml solution, it is further made upto 1 liter with sterilized diluted molasses. The process is repeated till 20 liters of solution containing yeast biomass

is obtained.

Further, yeast propagation is carried out in the yeast vessel in the fermenter house. The 20 liter of yeast solution obtained from laboratory is propagated to required volume through various stages in yeast vessels of capacities 100 l, 500 l, 2000 l and 5000 l from the yeast vessels the yeast biomass is fed to the pre-fermenters, in which diluted molasses is added in the pre-fermenters, aerobic conditions are maintained by means of submerged aeration to maximize yeast production. The capacity of Pre-fermenter vessels ranges from 15000 L to 18000 L.



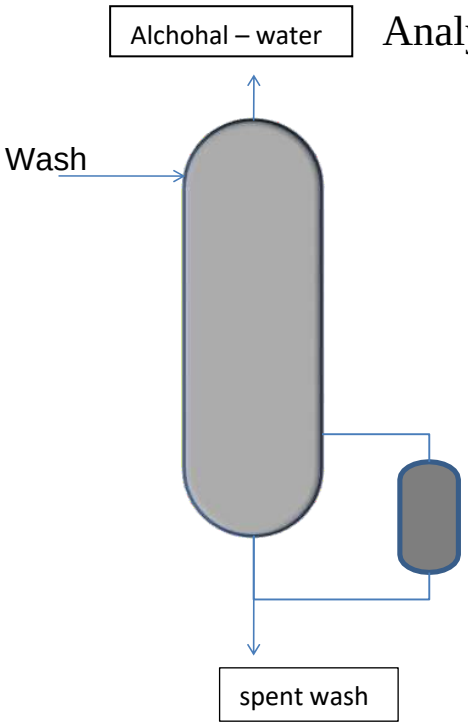

- *Pre fermentation and Fermentation:* - Fermentation is carried out in the fermentation vessels under controlled conditions of temperature and pH. The propagated yeast biomass is transferred to the main fermenters keeping volume at 10 to 15% of the total fermenter volume. The rest is filled with diluted molasses. After filling the fermenter, it is left for fermentation. This process occurs under anaerobic condition. Under these conditions, the glucose molecule breaks down to produce ethyl alcohol and carbon dioxide. The time required for completion of the fermentation process is 15 – 20 hours. The fermentation process is understood to be completed when the effervescence stops. Other measurement like specific gravity etc., are also taken to assess the completion of fermentation process Fermentation is an exothermic reaction. Hence, the temperature rises during the fermentation process. To maintain the temperature at 36 degree C., the fermenter vessels are required to be cooled with fresh water, through plate type heat exchanger. The yeast sludge along with solids present in molasses is collected at the bottom of the fermenter vessels. These solids need to be removed to make the fermenter vessels ready for another batch of fermentation process. The sludge is washed off by water. The washed sludge called fermenter washing constitutes a waste along with some alcohol.

The fermenter washing is centrifuged in a high speed centrifuge machine, which separates solid and liquid the liquid containing some alcohol is sent for distillation while the solid contained biomass and other solid is sent for bio-composting.

# Distillation

1 Analyzer Column
2 *Degasifying Column*
3 Pre-Rectification cum stripper column
4 Extractive distillation column

5. Recovery Column
6. Rectifier cum Exhaust Column
7. Simmering Column
8. MSDH column



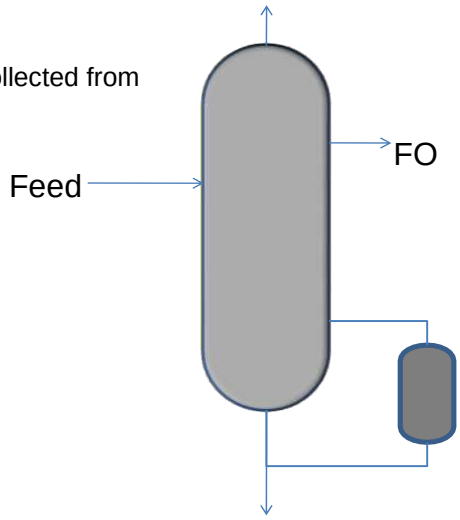

## Analyzer column: -

- In this column preheated fermented wash is stripped off from all volatile components, including ethyl alcohol.
- From bottom, spent wash is drained and sent to ETP.
- This column generally has a degasser section on the top, which removes all dissolved gases in the fermented wash.
- This column is generally operated under vacuum to eliminate the chance of scaling and reduce energy requirement.
- The vapors (45% to 55% ethanol vapors) of this column are condensed and fed to prerectifier column.

Vapour

## Pre-rectifier Column :-

- In this column the heavier alcohols (fusel oil) are separated and collected from top middle draw.
- It is operated under vacuum.
- The main product is drawn off from the top side of the column.
- Bottom product of the column is called spent lees.

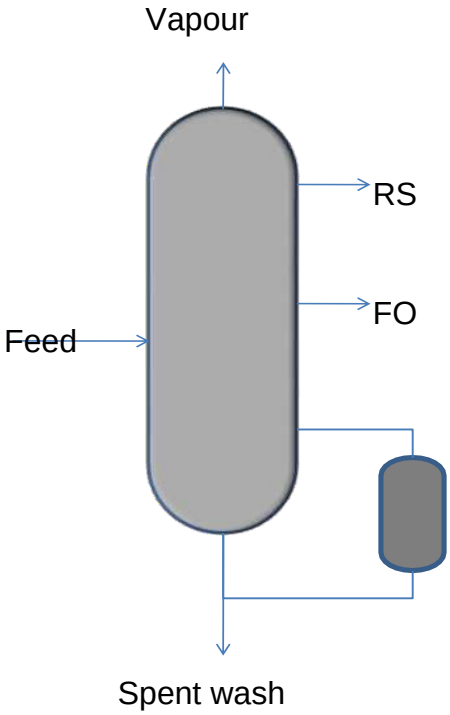



--ANALYZER COLUMN

Spent less

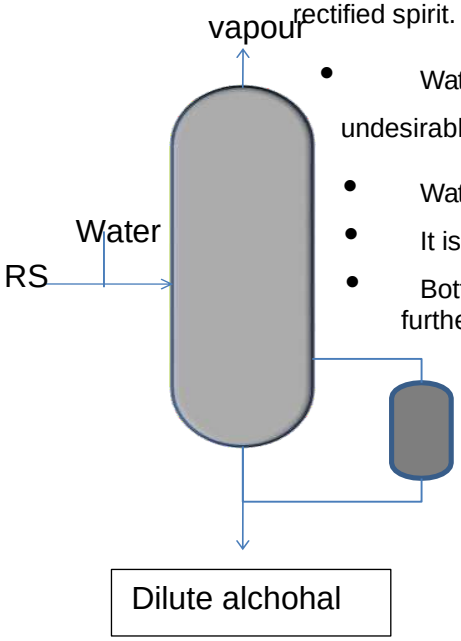
## Rectifier Column:-

- This column operates under elevated pressure.
- Rectified spirit, the first alcoholic product, is drawn from this column.
- The bottom product, spent lees, is used in the process of fermentation.
- Fusel oil and technical alcohol are also drawn from this column.



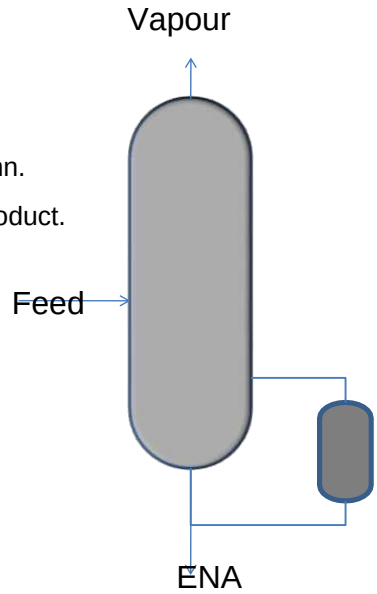
## Extractive Distillation Column

- In this column DM water is used as an extractant to dilute the rectified spirit.
- Water is added to change the relative volatility of the undesirable components to obtain a product clear of smell.
- Water is added in the ratio of 1:9.
- It is operated at atmospheric pressure.
- Bottom product is fed to the simmering column for further concentration.




## Simmering Column

- This column is operated under high reflux and vaccum
- Methanol, diacetyl and mercaptans are separated from the top of the column.
- The final product, i.e., extra neutral alcohol (ENA) is obtained as bottom product.

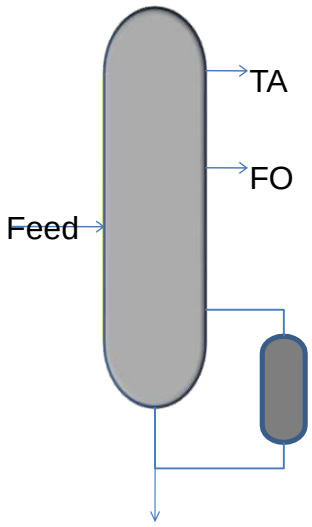



## Recovery Column

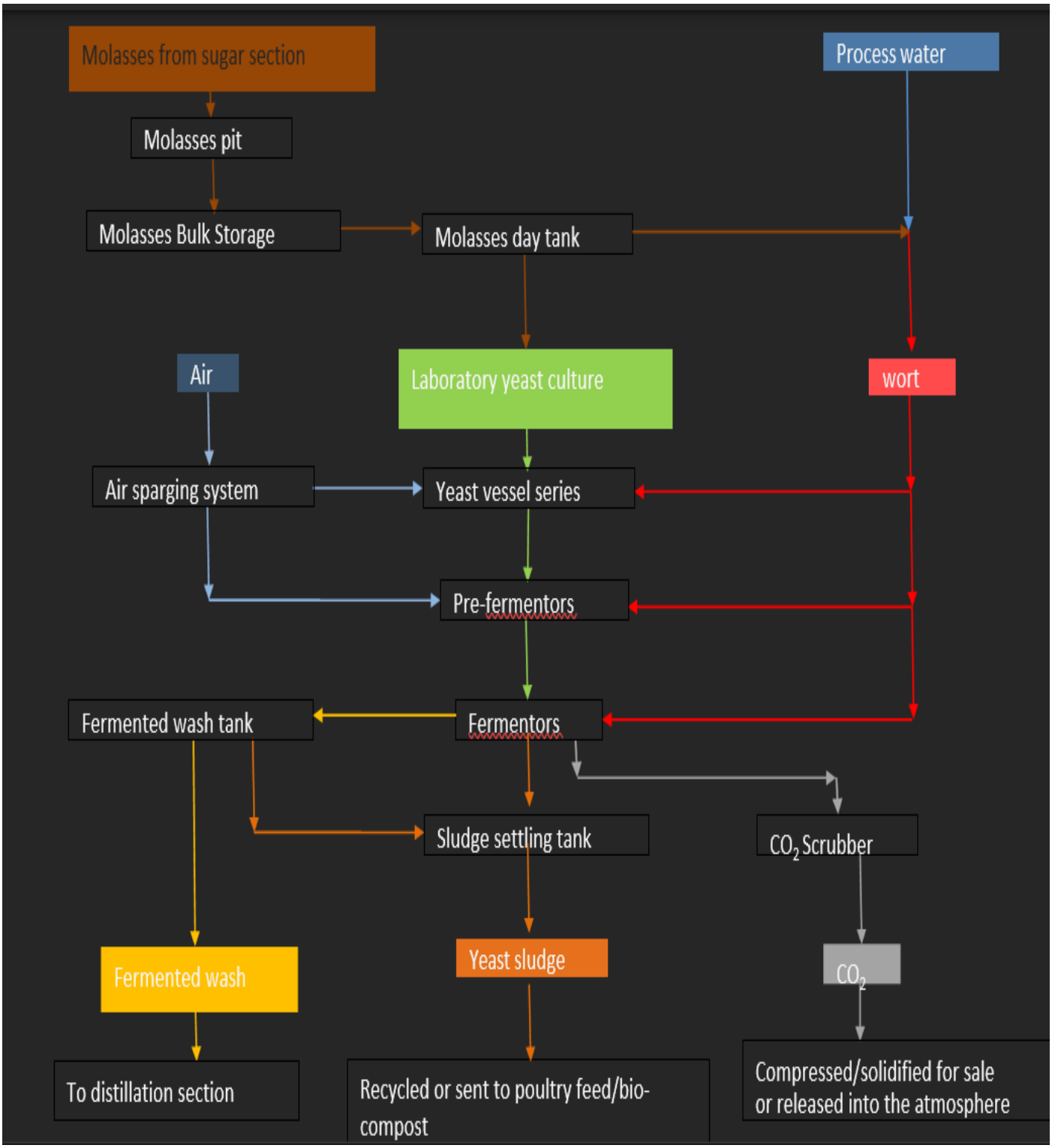
- Fusel oils along with the condensates of analyzer and ED column are fed to this column for concentration.
- A technical alcohol is taken out from the top ofthe

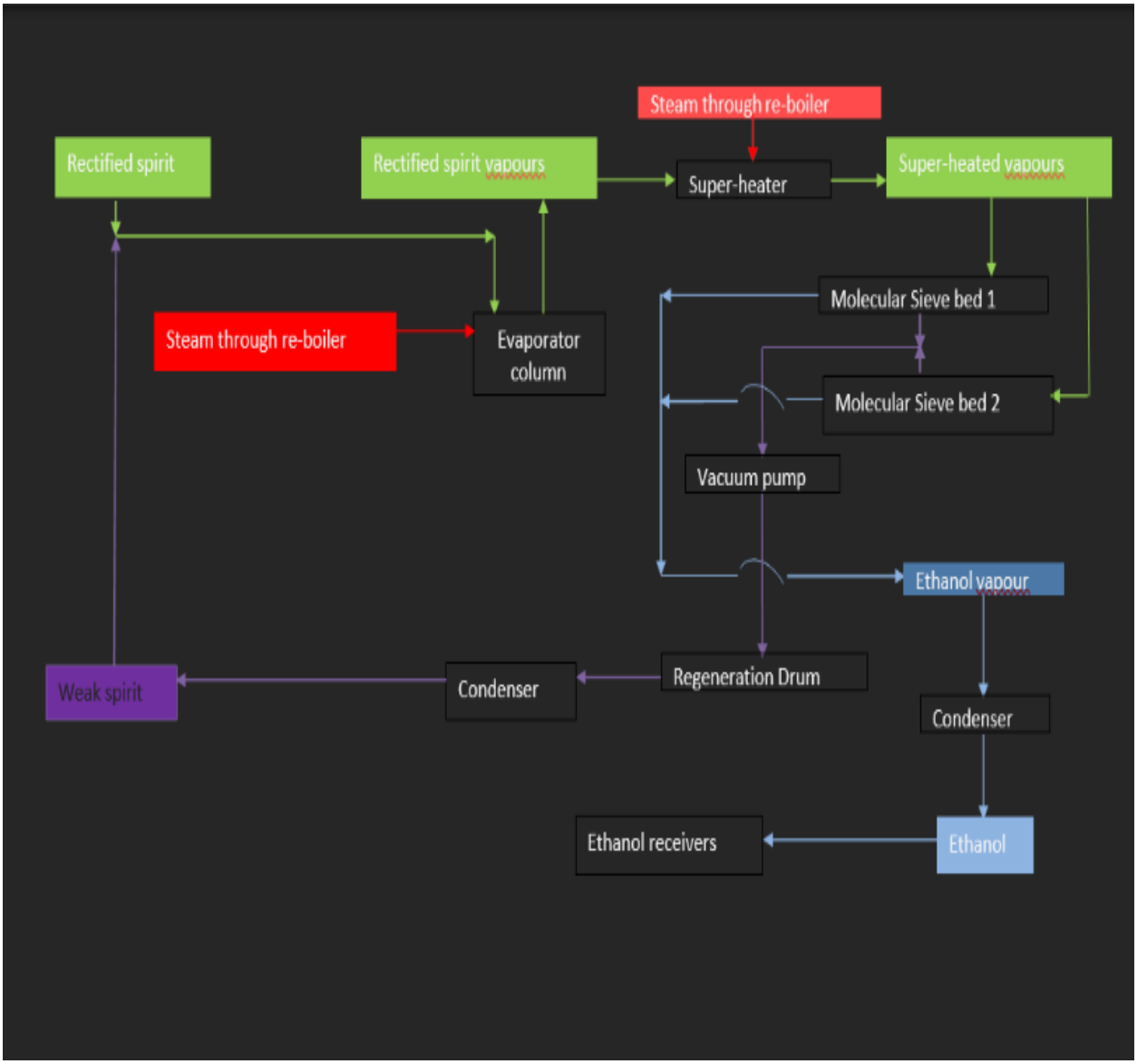
column.

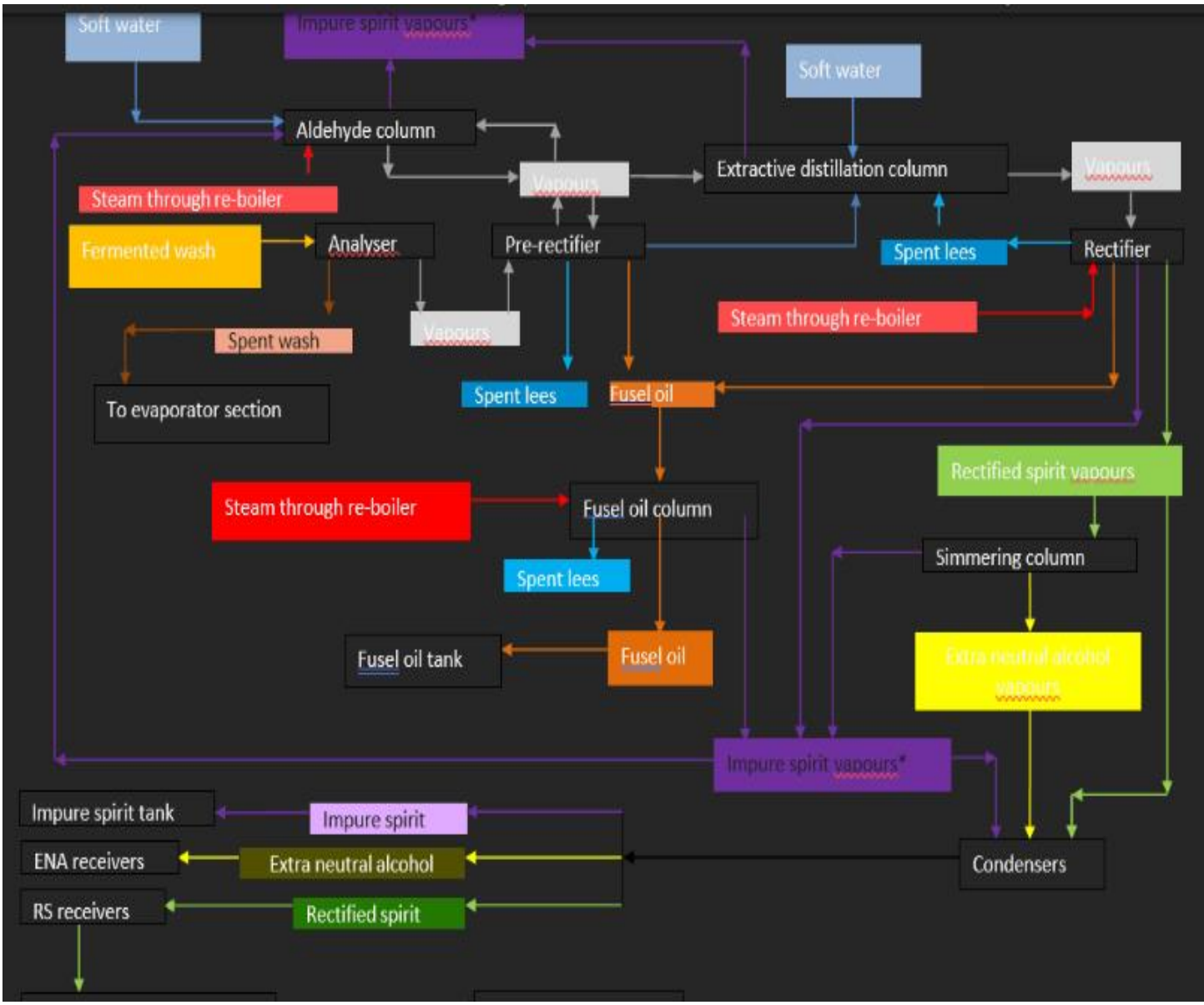
- Fusel oils are drawn off from upper trays
- Bottom lees is drained off.
- It is operated at atmospheric pressure.

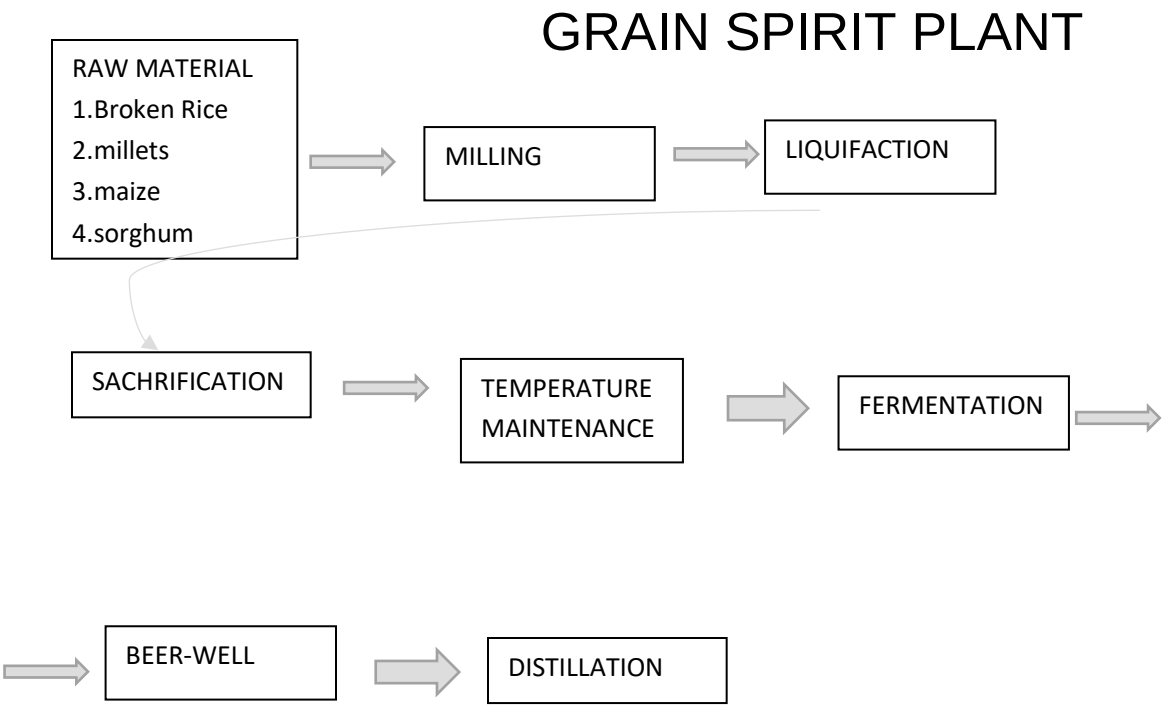



SPENT LESS


Molasses from sugar section
Process water
Molasses pit
Molasses Bulk Storage
Molasses day tank
Air
Laboratory yeast culture
wort
Air sparging system
Yeast vessel series
Pre-fermentors
Fermented wash tank
Fermentors
Sludge settling tank
$CO_2$ Scrubber
Fermented wash
Yeast sludge
$CO_2$
To distillation section
Recycled or sent to poultry feed/bio-compost
Compressed/solidified for sale or released into the atmosphere


Steam through re-boiler
Rectified spirit
Rectified spirit vapours
Super-heater
Super-heated vapours
Molecular Sieve bed 1
Steam through re-boiler
Evaporator column
Molecular Sieve bed 2
Vacuum pump
Ethanol vapour
Weak spirit
Condenser
Regeneration Drum
Condenser
Ethanol receivers
Ethanol


Soft water
Impure spirit vapours*
Soft water
Aldehyde column
Vapours
Extractive distillation column
Vapours
Steam through re-boiler
Fermented wash
Analyser
Pre-rectifier
Spent lees
Rectifier
Vapours
Steam through re-boiler
Spent wash
To evaporator section
Spent lees
Fusel oil
Rectified spirit vapours
Steam through re-boiler
Fusel oil column
Simmering column
Spent lees
Fusel oil tank
Fusel oil
Extra neutral alcohol vapours
Impure spirit vapours*
Impure spirit tank
Impure spirit
ENA receivers
Extra neutral alcohol
Condensers
RS receivers
Rectified spirit




# Manufacturing process details

The distillery will use grains as raw material in the production of rectified spirit. The process description of alcohol production in using grain as raw materials is as follows,

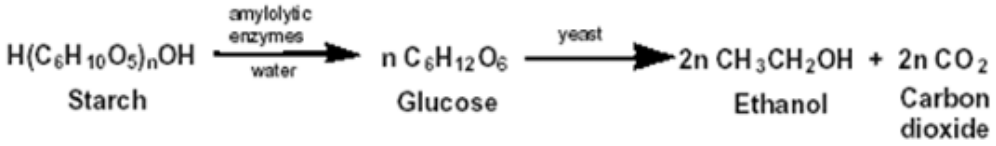
## Milling and flour handling

The incoming grain is first cleaned with the help of de-stoner and magnetic separators to remove stones and other material which may damage the hammers during milling. The grain is fed to hammer mill in controlled manner. In milling grains are crushed to flour of uniform size. Oversized screening rejects are segregated with the help of vibratory screen. These are taken to coarse bin before sending it to mill again. Intermediate hopper is provided for buffer capacity for flour storage. The flour is transferring to the mixing tank for slurry preparation process.

## Slurry preparation/liquefaction

Slurry from pre-masher is taken to slurry cum liquefaction tank where both steam &liquefying enzyme are added. The mixture of slurry and steam is then provided with the desired retention time at a given flow rate. The cooking process, accomplished in the above manner, converts the slurry into a hydrated, sterilized suspension and is therefore susceptible to enzyme for liquefaction. Liquefied mash is cooled in slurry cooler and transferred to fermentation section

The complete reaction of conversion of starch into ethanol can be represented as follows,




## Saccharification and fermentation

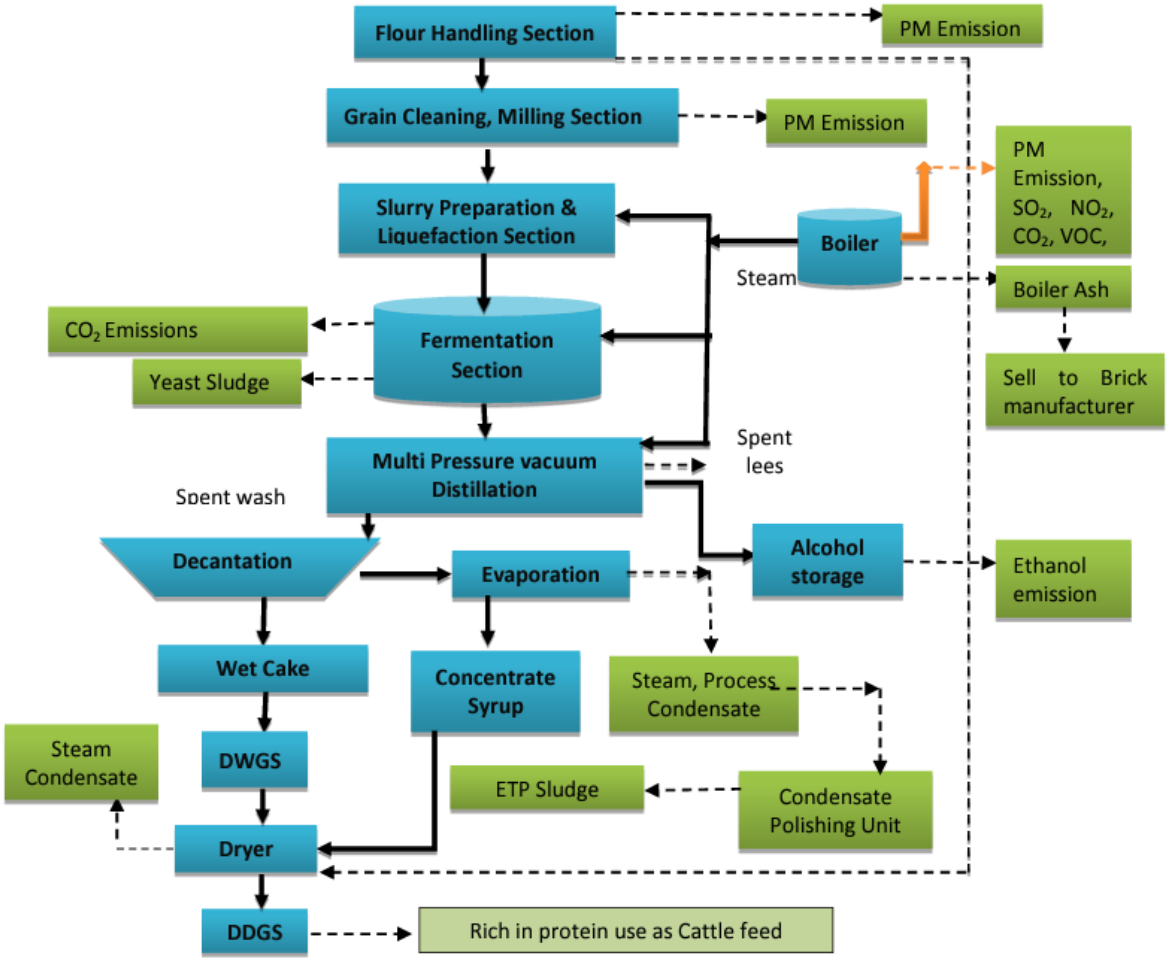
### *Yeast propagation:-*

Yeast seed material is prepared in water cooled vessels by inoculating sterilized mash with active dry yeast. Optimum temperature is maintained by cooling water. The contents of the yeast vessel are then transferred to pre-fermentors. The pre-fermentors are filled with mash and loaded with contents of the yeast. The prefermentor contents are transferred to the main fermenters.

### *Fermentation*

The purpose of fermentation is to convert the fermentable substrate into alcohol. To prepare the mash for fermentation, it may have to be diluted with water. The pH of the mash is adjusted to about 5.0 accomplished primarily by recycled slops (which also provides for nutrients) and by the addition of acid. Yeast is available in sufficient quantity to initiate fermentation rapidly and complete it in 54 to 60 hours. Significant heat release takes place during fermentation. This is removed by forced circulation cooling in external heat exchangers to maintain an optimum temperature of 300C. The re-circulating pumps also serve to empty the fermentors into beer well. After the fermentors are emptied, they are cleaned with water and caustic solutions and sterilized for the next batch. The carbon dioxide evolved during the process is scrubbed to prevent ethanol emissions by process water, which is taken

to beer well. The flow diagram of process description of grain spirit production is shown




# Wash to Extra Neutral Alcohol – MPR - Multipressure Distillation

The distillation scheme consists of seven columns namely

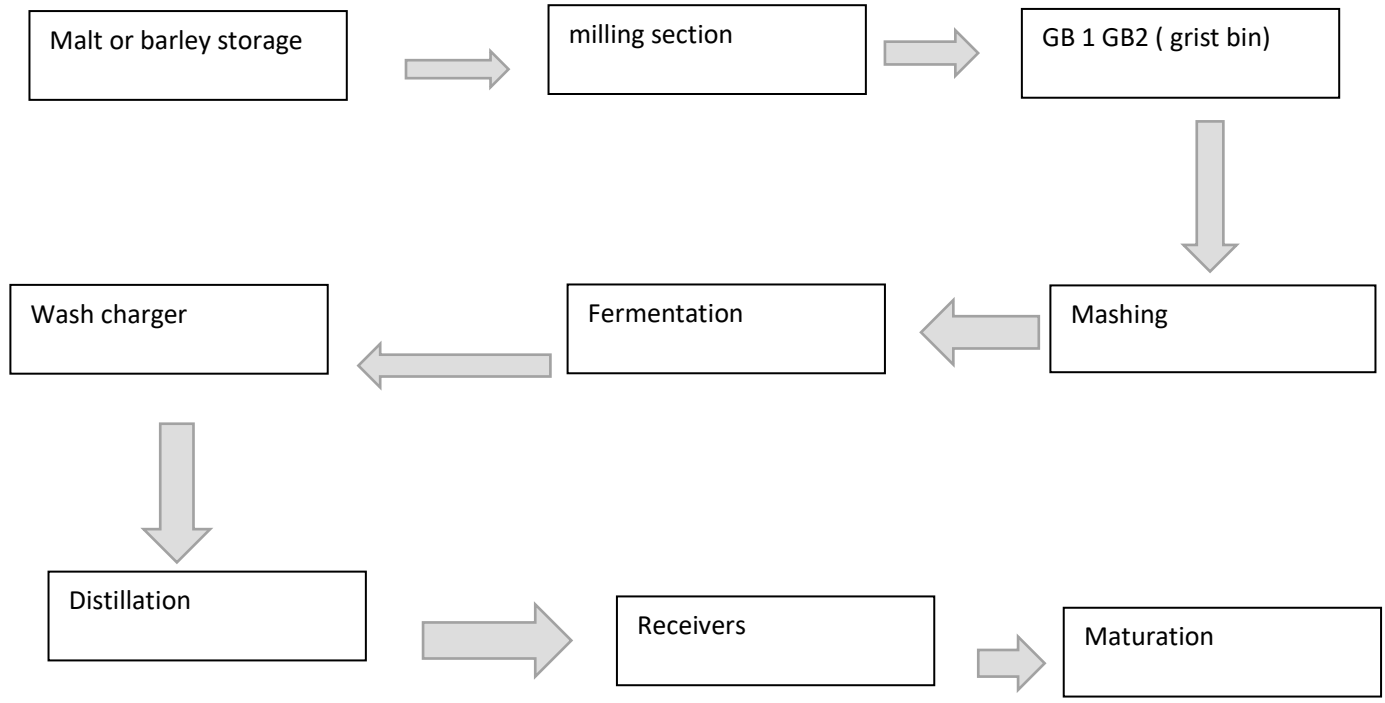
1. Degasifying-cum-analyzer column- Operation under vacuum
2. Pre-rectification- Operation under vacuum
3. Exhaust column- Operation under vacuum
4. Extractive Distillation Column-Operation under pressure
5. Rectifier-cum- Exhaust column- Operated under pressure
6. Recovery/Fused Oil Column- Operated under pressure
7. Simmering Column- Operated under atmospheric or vacuum

The Fermented wash is preheated in a fermented wash pre heater and fed to the analyzer column. The vapors of the analyzer are fed to pre-rectifier column. Bottom liquid from pre-rectifier column is fed to stripper column. Impure spirit and fusel oil liquid streams from various columns are introduced in recovery column for processing. Steam is supplied at the bottom of R/E column re-boiler, simmering column re- boiler &direct steam sparging is done in the recovery column. For the ENA production top product of pre-rectifier is fed to purifier column whereas bottom

liquid is fed to impure spirit purification column. Technical alcohol from the top of purifier column as well as fusel oil draws from pre-rectifier & R/E is fed to recovery. Final technical alcohol cut is taken from the top of impure spirit purification column whereas ENA is drawn from the bottom of the simmering column.

# MALT BASED PLANT

## Flow chart




***Raw material :-*** MALT is germinated cereals grains that have been dried in a process known as "malting". The grains are made to germinate by soaking in water, and then halted from germinating further by drying with hot air. Malting grains developed the enzyme required for modifying the grain's starches into various type of sugars, including the monosaccharide glucose, the disaccharide maltose. Malted grains are used to make beer, whisky etc. The purpose of malting is to create enzymes, break down the matrix surrounding the starch granules, prepare the starch for conversion. Malted barley is the source of sugars (principally maltose) which are fermented into beer. the process allows the grains to partially germinate, making the seed's resources available to the brewer. During germination enzymes in the aleurone layer are released, and new enzymes are created that break down the endosperm's

protein/carbohydrate matrix into smaller carbohydrates.

*Specification for barley malt :-*

1. Malt is a basic important ingredient for use in brewing and distilling industries. In addition, malt is used for preparing malt extract, malt vinegar, processed food meant for infants and children and medicinal preparations. To ensure that end-products are of an acceptable quality, it essential that malt should be of appropriate quality. Therefore, to make available malt of proper quality to the various group of consuming interests.

2. For preparing malt, barley is first steeped so that the moisture content is about 42 to 45 percent. Subsequently, it is allowed to germinate under controlled conditions for proper modification. The modified barley kernels are the killed in a current hot air. The green malt thus obtained, is dried at a temperature of 70 to 85℃to obtain malt of the desired quality.

Steps to produce ENA from MALT:

*FREEDOM FROM IMPURITIES: -*

FOREIGN MATTER— The proportion of all matter other than malt, culms rests, etc, shall not exceed 0.5% by mass.
DEAD BARLEY CORNS—Dead barley corns (kernels which have not germinated due to damage embryo or incomplete recovery from dormancy) in malt shall be not more than 5% by mass.
BROKEN KERNELS—The proportion of broken kernels (which are not whole) shall not exceed 0.5% by mass.

Barley malt shall be free from living insects and moulds and shall be free from dead insects, insects fragments and rodent contamination visible to eye (corrected, if necessary for abnormal vision) with the aid of suitable modification (not exceeding × 10).

*MASHING:-*

In brewing and distilling, mashing is the process of combining a mix of milled grains (malted barley) with water and heating this mixture. Mashing allows the enzymes in the malt to break down the starch in the grains into reducing sugars, typically maltose t0 create malty liquid called wort.

SACCHARIFICATION REST:-

The α-amylase rest is also known as the saccharification rest, because during this rest the α-amylase breaks down the starches from the inside, and start cutting off glucose one to four molecules in length. The longer glucose chains, some times called dextrin or maltodextrins, along with the remaining branched chains.

POT STILL:-

A pot still is a type of distillation apparatus or still used to distill alcoholic spirits such as whisky or cognac. Pot still operates on a batch distillation basis. Traditionally constructed from copper, pot stills are made in a range of shapes and sizes depending on the quantity and style of the spirit desired.

Process :-

During the first distillation, the pot still (or “wash still”) is filled about two-thirds full of wash with an alcohol content about 7-12%. The pot still is then heated so that the liquid boils.
The liquid being distilled is a mixture of mainly water and alcohol, along with smaller amount of other by-products of fermentation such as aldehyde and ester. Ethanol has a normal boiling point of 78.4°C, compared with pure water, which boils at 100°C. As alcohol has lower boiling point, it is more volatile and evaporates at a higher rate than water. Therefore, the concentration of alcohol in the vapour phase above the liquid, is higher than in the liquid itself.
During distillation, this vapour travels up the swan neck at the top of the pot still and down the lyne arm after which it travels through the condenser, where is cooled to yield distillate with a higher concentration of alcohol than the original liquid. This distillate is called “low wines” has a concentration about 21-23% alcohol by volume. These low wines can be further distilled a second time in a pot still to yield a distillate with a higher concentration of alcohol.

- Pot—Where the wash is heated
- Swan Neck—Where the vapour rise and reflux
- Lyne Arm—Transfer the vapour to the condenser
- Condenser-- Cools the vapour to yield the distillate

We have two pot stills namely Wash still and Spirit still, the feed of wash still is the fermented mash and the feed of the spirit still is the distillate of the wash still.

*Chemicals used for mash water :-*

| |
|---|
| $NaCl$ |
| $KNO_3$ |
| $Mg(NO_3)_2$ |
| $MgCl_2$ |
| $CuCl_2$ |
| $CaCO_3$ |
| $CaCl_2$ |
| $CH_3CHOH{\cdot}COOH$ |

These chemicals are added into hot water at 70°C for quality maintain and this water is mixed with grist.

Here rudiment yeasts are used, these yeasts are Dry yeast and Baker yeast since Dry yeast is most costly than Baker yeast which is bought from SOUTH AFRICA.

MATURATION :- The spirit still product receive in low wine tank no.2 ,and other m.s.v tanks then after that this is stored in containers having capacities 250 liters , these are the oak wood containers. that storage in oak wood for several years is known as maturation of spirit. the reason behind this is the flavour,and the oak wood absorb all the impurities from wood. thus, this matured spirit has better smell and efference.

In Rampur distillery there are 5 bottling units .
1. Civil bottling hall
2. defense bottling hall

3. G.S.P bottling hall
4.G.S.P Vodka bottling hall
5. country liquor bottling

SOME POPULER BRANDS OF RADICO.


Magic Moments! Launched in 2006, the brand became a rage overnight. The enthralling taste of Magic Moments, an international packaging not only set the town buzzing, but also unleashed the thirst for making every moment grand. Commanding over 50% market share across price points in Vodka category, it has reached the level of being the undisputed leader and a category driver for the industry. Produced from the finest grains, its triple distilling process is a mark of absolute purity that simply brings magic to life. This premium vodka is smooth and perfectly blends with your senses, giving an enriched taste. The spirit of Magic Moments can be celebrated with various tantalizing flavours that take excellence a notch up! No wonder, this remarkable brand of vodka is a millionaire brand of Radico Khaitan and has won many coveted laurels for the organization.


Indulge in the taste of excellence and experience the enriched XO blended premium brandy in the subline allure of Morpheus blue. A true embodiment of understated perfection. Named after the Greek God of Dreams. Its intense flavor leaves you with an epic aroma & rich aftertaste. This brand will provide an exotic experience to the Premium Brandy lovers.


This smooth blend celebrates success, friendship and the spirit of camaraderie even among rivals because when shared, even rivals become friends The brand offers a premium packaging which looks and feels like an International Scotch Whisky. The crystals on the bottle evoke a sense of class and luxury.


When a land is nurtured with the souls of Bravehearts, then royal pride shines through. Relaxed pastimes and sipping into life, are well deserved moments of immense pleasure. The breathtaking city of Jaisalmer is likened to a golden canvas, beckoning you to partake in its glorious history. Its vibrant streaks of color comes alive with stories of valiant princes, as its princely 15 gun salute ups the levels of royal pride to its highest. Dedicated to this spectacular way of life, Jaisalmer Indian Craft Gin harks back to an imperial age of Maharajas and Maharanis and their leisure moments. Befitting a state with many fascinating stories, our gin is a worthy experience with a chequered past that lives on in a new incarnation today.


A bright future demands unparalleled leadership qualities and bright minds. The spirit of brand Morpheus stands for those who Dare to Dream.Celebrate 10 years of master craftsmanship with Morpheus, India’s largest selling premium brandy. This richly-layered, sterling premium aged brandy is named after Morpheus, the winged Greek god of Dreams. Morpheus has a legacy of five Gold medals at the prestigious Monde Selection.


The journey of Pluton Bay is one of passion, a sense of adventure and a pursuit of excellence. It is a toast to the spirit of exploration as one sea captain said- "The spirits are now smoother to the tongue and have acquired a gold color during the voyage."

Pluton Bay is a spicy, dark brown exotic rum, smoother than any other. It's a promise of a million cheers for true lovers of quality rum.

## Conclusion

Fermentation processes utilize microbiological processes in producing chemical compounds but have an industry similar to all natural product processing. Those processes yielding simple structural chemicals, e.g. Ethanol, Butanol and Acetone are gradually being replaced by synthetic processes with chief and abundant raw materials. However, fermentation processes are still useful for production of complex structure, such as Citric Acid, Lactic Acid derived from low cost carbohydrate sources. The Starchy materials are usually grains like wheat bajra and sorghum which are not fit for human consumption are utilized since it saves a lot of economic burden from the company. These are primarily grain materials which are either infected or have got low quality or have been defected due to certain diseases. Even though they still contain starch which can be converted

to fermentable sugar during fermentation. But in the case of Barley malt these materials are carefully analyzed before milling to give a decent output as such analysis is done to check the moisture percentage and dust percentage in the materials. In conversion of the grain materials requires a series of processes which are; charging milling, liquefaction, saccharification, fermentation and distillation for recovery of alcohol. In milling process the grain is charged in huge filling sections known as silo. After charging the grain is sent for further processes known as liquefaction .In this process the hot steam treatment is given which helps in breaking up of the starch molecules bond. The starch molecule contains a complex structure of amylose and amylopectin which are linked through α 1-4 linkage and α 1-6 linkage. Hence these are very complex structures which are very difficult to be broken. The slurry of the material is prepared by mashing at different levels and as such the process is completely exposed to varying temperature difference following which the material completely turns to easy fermentable sugar. The yeast employed for the purpose is Saccharomyces cerevisiae which is known as top fermenting yeast as it reaches to the top column of the fermenter. The complete fermentation lasts for about 40 -42 hours and the specific gravity comes around 1.010 to 1.001. The complete process yields 80 KLPD of alcohol. The obtained result after fermentation is almost 8-9 % in the fermented wash .This wash is then sent for distillation in the distillation column to obtain almost 95 % of ethyl alcohol known ENA (extra neutral alcohol).The obtained alcohol is then sent to the blending unit of the distillery to get the required products. Grain generated products are usually more expensive owing to the fact that the whole process requires much more quality and generated spirit is of very high quality.27 In malt spirit plant the process in some manner is similar to grain but in malt spirit plant grains are allowed to sprout and then their moisture is removed to obtain moisture free grains .This process is known as malting in which soaking of the seed allows embryo activation and as such during mashing their is no need to add enzyme alpha amylase. After malting the material is sent to the milling sections to obtain raw material in the form of middle, coarse and fine. Only amyl glucosidase is added to obtain mashed wort. This wort is collected by treatment of grains by varying levels of hot water treatment which helps in breaking of the starch bonds. This process is known as cooking. The collected wort is sent for fermentation which gets over in 40 - 42 hours and results in 8- 9 % of alcohol in the fermented wash. This wash is then sent to the distillation column for obtaining malt generated spirit. The Molasses of 86-90ºC Brix with an average PH of 5.5 is received from different sugar factories. This Molasses is first received in pucca pit and from it the molasses is pumped to the storage M.S. steel Tank. Molasses is allowed to settle in the storage steel tank for 15 days and from here it is pumped to the Fermentation House. In the Fermentation House the Molasses is diluted with water to a required gravity thought a semi-automatic diluter. In the yeast vessels and bubs specific gravity of 1.040 is maintained and the fermenters are set up at about 1.100 gravity. The yeast from the laboratory is taken in a 4 gallons capacity yeast vessel to Fermentation House. It is first developed in sterilized molasses solution of wort of 1.040 degree sp. gravity for 12 hours. Before adding the yeast the molasses is sterilized in the yeast vessels, by steam coils inside the vessel. Air is supplied throughout the period for propagation of yeast From the yeast vessel the yeast it developed in Bub having wort of sp. gravity 1.040 Aeration is done in the Bubs. Sulphuric acid (commercial goods) Ammonium sculpture and urea are added in the yeast vessel and Bubs. After 12 hours yeast culture is transferred from the bubs to the fermenters. High gravity fermentation is being followed. The set up gravity is about 1.100. The duration of fermentation in the Fermenters is about 20 to 24 hours. After the Fermentation, the wash is pumped to the Distillation House with the help of wash pumps. First the wash is received in an overhead wash charger. Then the wash is passed in Beer Heater. The wash gets heated by the vapors coming from the rectifier top. The temperature of wash becomes 62-64ºC. This heated wash is now passed through the plate type heat

exchangers due to which it's temperature rises to 88-90ºC and this heated wash is now fed to the top of the analyzer column. Steam is applied to the bottom of the column. The rising vapours are then feed to the bottom of Rectification column. From the top of the Analyser column alcohol vapours are fed to the Aldehyde or Head column from where Head spirit (impure) is obtained after its condensation in the condensers. 28 In the Rectification column further rectification takes place and the rich alcohol vapours are sent to the preheater or Beer Heater from the top of the Rectifier. The vapors get condensed in it. The remaining vapors are passed to Main secondary and vent condensers. The condensate of all the condensers (i.e. reflux) including Beer Heater is again sent to the top of the Rectifier to increase the strength of alcohol and also to maintain temperature at top plate. The draw of RS is then taken from the second last plate (i.e. from the plate cost below the reflux plate) at a temperature of 78ºC. The RS is then brought to the room temperature by passing it in the cooler. Thus RS spirit, Heat spirit and Vent spirit are obtained as our desired product. In addition to this fusel Oil from 2nd to 9th plate at a temperature or 90-95ºC is also obtained in the fusel oil Decanter. The liquid left in the bottom of the Analyzer column, which is without any alcohol is drain away as spent wash (.e. effluent) similarly the liquid left at the bottom or rectifier column is taken in an exhaust column so as to recover the last drop of alcohol present in the liquid. Finally from the exhaust column the liquid is drained as spent lesse. Spent wash is sent to the effluent treatment plant to produce biogas by methane recovery plant and also to produce bio compost by bio composting. To conclude we can say that alcohol in the coming era will be a good source in the form of biofuel when petroleum and other fuels become a problem for mankind .Also in the coming time the myths regarding consumption of alcohol will be shattered as now the researches are proving that alcohol helps in curing heart diseases and other diseases related to heart. It is apparent from the foregoing discussion that the selection of feedstocks for ethanol production will vary from region to region, and even from farm to farm. The results of development work now being carried out will influence choices but, most significantly, the additional choices open to farmers resulting from the opportunity to produce feedstocks for ethanol production from a large variety of crops will alter the patterns of farming. It is not possible to predict what new patterns will evolve. However, it is clear that there will be benefits from the creation of choices in the form of new markets for existing crops and alternative crops for existing markets. In the near future, ethanol is likely to be produced primarily from grain. However, the development of processes for the effective use of other crops should yield results in the near term which could bring about a rapid increase in the use of nongrain feedstocks. The above study done was to obtain the idea and principles behind the fermentation process that yields alcohol. This project allowed me to venture and get a knowledge of the various methods of preparation of alcohol production through starchy and saccharine materials while it also allowed me to get an industrial exposure in an alcohol producing industry which helped me to grasp knowledge regarding biotechnological aspects and the techniques, methods that are adopted for production of alcohol on large scale.

----------THANK YOU----------