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STUDY OF SUGAR REFINING PROCESS THROUGH TOTAL PRODUCTIVE MAINTENANCE ON CENTRIFUGAL FOLLOWED BY ION EXCHANGE, PAN & CRYSTALLIZATION.

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Abstract. This paper studies the sugar refining process through total productive maintenance. The primary goal of this project is to examine the Sugar Refining Process (i.e., the conversion of raw sugar to refined sugar) using total productive maintenance. In this project, we will walk you through the process of obtaining raw sugar, melting it, and finally obtaining refined sugar in a step-by-step manner. We also go over the sugar analysis methods used, as well as the eight pillars and 5S foundation of total productive maintenance on raw sugar, refined sugar, and process intermediate quality. Overall fruitful management is the method of utilizing tools, personnel, resources, and auxiliary procedures to preserve and enhance the reliability of the manufacturing line and framework excellence.

Index Terms – sugar refining process, total productive maintenance

I. INTRODUCTION

After being extracted at a mill, sugar is refined at a refinery.
This is sucrose in its most purified, transparent, and white-lustrous granular state. Industrial production of this sucrose is done for a variety of uses. It has a minimal polarisation of 99.7 grades and can comprise up to 0.3% non-sucrose compounds. When raw sugar is delivered to the factory, it has still undergone the initial purification process at a mill. Particulates persist despite being pulverised, saturated, heated, and twisted. Since it includes syrup and imperfect glucose granules, sugary at this level is not edible. It is sold on the ICE contracts No. 11 sugar instrument and categorised as having polarisation less than 99.5 degrees.
The goal of quality maintenance is to keep and constantly improve the quality of equipment. At high rotational speeds, this is the most dynamic type of machinery used in sugar production. At speeds of up to 1200 rpm, the centrifugal spins the massecuite in a perforated basket.

ABOUT PRODUCT DETAILS BEFORE MANUFACTURING:

- Product – Raw Sugar
- Colour – 800 – 1200 IU
- Polarization – 99.0 – 99.49 Z
- Moisture = <0.2%
- Ash = <0.2%

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AFTER MANUFACTURING:

- Product - Refined Sugar
- Colour - <45 IU
- Polarization - >99.8 Z
- Moistur - <0.06%
- Ash - <0.027%

SUGAR REFINING PROCESS

MELTING

Melting is the first process that raw sugar goes through. While brushes and strainers remove impurities and coloration, in hot water, the sucrose is mixed until it dissolves to the required consistency. Sugar syrup is the end result. In carbonators, calcium hydroxide, also called as milk of lime, is mixed to the liquefied sucrose combination and brought to a boil stage. In a receptacle with specific dimensions, carbon dioxide is circulated through the combination. Proteins, wax, and lubricants are among the organic substances that the gaseous occludes — or shuts out — by reacting with the limestone to create tiny, solid calcareous fragments. The purified combination is now a brilliant or light golden beverage, brown or honey in coloring. Pressure filters and de-sugar sing filters remove the suspended calcium carbonate as well as other impurities.

VACCUM PANS

At this point, a low-sugar-content by-product of press-cake is formed, while the filtered, or pure rainwater, moves on to the following step of purification. To further purify and shift inorganic debris, Filtration composed of tiny biochar or native carbon particles are used to purify the pure water. This process also 'decolorises' the sugar, rendering it transparent and faintly coloured so that moreover reworking is possible. The liquid is now being concentrated and crystallised in vacuum pans. To reach accumulation, it is circulated across a succession of exchangers.

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ION EXCHANGE

CRYSTALLIZATION

To begin the crystallisation process, fine seed crystals are added, which is done in three stages. The process is terminated when the crystals reach the desired size. The initial precipitation, referred to as A impact, produces crystalline sucrose and a viscous watery byproduct called A jaggery. This is further refined to produce a B impact and a B grade sugarcane. Brown sugar preserves and C quality sucrose are made by repeating this procedure. It is a thick, black substance that cannot be economically crystallised using conventional methods.

Crystals of crystallization.

CENTRIFUGAL

Crystals are separated from molasses using a centrifugal separator. In sedimentation, sugarcane is spun through holes in a pierced wicker; the sugarcane is forced through the holes by centrifuge, while the sucrose is left on the bowl side. In a high rotational machinery, the rotational energy applied to a collection of sucrose grains encircled by different liquors results in the extraction of the liquid solution from the sugary granules.

To ensure quality, safety, and performance, The spinning container is produced using complex manufacturing procedures and unique high quality corrosion-resistant alloy steels. A flawless concentricity and turmoil rotational action are guaranteed by the completely polished hopper. The right amount of draining openings guarantees effective sugar release and a lengthy service lifetime for the container. The spindle is made of high-quality steel that has been ground and polished all over. The unique design eliminates the effects of stress concentration. The sugarcane cleaning method consists of cleaning pipelines with specialised tools that equally spread liquid fluids over the sugary tower's covering. This guarantees minimal liquid usage, high crystalline output, and consistent sugary cleaning. Continuous process implementation in manufacturing is one factor that ensures efficiency.

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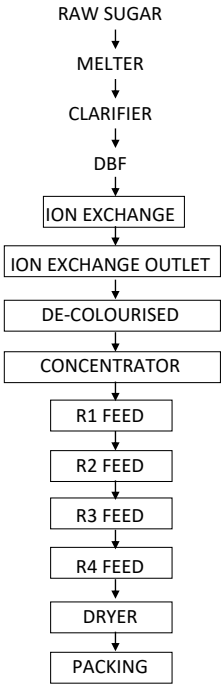
Continuous centrifugals from bma ensure continuous output with maximum throughput and even more in sugar production.

II. PROCESS FLOW CHART



TOTAL PRODUCTIVE MAINTENANCE

The term "TPM" alludes to the partnership among manufacturing and upkeep that aims to constantly raise the level of merchandise reliability, capability, and operating excellence. The Japanese established and refined the idea of Total Quality Management in reaction to repair and assistance issues they experienced in the factory setting. Another objective fueling TPM growth is an offensive approach targeted at truly humanising the operation and architecture of industrial machinery. Zero Product Errors, Zero Apparatus Unexpected Breakdowns, and Zero Mishaps are the three objectives of TPM.

EIGHT PILLARS OF TPM

We require strong pillars. That brings us to the eight TPM pillars, or basic TPM principles. Implementing them is critical not only for enabling TPM but also for ensuring its long-term viability**.**

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FOCUSSED IMPROVEMENT

TPM's first pillar is focused development. The top objectives are improvement, improvement, and improvement. To prevent the waste of resources such as tools, skill, natural resources, and power, the complete staff must embrace this purpose. The staff needs to be aggressive, receptive to fresh perspectives, and anxious to gather all over the conference to discuss issues.

AUTONOMOUS MAINTENANCE

Autonomy is the 2nd pillar of TPM in the notion that each staff acts as an independent "maintenance agent". Everyone does have the power to look after the things they deal with by cleaning, checking them, and doing their part. By doing this, all machinery is preserved, initial discovery process is improved, and support workers can focus on more challenging jobs. Become extra knowledgeable about automated upkeep and how to use it.

QUALITY MAINTENANCE

To create "0" faulty items is one of TPM's major objectives because this has a clear impact on client happiness. As a consequence, standard assurance and the execution of core operations for product testing constitute some other cornerstone. We suggest several root-cause evaluation methods to address issues.

PLANNED MAINTENANCE

The most efficient method to minimize delays and failures is practical completion, whether it is reactionary or proactive. In order to guarantee excellence, prevent client problems, and enhance conformance, keep all tools operating at peak efficiency. Machinery shutdown-required repair should be carried out upon normal business minutes.

EARLY EQUIPTMENT MAINTENANCE

Early equipment repair is one of the TPM strategy's eight pillars of success. When choosing new equipment or creating new goods that render servicing simpler, take into account prior experiences. This can be as easy as choosing wall paint that is washable (which makes cleaning simpler) or as difficult as choosing a robot with self-diagnosis capabilities (which improves production).

TRAINING AND EDUCATION

Investment in education and training is necessary for TPM. Otherwise, it would be difficult to trust each employee with routine upkeep or prevention. To operate, TPM needs to have a basic understanding of asset maintenance for assets that are used on a regular basis. Additionally, given how rapidly technology changes, ongoing instruction is the only way to guarantee that your employees are knowledgeable about the latest tools and industry standards.

SAFETY, HEALTH AND EVINRONMENT

TPM aims to have 0% burnout, pollution, or accidents at work. In addition to preventing accidents during system maintenance, effective work management also promotes the health and welfare of all employees.

OFFICE TPM

The eighth and final pillar is office TPM. This means that instead of leaving it to the "worker bees," administrative workers and managers should pitch in. From logistics to scheduling, everyone must be proactive and focused on improvements.

5S METHODOLOGY IN TPM

It is a technique that keeps the workplace neat, uncluttered, secure, and well-organized in order to lessen waste and encourage creativity. It aims to support the creation of a supportive workplace that is both physically and psychologically stimulating.

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Sort

Remove unnecessary things to shorten the time needed to find something. lessen your chance of getting sidetracked by unimportant things. Make examination easier. Increase the quantity of usable space that is accessible. Remove barriers to improve safety. Examine every object in a space to see if it is helpful or necessary to have it there. As soon as you can, take away anything superfluous. Those that can't be removed right away should be put in a "red tag region" so they can be taken out later with ease. Clear the workspace of all materials besides those required for production.

SET IN ORDER

Make the process as straightforward as you can. Set up work areas so that all tools and equipment are nearby, readily accessible, and arranged logically according to the type of work being done. Parts should be arranged as according their planned use, with the parts that are used the most frequently placed nearest to the work area. Place all essential items in a convenient location. Make finding and acquiring necessary items easy. Items ought to have set positions. To make it simpler to locate lost items and to return things to their rightful places, use correct labels, notes, or clues.

SHINE

Improves the efficiency and safety of something like the production process, reduces waste, and prevents mistakes and shortcomings. Sustain a safe and easy-to-work-in surrounding

.Maintain a clean and pleasant job atmosphere. When in place, anyone unfamiliar with the environment must be able to detect any problems within 15 m (50 ft) in 5 seconds.

STANDARDIZE

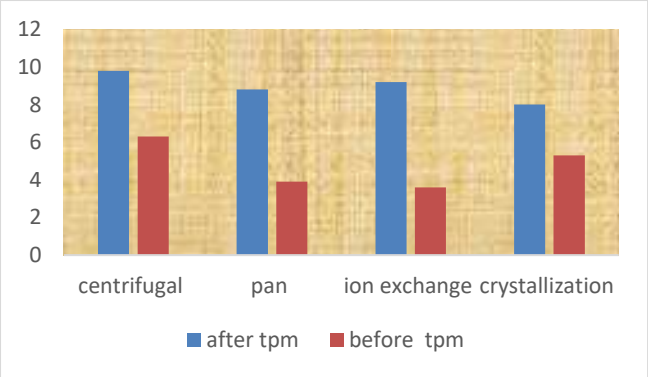
Establish procedures and timetables to ensure that the first three 'S' practices are repeated. Create a work structure to support the new practices and integrate them into the daily routine. Ensure that everyone understands their roles in sorting, organizing, and cleaning. Use photos and visual controls to keep things in order and audit checklists, regularly assess the status of 5S implementation.

SUSTAIN

Workers' self-discipline is employed to develop processes that can be sustained. "Do without being told" is another translation. Ensure that the 5S method is used. Plan training sessions. Conduct regular audits to ensure that all defined standards are implemented and adhered to.

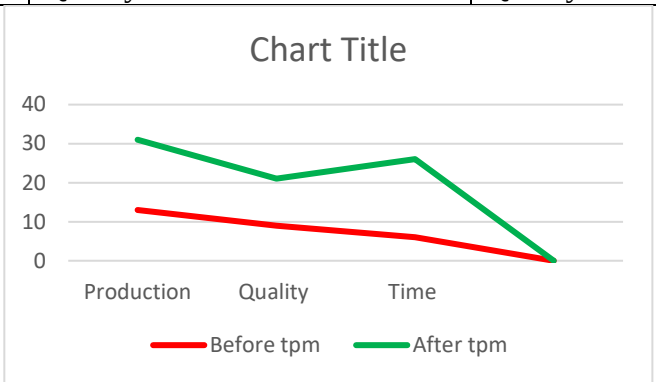
When possible, make improvements. Employee feedback can be extremely beneficial in identifying areas for improvement.

STATISTICAL ANALYSIS



s.no	Sugar refining process	Before tpm	After tpm
1	Centrifugal	Continuous breakdown & less efficiency in operating machine	It improves machines overall efficiency and production without breakdown
2	Ion exchange	Always nozzles leakage and sugar syrup wastage	Arrest of leakage in nozzles
3	Crystallization	Low pressure and regular valve	Pressure gives very accurate and

		problems	required
4.	Production	Sugar production up to 1350 kgs per hour	Production increases up to 1500 kgs per hour
5	Quality	Quality was moderate	Quality is massive &immoderate



RESULTS AND CONCLUSION

Implementing total productive maintenance in the sugar refining process yields good quality standards with 5s and 8 pillars process in refinery falls under total productive maintenance. TPM is a critical concept and fundamental technique for maximizing profits. For some businesses, TPM may be the only thing that stands between success and total failure. It is a real strategy that works. Employees must be properly trained in order to maintain an autonomous flow of maintenance as a serious activity for improving equipment effectiveness. Everyone should do their part and avoid making minor errors in routine work. It increases production and quality rate, previously its production was slow and quality of work was low, but after introducing total productive maintenance in the sugar refining process through making the quality stands and gives good results.

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