

Refurbishment of Coir Fiber Extraction Machine with Process Change for Enhanced Productivity

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Abstract : The devastating floods of the century during the month of August 2018 had inflicted immense damage to the lives of people and property in Kerala. Mala DFWICS Ltd R 614, a SC/ST coir co-operative under the Project Office – Thrissur, Kerala, India engaged in the fiber extraction process were severely affected during the floods. The entire society buildings and machinery were submerged in the flood waters for six days. All the machinery got damaged as a result, rendering the unit non-operational. After careful examination of the present condition of the machinery and electrical systems at the Mala DFWICS Ltd. R 614, it is proposed to refurbish the machine to make the unit operational with an enhanced capacity of 15000 coconut husks per 8 hours. Accordingly, the refurbishment of the fiber extraction unit started from Jan 2020 and completed by June 2020. The functionality of the system has been tested and verified. A test of run of 30000 husk was performed for the verification purposes.

Index Terms— Coconut husks, Fiber extraction, Machine, Flood, Nonoperational, Refurbishment. (key words)

I. INTRODUCTION

Fiber extraction machine is one the equipment used to extract coir fiber from green and dry coconut husks. The coir fiber extracted is further utilized for the production of coir yarns, coir ropes, coir mats and coir mattings. The devastating floods of the century during the month of August 2018 had inflicted immense damage to the lives of people and property in Kerala. Mala DFWICS Ltd R 614, a SC/ST coir co-operative under the Project Office – Thrissur engaged in the fiber extraction process was severely affected during the floods. The entire society buildings and machinery were submerged in the flood waters for six days. All the machinery got damaged and as a result, the unit became non-operational. The Department of Coir Development, Kerala along with support of CMD-PMU initiated to conduct a feasibility study to make the Fiber Extraction Unit operational with an enhanced production capacity of 15000 husks per 8 hours shift by refurbishing the existing machinery.

II. METHODOLOGY

Site visits at the Mala DF unit was conducted. The exact condition of the fiber extraction unit was checked and the possibility of restoring them to working condition was evaluated. Site visits have revealed that the unit has been severely affected by the flood. All machinery and the electrical installations were inundated by the flood waters for six days in August 2018. The machines were found to be in rusted and silt covered conditions. Electrical lines and installations are also found to be severely damaged. The flood affected condition can be understood by the following photographs.



Fig 1 Fiber Extraction Unit



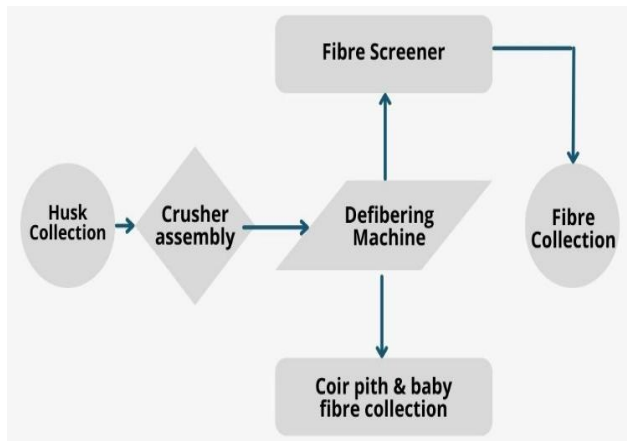
Fig 2 Conveyors and Motors



Fig 3 Electrical Panel

After careful examination of the condition of the machinery and electrical systems at the Mala DFWICS Ltd. R 614, concluded that it is possible to refurbish them to make the unit operational with an enhanced capacity of 15000 husks per 8 hours. However, certain pre-works like sand blasting of the machinery may be needed to identify the required parts for refurbishment.

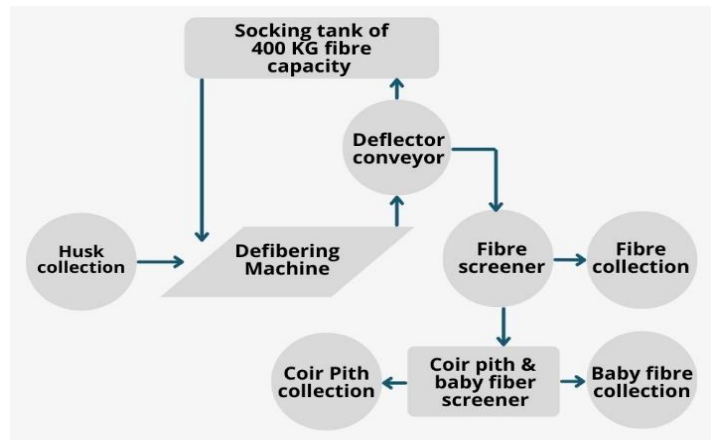
In addition to this refurbishment, a new fiber extraction process is being developed to replace the existing one in order to improve fiber quality.



Layout 1 Existing Defibering process layout

The current fiber extraction process includes a 15 HP crusher assembly for pre-crushing the husks prior to fiber extraction, a 20 HP defibering machine for extracting fiber from crushed husks, and a 1 HP fiber screener. There were no mechanisms in place to separate coir pith and baby fiber. Because of the mixture of baby fiber and coir pith, the value addition of coir pith was difficult. The total daily production capacity was 10,000 husks.

This proposed layout is designed to increase processing capacity with superior fiber quality. Process modifications were made by removal the crushing operation from line and introduced a soaking mechanism. Initially beaten fiber is traversed to soaking tank and immersed for a period of 1 hr. The power rating of the defibering machines has been enhanced to 30 hp for increased productivity. The soaking tank is capable to accommodate 400 kg of fiber obtained after initial beating operation. After one hour soaking the fibers are again fed to the DF machine for second beating process. Defecting change over mechanism is incorporated in the system for easy operation of the first and second DF operation. With the newly proposed process line, the fiber quality has been enhanced with minimal breakage and impurities. As a result, superior quality fiber can be expected. With this proposed plan, the production capacity can be increased to 15000 husk per day. 2 HP fiber screener is suggested to remove excess pith attached to it. A separate screener of 2 HP is also proposed in this setup for the separation of baby fiber from coir pith.



Layout 2 Proposed Defibering process layout

III. REFURBISHMENT

The following are identified as the main activities required for the refurbishment of the machinery and electrical system

1. Machinery

- Removal of Crusher unit from the process line to reduce operating time.
- Sand blasting of the beater machine, willowing machine, rollers, conveyor path, etc.
- Enhancing the capacity of beater machine.
- Addition of new arms to beater shaft to get more output and better fiber.
- Replacement of new shaft to the beater machine due to rusting.
- Replacement of blades to improve the quality the fiber.
- 50/50 Square bars are to be welded to get stronger husk beating.
- Replacement of GI sheet to cover the machines.
- Replacement of plumber block of the beating shaft.
- 18 Gauge GI sheet is required to be used for covering the screener.
- SQR rod of 25*25mm thick is need to be used to support the GI sheet for the screener and Beater machine.
- Reduction in pulley size to reduce the amount of force needed to lift a load.
- Around 4 pulleys are need to be used in a way that they would reduce the amount of force needed for the transfer of fiber from one place to another.
- 4/8 mesh is to be used to for screener to separate fiber and pith.
- For the transfer of fiber, conveyor belts are need to be replace from beater machine to screener.
- Welding: The type of welding was assessed and found to be TIG welding. It has a shorter life span and are proved to be not ideal for the particular type of machinery being used in the DF unit. Therefore, TIG welding will be replaced with MIG welding so as to produce high quality welds much faster.

2. Electrical

- Installation, testing and commissioning of MSB Panel
- Replacing 20hp +1.5hp motors (2 no.s)
- Incomer cable – 50 Sq.mm
- Outgoing cable – 35 Sq.mm
- Outgoing cable 2 – 25Sq.mm
- Installation, testing and commissioning of DB Panel
- Outgoing cable -4 Sq.mm
- Earthing
- MSB – 25*3 Cu Strip
- DB – 10 SWG

- 50HP -25*3 Cu strip
- 40HP – 4 SWG
- 5 HP- 10SWG
- Associated earthing rod, fixtures ,inter connections
- Building + office room lighting
- Tube light – 18w
- Wiring cable – 1.5Sq.mm
- Switches & switch board conducts and associated clam

It was estimated that the whole refurbishment process will involve 60 days of activities. The refurbishment of the DF unit started from Jan 2020 and completed by June 2020. The whole bearings of crusher machine, screener and conveyors were replaced Pulleys, Motors, Belts (Fenner), Beating Blade (10mm MS plate), Beating Arm (10mm MS plate) were replaced. New screener to separate pith and fiber was fabricated. New conveyor is added to screener. Replaced all nut and bolts with locknuts (TVS). Added relief valve in the hydraulic press bailing unit. Replaced all sealant in the hydraulic press unit. Gearbox overhauling was executed. Completed the whole electrical wiring. 3 x 2HP motors (Crompton) was replaced. A motor upgrade of 20HP to 30HP was completed to increase the efficiency and enhanced the productivity from 10000 husks to 15000 husks in 8hrs shift. A new panel board was installed. All refurbishment was done by re welding with EA7018 electrode. Dust protection cover was installed. Completed sand blasting to crusher, screener, and roller parts. Plywood is added to prevent overflow of fiber from the conveyor. The husk feeder is modified.

The functionality of the system has been tested and verified. A test of run of 15000 husks was performed for the verification purposes. Below mentioned are some of main changes performed to DF unit.



Fig 4 Refurbished Fibre Extraction Unit



Fig 5 Screener



Fig 6 New Screener and Willowing unit



Fig 7 Panel Box

IV. CONCLUSION

The refurbishment of the DF unit is successfully completed within the budget allotted and timeframe given. All the tests and inspections of the DF unit are completed and is handed over to the respected authorities. The refurbished system is now capable of fiber extraction of 1000 husks in 35 minutes.



Fig 8 Before



Fig 9 After

V. ACKNOWLEDGMENT

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