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OPTIMIZATION OF PRODUCTIVITY IN AGRO INDUSTRIES USING RELIABILITY CENTERED MAINTENANCE

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ABSTRACT

India is one of the second largest producer of rice in the world. Nearly 70% of the population depend on agriculture and agro-based industries. The main drawback of this industry is high maintenance cost and low production. To overcome this problem the Reliability Centered Maintenance (RCM) method is used. In this method was developed by the aircraft industry only. This is the first time used in the agro industry. The proposed method is to consider one agro industry and calculate three months daily analysis. The effectiveness of this project is to compare with previous analytical report and RCM method.

Keywords- Reliability centered Maintenance (RCM), Criticality Analysis (CA), Failure Mode and Effects Analysis (FMEA) etc.,

I. INTRODUCTION

Maintenance is defined as an action or combination of actions carried out in routine or recurring manner to replace, repair, modify, service the component or group of components of a plant and machinery for keeping a particular machine or system in its normal operating condition so that it continues to operate at a specified availability for a specified period. Maintenance has a number of functions as the efficiency and life of man, machine, equipment, building and plant depends on the nature of working environment used for particular production system etc....Proper maintenance will reduce the deterioration of life of the equipment; help to keep it in good working condition which will help to achieve the production target.

R.Paranthaman, K.Alagusundaram and J.Indhumathi India Institute of Crop Processing Technology, Thanjavur, Tamil Nadu, India Production of Protease from Rice Mill Wastes by Aspergillus niger in Solid State Fermentation On the light of the obtained results, it could being the log phase of the growth of the fungus for concluded that fermented PONNI rice broken fungus Aspergillus niger at 35°C for 72 h and pH 7.0 are the most suitable conditions for protease production [1]. Kanlayakrit, Wand Maweang, Faculty of Agro-Industry, Kasetsart University, Bangkok, Thailand,2Center of Excellence on Agricultural Biotechnology Bangkok,Thailand,3Department of Agro-Industry, Faculty of Agriculture,Ubon Ratchathani University, Upon Ratchathani,Thailand,Postharvest of paddy and milled rice affected physicochemical properties using different storage conditions Storage of paddy and milled rice at warehouse condition for ten months revealed the highest change in the gel consistency, elongation ratio and RVA pasting properties. However, the obvious change in the physicochemical properties was observed in Kalasinthan, KhawDokMali [2]. Kazuhiko itoh, Shuso Kawamura andYoshinori ikeuchi Department of Agricultural Engineering, Faculty of Agriculture, Hokkaido University, Sapporo, and Japan Received May 13, 1985 Processing And Milling of Parboiled Rice. This study was carried out in order to obtain fundamental data for the parboiling process and milling of rice [3]. Er. Banshari Rath, Prof B.K.Mangaraj and Dr.Bishnu Prasad Mishra Manager (Electrical), Idco, Idco Tower, Janpath, Bhubaneswar, Odisha, India, Fuzzy Logic Based Simulation for Modeling of Sustainable Marketing Policy for Modern Rice Mills in Odisha Rice mill up- gradation and installation of new modern rice mill in Odisha will produce rice of national as well as international standard. The slow procurement and marketing problems associated with rice will be solved permanently with increase of rice mills in strategic places with calculated manner. The logistics associated with procurement of rice mills and paddy can be developed [4]. R. P. Kachru Asst. Director General (Process Engineering), Indian Council of Agricultural Research, New Delhi, Agro-Processing Industries in India—Growth, Status and Prospects minimize product losses ,add maximum value, achieve high quality standards, keep processing cost low ,ensure that a fair share of added value goes to the producer[5]. K.Laxminarayana Rao, Food and Agriculture Organization of the United Nations Rome, 2006 Agro-industrial parks Experience from India. The establishment of dedicated industrial estates started in the southern states of India during the 1980s. An exclusive industrial estate for pharmaceutical industries was established in Tamil Nadu State and included the construction of sheds, a common effluent plant, and power plant [6]. Mrs. P. Nalini Assistant Professor (Senior Grade), Department of MBA, Velalar College of Engineering and Technology, Erode, Problems & Prospects of Rice Mill Entrepreneurs – The Conceptual Framework, The literature survey depicts the common problems faced by Entrepreneur and individual characteristics required for entrepreneurship and external supports need from external environment also. And from above conceptual work key factors for the research work is identified pertinent to the problems and prospects of rice mill entrepreneurs [7].

II. RELIABILITYCENTERED MAINTENANCE

When RCM is used for agricultural the methodology is applied by the rice manufacturer. The preventive and predictive maintenance outcomes are written into the mill's operating and maintenance procedures that every agro industries owner is required by international law to adopt and follow. The manuals are rigorously adhered-to by highly skilled, licensed and independently tested technicians. What the Rice manufacturer sets down in the Agro industry maintenance schedule the operator must do at penalty of legal action resulting in goal and fines for noncompliance.

III. CRITICALITY ANALYSIS

The Criticality Analysis (CA) provides relative measures of significance of the effects of a failure mode, as well as the significance of an entire piece of equipment or system, on safe, successful operation and mission requirements. In essence, it is a tool that ranks the significance of each potential failure for each component in the system's design based on a failure rate and a severity ranking. This tool will be used to prioritize and minimize the effects of critical failures early in the design.

The RCM outcomes that require design changes are the paddy manufacturer's responsibility to do and to then disseminate throughout the fleet. Every design change approved by the regulating machines must be made by the agro industries operator. Improvements in agro industries equipment and in operating and maintenance practices naturally result by the design of the regulated system in-place.

In the agro industry there is no choice of when a scheduled-maintenance task is done, nor of what will be done, nor of how well it must be done. When an agro machine or agro frame reaches the scheduled the plant must be brought in for maintenance. Already the decision has been made by the manufacturer of what parts to replace during the outage and what parts to inspect for condition. If an on-condition inspection finds a problem the plant cannot return to service until the issue is corrected. There are no options to run the plant.

A. Types of RCM

The RCM analysis may be carried out as a sequence of activities. Some of these activities, or steps, 1. Study operation 2.System selection and definition 3.Functional failure analysis 4.Critical item selection 5.Data collection and analysis 6.Failure modes, effects and criticality analysis 7.Selection of maintenance actions 8.Determination of maintenance intervals 9.Preventive maintenance comparison analysis 10.Treatment of non-critical items 11.Implementation 12. In service data collection and updating.

B. Formulae

1. Availability= {Available Time-Plant down Time}-{Break down+ Change over time} /Available Time-Plant down time
2. Performance efficiency = Actual Production/Rated Capacity
3. Rate of quality = Actual Production-Rejected in Maintenance/Actual Production
4. OEE = Availability x Performance efficiency x Rate of quality
5. Watts = Actual load in Amps x 415V x 0.92
6. Units/hr = Watts/1000
7. Actual KVA = Actual load in Amps x415 V/ 1000
8. Connected KW = Power in HP x 0.75
9. Power Factor = Actual KVA/ Connected in KW

a) The CA can be performed using either a quantitative or a qualitative approach. Figures identify the categories for entry into their respective CA using DA Forms 7611 and 7612, respectively. Availability of part configuration and failure rate data will determine the analysis approach. As a general rule, use figure when actual component data is available and use figure when no actual component data or only generic component data is available.

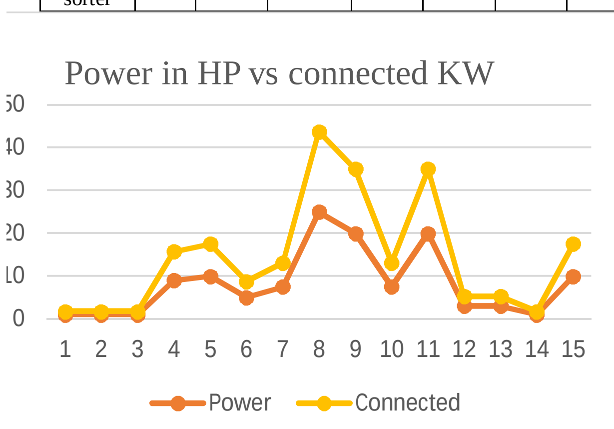
b) Figure is a representation of the different levels of data that a facility may have. Depending on the level of data available, the analysts must determine which approach they will use for the CA. The areas where there are overlaps between quantitative and qualitative, the analyst will have to assess what the expectations are for conducting the analysis to determine which approach will be used.

IV. FAILURE MODE EFFECT AND CRITICALITY ANALYSIS

The FMECA is composed of two separate analyses, the Failure Mode and Effects Analysis (FMEA) and the Criticality Analysis (CA). The FMEA analyzes different failure modes and their effects on the system while the CA classifies or prioritizes their level of importance based on failure rate and severity of the effect of failure. The ranking process of the CA can be accomplished by utilizing existing failure data or by a subjective ranking procedure conducted by a team of people with an understanding of the system. Although the analysis can be applied to any type of system, this manual will focus on applying the analysis to a C4ISR facility. The FMECA should be initiated as soon as preliminary design information is available. The FMECAis a living document that is not only beneficial when used during the design phase but also during system use. As more information on the system is available the analysis should be updated in order to provide the most benefit. This document will be the baseline for safety analysis, maintainability, maintenance plan analysis, and for failure detection and isolation of subsystem design. Although cost should not be the main objective of this analysis, it typically does result in an overall reduction in cost to operate and maintain the facility.

V. MACHINERY REPORT

Machinery Name	Power in HP	Actual load in Amps	Standard load in Amps	Power in Watts	Unit /hr	Actual KVA	Connected KW	Power factor
Boiler	1	1.7	2	649.06	0.65	0.7055	0.75	0.941
Elevator	1	1.5	2	572.7	0.57	0.6225	0.75	0.83
Dryer	1	1.5	3.5	572.7	0.57	0.6225	0.75	0.83
Dryer	9	30	35	11454	11.45	12.45	6.75	1.844
Dryer	10	32	35	12217.6	12.22	13.28	7.5	1.771
Paddy cleaner	5	6.5	7.5	2481.7	2.48	2.6975	3.75	0.719
Sheller	7.5	10	15	3818	3.82	4.15	5.625	0.738
Huller	25	35	40	13363	13.36	14.525	18.75	0.775
Rice whitener	20	25	30	9545	9.55	10.375	15	0.692
Blower	7.5	10	12	3818	3.82	4.15	5.625	0.738
Silky polisher	20	25	30	9545	9.55	10.375	15	0.692
Blower	3	4.3	5	1641.74	1.64	1.7845	2.25	0.793
De stoner	3	4.2	5	1603.56	1.60	1.743	2.25	0.775
Cylindrical grader	1	1.5	2	572.7	0.57	0.6225	0.75	0.83
Rice colour sorter	10	13	15	4963.4	4.96	5.395	7.5	0.719



VI. ANALYTICAL REPORT

Overall Efficiency report for the DAY shift of January'14

Date	Available (a) Time	Plant Down Time(b)	Breakdown (C)	Change over time(d)	Availability	Actual Prodction	Rated Capacity	Performanc Efficiency	Rejected in MT	Rate of Quality	OEE
1/1/2014	0	0	0	0	0	0	0	0		0	0
2/1/2014	8	0	1	0	0.875	14	32	0.4375	0	1	0.3828125
3/1/2014	8	0	0	0.5	0.9375	16	32	0.5	0	1	0.46875
4/1/2014	8	0	0	0	1	16	32	0.5	0	1	0.5
5/1/2014	8	0	0	0	1	16	0	0	0	1	0
6/1/2014	8	0	0	1	0.875	15	32	0.46875	0	1	0.4101563
7/1/2014	8	0	0	0	1	16	32	0.5	0	1	0.5
8/1/2014	8	1	0		1	14	32	0.4375	0	0	0
9/1/2014	8			0.5	0.9375	16	32	0.5	0	1	0.46875
10/1/2014	8		2		0.75	12	32	0.375	0	1	0.28125
11/1/2014	8	1			1	14	32	0.4375	0	0	0
12/1/2014	8		1	1.5	0.6875	12	32	0.375	0	1	0.2578125
13/1/2014	8	0	1	0	0.875	15	32	0.46875	0	1	0.4101563
14/1/2014	0		0		0	0	0	0	0	0	0
15/1/2014	0	0			0	0	0	0	0	0	0
16/1/2014	0	0	0	0	0	0	0	0	0	0	0
17/1/2014	0		0	0	0	0	0	0	0	0	0
18/1/2014	8	0	0		1	16	32	0.5	0	1	0.5
19/1/2014	8	1	0		1	14	32	0.4375	0	1	0.4375
20/1/2014	8		1	0	0.875	15	32	0.46875	0	1	0.4101563
21/1/2014	8		0.5	0	0.9375	15.5	32	0.484375	0	1	0.4541016
22/1/2014	0				0	0	0	0	0	0	0
23/1/2014	8		1		0.875	15	32	0.46875	0	1	0.4101563
24/1/2014	8		1		0.875	16	32	0.5	0	1	0.4375
25/1/2014	8		0		1	16	32	0.5	0	1	0.5
26/1/2014	8		0		1	16	32	0.5	0	1	0.5
27/1/2014	8			2.5	0.6875	16	32	0.5	0	1	0.34375
28/1/2014	8		2	0	0.75	12.5	32	0.390625	0	1	0.2929688
29/1/2014	0				0	0	0	0	0	0	0
30/1/2014	8		0		1	16	32	0.5	0	1	0.5
31/1/2014	8		0		1	16	32	0.5	0	1	0.5
Total	192	3	10.5	6	0.9126984	360	736	**0.48913**	0	1	**0.446429**

OEE O.446429% 44.64%

overall efficiency effectiveness day shift february 2014

Date	Available (a) Time	Plant Down Time(b)	Breakdown (C)	Change over time(d)	Availability	Actual Prodction	Rated Capacity	Performance Efficiency	Rejected in MT	Rate of Quality	OEE
1/2/2014	8	0	0	0	1	16	32	0.5	0	1	0.5
3/2/2014	8	0	1	0	0.875	14	32	0.4375	0	1	0.382813
5/2/2014	8	0	0	0	1	6	32	0.1875	0	1	0.1875
7/2/2014	8	0	0	0	1	16	32	0.5	0	1	0.5
9/2/2014	8	0	0	0	1	16	32	0.5	0	1	0.5
11/2/2014	8	0	0	0	1	16	32	0.5	0	1	0.5
13/2/2014	8	0	0	0	1	16	32	0.5	0	1	0.5
15/2/2014	8	0	0	0	1	16	32	0.5	0	1	0.5
17/2/2014	8	0	0	0	1	16	32	0.5	0	1	0.5
19/2/2014	8	0	1	0	0.875	14	32	0.4375	0	1	0.382813
21/2/2014	8	0	0	0	1	16	32	0.5	0	1	0.5
23/2/2014	8	0	0	0	1	16	32	0.5	0	1	0.5
25/2/2014	8	0	0	0	1	16	32	0.5	0	1	0.5
27/2/2014	8	0	0	0	1	16	32	0.5	0	1	0.5
Total	112	0	2	0	0.982142857	210	448	**0.46875**	0	1	**0.460379**

OEE in Day	0.460379	46.0379464 %

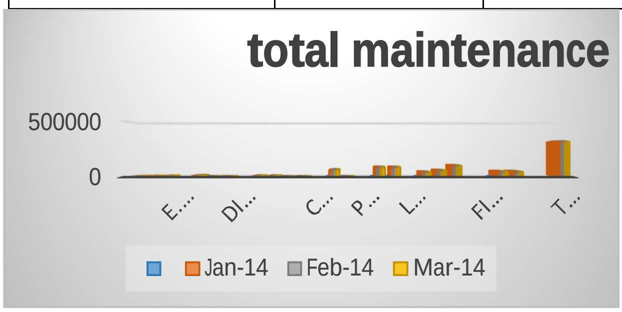
overall efficiency effectiveness day shift mar 2014

Date	Available (a) Time	Plant Down Time(b)	Breakdown (C)	Change over time(d)	Availability	Actual Prodction	Rated Capacity	Performance Efficiency	Rejected in MT	Rate of Quality	OEE
1/2/2014	8	0	0	0	1	16	32	0.5	0	1	0.5
3/2/2014	8	0	0	0	1	16	32	0.5	0	1	0.5
5/2/2014	8	0	0	0	1	16	32	0.5	0	1	0.5
7/2/2014	8	0	0	0	1	16	32	0.5	0	1	0.5
9/2/2014	8	0	0	0	1	16	32	0.5	0	1	0.5
11/2/2014	8	0	0	0	1	16	32	0.5	0	1	0.5
13/2/2014	8	0	0	0	1	16	32	0.5	0	1	0.5
15/2/2014	8	0	0	0	1	16	32	0.5	0	1	0.5
17/2/2014	8	0	0	0	1	16	32	0.5	0	1	0.5
19/2/2014	8	0	0	0	1	16	32	0.5	0	1	0.5
21/2/2014	8	0	0	0	1	16	32	0.5	0	1	0.5
23/2/2014	8	0	0	0	1	16	32	0.5	0	1	0.5
25/2/2014	8	0	1	0	0.875	14	32	0.4375	0	1	0.382813
27/2/2014	8	0	0	0	1	16	32	0.5	0	1	0.5
Total	112	0	1	0	0.991071429	222	448	**0.495535714**	0	1	**0.491111**

OEE in Day	0.491111	49.1111288 %

VII. PRODUCTION REPORT

Maintenance cost		Jan-14	Feb-14	Mar-14
	bearings	2000.00	1000.00	1000.00
	belt, rubber	3000.00	2000.00	2000.00
	Total	**5000.00**	**3000.00**	**3000.00**
E.B.Consumption				
	Total Units consumed	10875.00	11250.00	10312.50
	Units consumption/M.T.	**2.175**	**2.250**	**2.063**
	Units consumption/Hour	90.625	93.750	85.938
Diesel Consumption in Lts				
	diesel	7500.00	7500.00	7500.00
	Total	**7500.00**	**7500.00**	**7500.00**
	Rate of consent diesel	2.500	3.000	2.143
	Cost/M.T. in diesel	82.600	99.120	70.800
Cost of Production in Rs.				
	E.B.Cost	**65,250.00**	**67,500.00**	**61,875.00**
	E.B.Cost/M.T.	**13.050**	13.500	12.375
Packing charges in Rs				
	6000 Backs	90,000.00	90,000.00	90,000.00
	TOTAL	**90,000.00**	**90,000.00**	**90,000.00**
Labour Cost In Rs				
	BOYS	45000.00	45000.00	45000.00
	GIRLS	60000.00	60000.00	60000.00
	TOTAL	**1,05,000.00**	**1,05,000.00**	**1,05,000.00**
Fire Wood in Rs				
	20 TON	50,000.00	50,000.00	50,000.00
	TOTAL	**50,000.00**	**50,000.00**	**50,000.00**
TOTAL MAINTENANCE COST		**3,22,750.00**	**3,23,000.00**	**3,17,375.00**



VIII. CONCLUSION

In this project the RCM technique is used to reduce the operating cost and maintain power factor in agro industries. The implementation of this project is to calculate three months daily analysis report and the result is above technique is very effective because the cost is nominal value and the production was increased.

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