Engineering Failure Analysis 54 (2015) 146–149

Contents lists available at ScienceDirect

Engineering Failure Analysis

journal homepage: www.elsevier.com/locate/engfailanal

An industry survey of the screw press system in palm oil mills: Operational data and malfunction issues

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ARTICLE INFO

Article history:
Received 25 November 2014
Accepted 6 April 2015
Available online 11 April 2015

Keywords:
Incident investigation
Machinery failure
Maintenance

ABSTRACT

Research questionnaires were disseminated to active palm oil mills across Malaysia to acquire information on (i) the mill operation, and (ii) any malfunction issues concerning the screw press system. A total of 105 mills responded to the survey (response rate = 25%). The relationship between the mill operational data (processing capacity, daily operation cycle), the screw press system (type, quantity), and the malfunction frequency was examined. The double screw press machine dominated the palm oil milling industries due to its larger capacity that entails a shorter processing time in comparison with the single screw press. Recurring malfunction problems were prevalent in both types of screw press system. While fatigue, corrosion, wear and tear are inevitable due to the heavy usage and natural causes, an irregular maintenance schedule and poor handling topped the list of common cause for malfunction of the screw press.

1. Introduction

In the processing of crude palm oil, a screw press is the primary equipment for separating the oil palm fruit components, *i.e.* oil and solids. The output from the screw press (liquid phase – crude palm oil, water; solid phase – mesocarp fibre, nuts, broken kernel, and shell) is fed to two subsequent isolated production lines, namely crude oil purification and kernel recovery [1]. Hence, this critical unit dictates the processing capacity of a mill, *viz.* the maximum amount of fresh fruit bunch (FFB) that can be processed on an hourly basis. By using a survey questionnaire, this work attempts to gather from palm oil mills in Malaysia (a) the basic operational data, and, (b) the details of common malfunctions of the screw press unit. The former information is necessary to collect data concerning the processing capacity of the mills, as well as to investigate the relation of that operational data with the type and quantity of screw press employed. The screw press unit in palm oil mills has not been comprehensively studied before [2] and incidents of malfunction are frequently reported. Hence, the latter objective to review these malfunctions and as such, the survey recipients were requested to provide an estimate of the malfunction frequency based on their operational records and experience.

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http://dx.doi.org/10.1016/j.engfailanal.2015.04.003
1350-6307/

2. Materials and methods

2.1. Survey questionnaire

The survey questionnaire was prepared based on published literature and verbal communication with the mill personnel during several technical visits. The descriptive questionnaire was divided into two parts: Part 1 contained questions related to the mill operation, *i.e.* processing capacity, daily operational hours, off-days per month, and number of screw press units available, while Part 2 focused on the malfunction issues that frequently arise with screw press machine.

Acknowledging the confidential nature of the mill operational data of the respondents, the survey was conducted in such a manner as to ensure the anonymity of the respondents in the following manners:

(a) There was no tracer for identification purpose in the distributed questionnaires.
(b) A disclaimer was included in the questionnaire, and the accompanying invitation letter, stating that the survey response will not be published individually as the results would be reported in aggregated form.
(c) The respondent was allowed, at their discretion, not to provide any response at any point in the questionnaire.
(d) No query was made on the mill's oil extraction rate, oil losses, screw press brand or manufacturer's details.

The survey questionnaire was sent out to the prospective respondents by post. This method was chosen instead of other communication channels, *i.e.* facsimile or electronic mail, because it was the most reliable method for contacting the palm oil mills that are situated in remote locations, especially those in East Malaysia [3].

2.2. Data processing

The collected data from all the responding mills was pooled and then analyzed using the Statistical Package for Social Sciences (SPSS) version 16. The Descriptive Analysis module was mainly used throughout the data processing stage to obtain a summary of the survey data, as well as to organize the responses into specific groups.

3. Results and discussion

A total of 105 mills returned the survey questionnaire which represented about a quarter of the total active palm oil mills in Malaysia (response rate = 25%). This weak response situation, which was also observed in another recent survey involving palm oil mills as respondents [3], might possibly have arisen due to communications problem and privacy policies.

3.1. Mill operation

From the outcome of the first part of this survey (Table 1), the majority of the respondents employed the type of screw press unit with two screw flights (commonly referred as a double screw press). On average, this type of screw press could handle more material as opposed to its single screw counterpart. Thereby, the selection of screw press type was reflected in the daily processing capacity of the mill. The quantity of screw press units installed in a mill depends on the mill capacity, daily operational hours and screw press type. The mill-to-mill comparison (point (e) in Table 1) further demonstrates this statement.

All the responding mills (except one mill with a comparatively low processing capacity), employed at least two, if not more, screw press units for their operation. This could allow a mill to have several screw presses running in parallel, as well

Table 1
Mill operational data.

	Single screw	Double screw	Mixed
(a) Number of respondents employing the system	33	70	2
(b) Individual unit processing capacity (ton FFB/h)[a]	15.0	18.2	N/A[b]
(c) Quantity of screw press units	Min: 1 Max: 6	Min: 2 Max: 14	Min: 2 Max: 10
(d) Mill processing capacity (ton FFB/h)[a]	774.42	926.88	N/A
(e) Mill-to-mill comparison (quantity of screw press units employed)			
i. Processing capacity: 300 ton FFB/h Daily operation cycle: 8 h	3	2	N/A
ii. Processing capacity: 800 ton FFB/h Daily operation cycle: 20 h	4	3	N/A
(f) Daily operation cycle (h)	Min: 8 Max: 24	Min: 7 Max: 24	Min: N/A Max: N/A

[a] Average value of the dataset for each group.
[b] Value could not be determined as respondents did not provide specific value for each system.