

Converting manufacturing process in to green: A case study from the tea industry in Sri Lanka

Extended Abstract

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Background

Green manufacturing Concept refers to lessen the impact of the manufacturing process on the environment. A number of principles have been outlined such as reduction of energy and resource use, reduction of material waste and emissions, use of recyclable materials, fewer manufacturing steps, new manufacturing technology, environmental training (Porter & van der Linde, 1995). This research focuses on implementing green manufacturing concepts in medium scale tea industries.

Objectives

Objectives of this research are to find methods, practices, techniques: to efficiently use energy, water, and other resources, to reduce waste generation, pollution and environmental degradation, to reduce unnecessary costs, to increase quality of the tea production, to protect occupant health and safety in the tea manufacturing process.

Methodology

The study has used the case study approach to collect the required data from a tea factory, after observing five low grown orthodox black tea manufacturing factories. The main tool used for this study is the material and energy flow analysis. The study mainly relies on secondary data and primary data. The secondary data were obtained from 2011 to 2016 through factory electricity bills, factory tea book, tea market reports on the internet, published and unpublished reports of tea research Institutes in Sri Lanka, Journal articles. The primary data were collected through observing tea factories and conducting in depth discussions with the factory officers and employees.

Results

The descriptive analyses have determined the following significant problems:

- Productivity of made tea shows downward trend over the time and it denotes raw material wastage.
- There is a gap between productivity of made tea and graded tea. The fibers and stakes are the major wastes generated in the grading process.

The observations have determined the following significant problems in the industry:

- Withering process consumes high electricity due to no control over the speed of motors.
- They do not use a displayer in the withering process to notice start and end timing, turning and mixing times as well as hydrometer readings.
- All the hydrometers are out of date.
- Green leaves wastage occurs in the rolling process as they move the leaves manually.
- This process also consumes high electricity as it repeats the process when the sizes of the particles are large.
- Fermentation process has high water usage due to temperature inside the factory.
- Drying process generates boiler ash, heat, dust, and emits SO₂, CO₂.
- For lighting they use compact fluorescents.
- Food hygiene practices cannot be seen in the manufacturing process.

Conclusions & Recommendations

Electricity usage can be reduced using following equipment, methods and systems.

- Variable speed motors
- Power factor correction capacitors
- Variable frequency drivers
- By replacing LED bulbs instead of compact fluorescents
- Through a well-planned production schedules
- Net metering system can be used to generate electricity using solar panel

To reduce thermal energy requirement for the tea dryer:

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- Wood chips can be introduced instead of wood logs, as a fuel for the drier
- Solar thermal energy is an economically preferable alternative when compared to fuel wood combustion

During sorting, fibers (stake) are produced. Those fibers can pulverize and recycled in process as the re-conditioner. Some portions of the denatured wastes can be used as fertilizer for cultivation. Conveyers can be used to move raw material from one stage to another without any waste.

To reduce water consumption

- Heat prevailing blocks can be used instead of tar ground around the factory

Employees must wash their hands and enter the production facility and then wear appropriate uniforms, gloves, mask and caps for their safety as well as to improve the quality of the product.

Keyword: Green Manufacturing, Tea Industry, Energy Consumption, Water consumption, Waste generation

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