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IMPROVING THE SYSTEM IN PROCESS AND PACKING AREA TO MAXIMIZE THE OUTPUT AND MINIMIZE HUMAN INTERFERENCE

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ABSTRACT

Efficiency of industrial production lines is crucial as it results in an improved production and utilization of available resources. The goal of the study was to increase the production rate of the line to meet the continuously increasing demand on its product within the existing limited space in the plant. In this paper study was clean-in-place (CIP) and automation for increase the productivity and decreased the human requirement; CIP is an important component in guaranteeing food safety in food processing plants. Successful cleaning betweenproductionruns avoids potential contamination and products that don't meet quality standards. The need to automate industrial processes is driven by several key requirements for competitive success and in some industries, viability of the manufacturing plant. Automation which is popularly known as LCA is simple pneumatic, hydraulic, mechanical and electrical devices put into the existing production machinery, so that their productivity can be improved.The automation is improved the productivity, product quality, profitability and human requirement.

Keywords: Automation System, Clean-In-Place, Data Management System, Man Power Utilization, PLC.

I INTRODUCTION

CIP is an important component in guaranteeing food safety of food processing plants. Successful cleaning between production runs avoids potential contamination and products that don't meet quality standards. Carrying out CIP correctly from design to validation ensures secure barriers between food flows and cleaning chemical flows. It is also most important CIP is carried out effectively and efficiently, and contributes to an overall low total cost of ownership [14].The automation of manufacturing plants has been actively pursued for more than 50 years. The need to automate industrial processes is driven by several requirements for competitive success and in some industries, viability of the manufacturing plants. The need to automate industrial processes is driven by several requirements for

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competitive success and in some industries, viability of the manufacturing plants. The control system will play a major role in control on all parts of the project. Electrical DC motors control were used as actuators for the entire process to move the upper and lower conveyor belts, and the sensors used to feed the control system by system information [10].

1.1 Problem Definition

Improving the system in process and packing area to maximize the output production process and minimize the man power requirement. Automation of improve production and quality also to reduce the human interference.

1.2 Objective

- To perform the time study on operator activity at production line of floor console
- To determine the current labor utilization at production line of floor console
- To propose ideal man to machine ratio based on the current labor utilization
- To propose improving in process and packing area to maximize the output
- To propose the minimize man power utilization

1.3 Measuring Man Power Utilization

Essentially human capitalize nearly all the process on the industrial shop floor from the management to the operators. A Visualizing industrial environment which includesa big number of people from various departments working together in meeting the set goals.The supporting departments play an equal role as the production team in order to maintain the consistence pace of work on the industrial shop floor. There are three basic departments in industries which are the total quality management (TQM), production planning and control (PPC), maintenance and adding to that is others (vendors) also is added to the list as one of the major contribution on production interruption [5].

1.4 Materials and Advanced Packaging Methods

This section presents several types of packaging materials followed by advanced packaging methods. Packaging materials are selected based on the specific food types. Oxygen-sensitive foods require packaging with barrier properties that can prevent spoilage due to oxidation. Plastics have been used for a long time, but sustainable and green protocols recommend forgoing plastics for other materials that are biodegradable and environmentally friendly [8].

1.5 Packaging Machineries and Automation Systems

Food processors use a variety of machines for different production lines and for various food types. Several machine types are integrated into a single packaging line. Some of the machine types are cartooning, wrapping, labeling,

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shrinking, sealing, case and tray forming, capping, cooling and drying, feeding, palletizing, picking and placing (robotic systems), cleaning and sterilizing, in addition to inspection and detecting machines. The conveying systems perform functions such as washing, flipping, rotating, pushing, indexing, diverting, or accumulating products at various points in the product line. Some conveyor systems run around the clock for two to three months because of harvesting season. Their capabilities and limitations are therefore enforced and influenced by material and physical properties such as tension, length, and friction, as well as operational capability that include electrical systems [8].

II LITERRATURE REVIEW

D. O. Fakorede. et al.[1]suggested that the productivity has often been cited as a key factor in industrial performance, and actions to increases are said to improve profitability and the wage earning capacity of employees. Improving productivity is seen as a key issue for survival and success in the long term. Hsiang-Chin Hung. et al.[2]has examined increasing number of companies have used different types of quality programs in order to increase internal and external customer satisfaction as well as to reduce quality cost. Among all of these programs, Six Sigma is perhaps the most widely-accepted initiative by all a broad range of organizations. Wanvipa Seranevijaikitkha et al.[3]have suggested the production line domestic manufacturers need to reduce costs and improve their production efficiency. The production system of a small roasted and ground candy plant was investigated using computer simulation technique. Rohana Abdullah et al**.** [4]has studied manufacturing organization with increased in the organizational complexity is facing difficulty in measuring its performance. Various factors could affect manufacturing performance such as equipment performance, material planning and human resources. S. K. Subramaniam et al.[5]has suggestedefficiency and accuracy at the production lines enables a better production and utilization of the available resources. The data available should be interpreted accurately in order to identify the various faults at production level and to immediately rectify them to improve efficiency. A. H. Hamidon et al. [6] has suggests efficiency and accuracy on the production lines enables an improved production and utilization of available resources within industries. Due to time constrain in the production process, the workers have to keep on their to ensure daily goals are met as set by the management. In the race for achieving set goals, human capital is the prime concern, even machineries also considered as a role player in the production lines. Benjamin Jude [7] has studied the typical Clean-in-Place (CIP) process requires large amounts of water, chemicals and energy. It is estimated that on average, a food and beverage plant will spend 20% of each day on cleaning equipment. Many manufacturers are unsure of how their CIP systems are performing. Nitaigour Premchand Mahalik [8] has examined the food processing and packaging industry is becoming a multi-trillion dollar global business. The reason is that the recent increase in incomes in traditionally less economically developed countries has led to a rise in standards of living that includes a significantly higher consumption of packaged foods. .Sagar T. Payghan et.al [9]suggested automation industry which describes the technical issues of automation control system in operation development, improving management level and high efficiency process in bottle filling plant. In the bottle filling plant various processes need to be controlled and monitored regularly. Thus it becomes tedious job to handle the plant manually. Alhade A. Algittaet. al. [10] studied the Inductive sensor and photoelectric sensor was used to

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provide the information to the controller. Electrical DC motors used as output actuators for the system to move the conveyor belts after get the orders from the control system. PrachiNaik [11]has examined the quantitative packaging of various items should be accurate and this leads to the direct impact on the survival and economic benefits. Mostly manufacturers have being opting for a highly automated production line. The Low Cost Automation which is popularly known as LCA is simple pneumatic, hydraulic, mechanical and electrical devices put into the existing production machinery, so that their productivity can be improved.Handbook clean and place [14] Cleaning in place, or CIP, refers to all those mechanical and chemical systems that are necessary to prepare equipment for food processing, either after a processing run that has produced normal fouling or when switching a processing line from one recipe to another. Cleaning in place means that cleaning takes place without dismantling the system.

III STUDY ON CLEAN IN PLACE (CIP) OF PRODUCTION LINE IN INDUSTRY

Cleaning in place or CIP, refers to all those mechanical and chemical systems that are necessary to prepare equipment for food processing, either after a processing run that has produced normal fouling or when switching a processing line from one recipe to another. Cleaning in place means that cleaning takes place without dismantling the system [14].A typical Clean-in-Place (CIP) process requires large amounts of water, chemicals and energy. It is estimated that on average, a food and beverage plant will spend 20% of each day on cleaning equipment, which represents significant downtime for a plant. Energy usage varies depending on the process. Many manufacturers are unsure of how their CIP systems are performing. A number of companies have addressed CIP improvements with small modifications such as altering the chemical concentration, or by adjusting the time taken for each stage of the CIP process. However, very few food and beverage manufacturers have put tools in place that render the CIP process efficient. Recent innovations in technology now enable plant operators to calculate the optimal mix of water, chemicals, temperature and flow required to achieve safety standards while saving at least 20% in energy cost and by reducing the downtime for cleaning by at least 20% [7].

3.1 Cleaning In Place (CIP)

Cleaning cooking vessels at home is performed by hand. In the food industry this is called “cleaning out of place”, or COP. All equipment is dismantled and cleaned manually. Today this has been replaced with CIP, cleaning in place, in most parts of the food industry where food is pumped and undergoes continuous processes. Some equipment still needs to be dismantled and manually cleaned, but wherever possible, CIP is the preferred choice. In CIP the equipment is not dismantled, but is cleaned in the same set-up as it was used during production. Cleaning liquid is then circulated through the equipment in a cleaning circuit [14].

3.2 Cleaning Parameters

The energy required is kinetic, chemical and thermal energy.These three factors, together with the contact time determine the effectiveness of the cleaning. These four parameters are interconnected and depend on each other,

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which mean that if any of the parameters is changed, the other three might need to be adapted so as to give the same end result as before.The mechanical forcein cleaning in place is the shear forces created by the flow. Compare cleaning a car with a nozzle on the water hose or without a nozzle. In a plant the flow velocity of the cleaning liquids can be increased by pumping it faster. As a general CIP rule it is said that the flow must be turbulent and that the flow velocity should be at least 1.5 m/s to have an adequate mechanical force. The second force to use to get soil to leave a surface is chemical force. To get equipment clean chemicals have to be used in combination with the mechanical force, the flow. Most often alkaline detergents are used first. They dissolve protein, fat and sugars (i.e. mostly organic soil).The third force to use is thermal force, heat. Molecules move faster at an elevated temperature and therefore the effectiveness of a detergent is increased with increased temperature. As a general rule a plant should be cleaned at the same temperature as it has been processing the food.The fourth and last parameter is time how much time the other three forces are in action. Eventually most surfaces will be clean but it wills just take longer if the optimal temperature is not used or the correct concentration of detergent or a non-sufficient flow is used [14].

3.3 Automation Optimization

Automation improves the quality of information available and allows tighter control of the various parts of the cleaning process (such as creating parameters around the opening and closing of valves and pump operation). It is important that the automation architecture is open; this enables the CIP processing equipment to communicate with other process equipment such as tanks or pasteurizers. Integrated “status check” ability streamlines the efficiency of the operation.

3.4 CIP System Safety

A successful and safe cleaning result is based on controlling the four key parameters of Sinner’s circle: the concentration of detergent, the flow rate, the temperature and the time. Complete control of the flow has to be maintained, adapting it to what is being cleaned. You must also control the concentration of detergent, for example by measuring conductivity. To assure that no detergent solution contacts the food products, it is important to use a valve solution with “block and bleed” leakage protection at connection points between pipes distributing cleaning liquids and the food processing equipment being cleaned. Safety is also crucial in the work environment since cleaning stations use dangerous chemicals. For example, it is advisable to position the dosing pump and the handling of the concentrated chemicals far away from the operator’s normal position. Soft metals, such as aluminum, are totally forbidden in a cleaning station since hydrogen gas can develop and form explosive oxy-hydrogen gas when in contact with acid and bases, especially in concentrated form.

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IV AUTOMATION OF PACKAGING MACHINERY IN PRODUCTION INDUSTRY

Industry automation becomes the global trend in manufacturing, packaging process is one of the most uses in industry; more and more companies are switching to automation. The firstindustrial revolution was the introduction of mechanical production facilities starting in the second half of the 18thcentury and being intensified throughout the entire 19th century. From the 1870s on, electrification and the division of labor led to the second industrial revolution. The third industrial revolution, also called "the digitalrevolution", set in around the 1970s, when advanced electronics and information technology developed further theautomation of production processes.

4.1 Components Selection

The Automatic Packaging Machine system is a combination of electronic, electrical and mechanical parts.

- Sensors

A sensor is a device that measures a particular characteristic of an object or system. Some sensors are purely mechanical, but most sensors are electronic, returning a voltage signal that can be converted into a useful engineering unit. Sensors are used in everyday objects such as touch-sensitive elevator buttons (tactile sensor) and lamps, which dim or brighten by touching the base.

- Actuators

Actuation defines as the result of a direct physical actions on the process, such as drilling a work piece or rotate the object from side to another side by rotating the upper rotary disk.

- Conveyor Belt

A belt conveyor system consists of two or more pulleys. There are two main industrial classes of belt conveyors; Those in general material handling such as those moving boxes along inside a factory and bulk material handling such as those used to transport large volumes of resources and agricultural materials, such as grain, salt, coal, ore, sand, overburden and more

- DC Motor

DC motors have been used in industrial applications for years. Coupled with a DC drive, DC motors provide very precise control. DC motors can be used with conveyors, elevators, extruders, marine applications, material handling, paper, plastics, rubber, steel, and textile applications [10].

4.2 Why Automate

The need to automate industrial processes is driven by several key requirements for competitive success and,in some industries; viability of the manufacturing plants .they can be listed as those needing to improve productivity, product quality, and profitability.Plant productivity may be defined as the quantity of end product manufactured per unit of operation parameter plant size, number of workers, time of operation, etc. therefore, productivity is directly related to how efficiently the input resource are utilized in translating them into marketable end product.Quality assurance is one of the most important goals of any industry. The ability to manufacturing high quality product consistently is the

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basis for success in the highly competitive food industry. Quality assurance method used in the food industry traditionally involved human visual inspection. Such methods are tedious, laborious, time-consuming and inconsistent.Increased profit is most important parameter of improved product profitability. improve profitability not only add to shareholding value but also allows management to invest process strategically in expanding plant operation, increasing product line, improving quality, etc. [12]

4.3 Types of Production Line

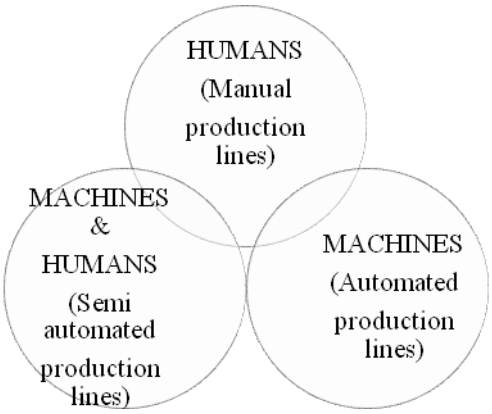

Fig.1 Types of Production Line

A production line is commonly known as a set of sequential process which is established on an industrial shop floor. The fundamental system in a production line is further improved and redesigned based on the industrial desired. The production or manufacturing lines of industries worldwide can be categories into three types, which are automated production lines, semi-automated production lines and manual production lines [15].

- Manual Process

Humans in the production lines are called workers or operators who perform simple repetitive tasks as designed to permit very high rates production per worker.

Fig.2 Manual Manufacturing Process

The workers are specially trained to perform these tasks to their best capability to ensure optimum quality of goods or products. The modernization in industries has revoke and introduced new technologies to ease human life in the production lines.

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Semi-Automated Process

Fig.3 Semi-Automated Process

Most of the industries have installed machineries to accompany human workers which are known as semi-automated process lines to accomplish better production rate base on customers demand. A worker performing his task with the help of a machine is as shown in Fig.3.

Automated Process Line

Fig.4 Automated Process Line

Fully automating the production process is considered the most significant way of producingproducts to an optimum level. Automated processlines are designed to operate with fewer workers as acost cutting measures in the long run. Apart fromthat, such production processes is designed to fullfill mass or moderate production output and isideally suited to serve large, relatively homogeneouspopulations of consumers. The automated processline which uses a robot to perform repetitive task asdesigned is shown in Fig. 4

V CONCLUSION

Food and beverage manufacturers who seek to drive operational efficiency and cut costs should begin by performing an audit of their CIP system to identify areas for improvement. The audit will help determine whether incremental improvements such as balancing out the line capacity or adding a recovery tank to re-use water need to be made. A high level of efficiency can be achieved by addressing CIP design, energy efficiency improvements, and advanced process automation. Such an initiative will result in a positive impact on waste, energy costs, and environmental resource issues. Improved food safety and increased production will benefit both peace of mind and profit margins. To increase the productivity we have made use of the automation system, which in turn brings economic progress.

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The main purpose of this PLC in automation is to control the whole system. The installation cost is not cheap but it can efficiently run for a long period of time. Performance, flexibility and reliability is mainly based on the investment. By taking these necessary steps industries can improve and maintain more efficient production lines.

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