

AUTOMATIC CONTROL FOR LEACHING PROCESS

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This Report Is Submitted In Partial Fulfillment of Requirements for the Degree
Of Bachelor in Electrical Engineering
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“I hereby declared that I have read through this report and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering (Power Electronic and Drives)”

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“I hereby declare that this report is a result of my own work except for the excerpts that have been clearly in the references”

Signature :

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Date : 22nd APRIL 2009

Specially dedicated to

My beloved father and mother ...

Che Mat Bin Ngah & Fatimah Binti Jusoh

My beloved brother and sisters ...

Ahmad Shazril Imri, Asma, Farihah, Nazila

My inspirational motivator ...

All my friends,

Thank you for everything ...

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ABSTRACT

This project used the PLC (programmable logic controller) as the controller in order to control the leaching process of Nata de Coco. This project can be separated into two parts which are hardware and software. The hardware part consists of developing the structure that absorbs tanks, valves, cages and pipes. Meanwhile the software part is developing the ladder diagram which is control the entire process after transfer it into the PLC. This project applied the touch screen to allow the users to control and monitor the leaching process of Nata de Coco. Beside that, the air pressure is used in this project to rolling the Nata de Coco in the tank while the leaching process. The pH paper used to measure the level acidity of Nata de Coco in order to stop the leaching process after pH's value achieves the neutral level. Lastly, the analysis is making to study production of Nata de Coco in large scale. By developing of this project, the leaching process of Nata de Coco with manually in small medium industry sector can be replaced with automatic system in order to increase the productivity and reduce the cost of manpower.

ABSTRAK

Projek ini menggunakan PLC (*programmable logic controller*) sebagai pengawal yang bertujuan untuk mengawal keseluruhan proses pencucian Nata de Coco. Projek ini dibahagikan kepada dua bahagian iaitu bahagian perkakasan dan perisian. Bahagian perkakasan adalah membina struktur yang mana melibatkan tangki, injap, sangkar dan paip. Sementara itu, bahagian perisian adalah dengan membina rajah tangga yang mana akan mengawal keseluruhan proses selepas dipindahkan ke dalam PLC. Projek ini mengaplikasikan paparan sentuh bertujuan membenarkan pengguna untuk mengawal dan mengawasi proses pencucian Nata de Coco. Selain itu, tekanan udara juga digunakan di dalam projek ini bertujuan untuk memutarakan Nata de Coco di dalam tangki semasa proses pencucian. Kertas pH digunakan untuk mengukur tahap keasidan Nata de Coco dan bertujuan untuk memberhentikan proses pencucian selepas nilai pH mencapai tahap neutral. Akhir sekali, analisis dijalankan untuk mengkaji penghasilan Nata de Coco dalam skala yang besar. Dengan membangunkan projek ini, proses pencucian Nata de Coco secara manual di dalam sektor industri kecil sederhana boleh digantikan dengan sistem automatik bertujuan untuk meningkatkan penghasilan produk dan mengurangkan perbelanjaan untuk tenaga manusia.

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CHAPTER 1

INTRODUCTION

This chapter explained about the importance of this project. The discussion included the background of the project, problem statement, objectives and scopes of project.

1.1 Background

The leaching process is a process by which inorganic, organic contaminants or radio nuclides are released from the solid phase into the water phase. This process is ready under the influence of mineral dissolution, desorption, complexation processes as affected by pH, redox, dissolved organic matter and biological (micro) activity. The leaching process itself is universal, as any material exposed to contact with water will leach components from its surface or its interior depending on the porosity of the material considered.

One of the process involve in the production of Nata de Coco is leaching process. Leaching process in Nata de Coco can be defined in general as using water to leach contaminant from the Nata de Coco. This process can kill and remove bacteria, and neutralize the pH of the Nata de Coco which is acidic after the process of fermentation. The pH of the Nata de Coco is about 2.2 to 3.0 before leaching process and after leaching process, the pH of Nata de Coco has pH of 7.0.

Control of industrial processes is a broad field of concern that cuts across virtually every area of science and technology. The basic operating principles utilized by the control function are so specialized and unique that a whole new field of study has been created. Such terms as process control automation, computer integrated manufacturing, computer numerical control, process instrumentation, and flexible manufacturing systems are commonly used to describe this particular function in industry. Control is an essential function of manufacturing.

Process control is a unique part of industry that deals with the control of variables that influence materials and equipment during the development of a product. It may range from a relatively simple operation, such as filling bottles, to maintaining a proper level in an analytical procedure that determines the content of a complex chemical solution. The end result of the operation, in most cases, is a procedure that initiates some type of control function. Controlling manufacturing process is the basis of industrial automation today.

1.2 Problem Statement

Present in era technology becomes vital part in existence diurnal. Technology can help and facilitate human make any job. This entered into manufacturing process and production Nata de Coco. Previously, manufacturing process and production the Nata de Coco carried out in manual process. With this method, need lot of staff to control stated process. The conventional method for Nata de Coco leaching process takes in excess of the time and has a low efficiency.

In current industry, the entire leaching process of Nata de Coco is ready conventionally. Manpower is needed to direct water flow at the leaching tank and drain the water in convinced time expected. Manpower is also needed to monitor the entire leaching process. Even though leaching process of Nata de Coco implicated the water flow, there is water system used in the current industry. This system used a lot of water in one moment to closing stages the leaching process. Every one of these causes the leaching process of Nata de Coco implicated a lot of manpower to work and monitor the entire process.

To solve these problems, an automated water system is able to designed and implemented on the leaching process of Nata de Coco. First of all, a water system can be designed for Nata de Coco leaching process. After the design of the water system, the automation system process can be designed subsequently. The automation system process designed using the Programmable Logic Controller (PLC). The PLC is open-off nature and the automation system process is an on-off system.

1.3 Objectives of the Project

To accomplish the target in this project, the objective below have been fixing as a guide in how to execute this project to improve its ability. The main objectives for Final Year Project (FYP) are:

- i. To design and build one prototype for leaching process of Nata de Coco.
- ii. To control leaching process by automatic control.
- iii. To control acidity level of Nata de Coco.
- iv. To develop a program that can control leaching process automatically.
- v. To study and analyze the load capacity for large scale of Nata de Coco production.

1.4 Scope of the Project

To guarantee that the objectives of the project are achieved, a few important elements must be considered. The scopes for this project are as follows:

- i. Design the prototype for leaching process of Nata de Coco by automatic control.
- ii. Build the automatic control leaching process for 2 tanks with ½ kg load each tank.
- iii. Using the PLC to control the leaching process of Nata de Coco.
- iv. Study and analyze for 50kg load capacity of Nata de Coco production.

CHAPTER 2

LITERATURE REVIEW

Literature review is the study relating with the project would be exercised. Where, project want to be carried out must base to the theory, observation, recitation, understanding and documentation those related with field irons in the fire and have process arrangement and work procedure to make sure travel orderly project. Therefore, the projects want to be implemented must include building aspect project, material and equipment which are used. This matter very important for achieve objective of the project and it can also help in implementing project with more effectiveness, fluent and perfect.

2.1 Control Valve System

Comparison of Friction Models Applied to a Control Valve

(Author: Claudia Garcia-2008) [1]

The purpose of this paper is to implement and test different friction models applied to control valves. Control valves are the most common final control elements in industry. One of the main factors that affect the behavior of the control loops is friction in control valves. Performance assessment of control loops is an important research theme, and there are many tools to detect variability in control loops.

The control valve system also has motorized proportional valves. A production and process automation with electronic regulation and control equipment requires interfaces between the electronic and fluidic control loops. The valve described for regulating the flow rate of liquids and gases represents such an interface. Motorized valves are used

wherever exact adjustment to the actual requirements is needed. There is a choice of different designs to suit the application and requisite accuracy.

2.2 PLC Programming

Converting PLC Instruction Sequence into Logic Circuit: A Preliminary Study (Author: Shuichi Ichikawa, Masanori Akinaka, Ryo Ikeda and Hiroshi Yamamoto) [2]

A Programmable Logic Controller (PLC) is a kind of computer, which has been widely adopted for sequence control of industrial machinery. Although PLC is flexible and well established, the performance of PLC does not always satisfy the requirements in large and highly responsive systems

By implementing a control program with hard-wired logic using reconfigurable devices a flexible and highly responsive system could be realized. Since an FPGA chip can contain maximally ten million logic gates, a very large control system could be implemented with a single chip. This may sometimes lead to downsizing and reduction of system components.

The ladder diagram has been widely accepted to describe PLC programs. A ladder diagram consists of one or more rungs, each of which consists of a condition part and a process part. Either the condition part or the process part can be an input/output or an instruction. The output of a rung is activated if the corresponding input condition is satisfied; otherwise, the output is deactivated. The instruction of a rung is executed if its input condition is satisfied.

Rungs are ordered, and interpreted in due order. A ladder diagram is executed in the following manner:

- i. At the beginning of a ladder, all inputs are collected and stored into the corresponding internal memory elements, which are read and modified by rungs (input phase).
- ii. Rungs are interpreted in due order
- iii. When the bottom of a ladder is reached, all output ports are updated by the corresponding internal memory value.
- iv. The ladder is then executed all over again from the input phase.

2.3 Research study from ANZAG Industries

ANZAG Industries Sdn. Bhd is a local company that categorized in small medium industry. This company specializes in manufacturing Nata de Coco. ANZAG Industries is located at small medium industries area at Bemban, Melaka.

2.3.1 What is Nata de Coco?

Nata de Coco is a chewy, translucent, jelly-like food product produced by the bacterial fermentation of coconut water. Nata de Coco is most commonly sweetened as a candy or dessert, and can accompany many things including pickles, drinks, ice cream, puddings and fruit mixes. The product originates from the Philippines. The primarily coconut water dessert is produced through a series of steps ranging from water extraction, mixing, fermentation, separating, cleaning, cutting to packaging. Commercial nata de coco is made by small farmers in the Philippines. It requires glacial acetic acid, however, and spillage of this ingredient will make the topsoil acidic. The nutritional values of coconut products vary according to the different stages of development. The mature coconut is a good source of iron and potassium. Approximately 86% of the calories in coconuts are from fat, most of which is saturated fat. [10]

The characteristics of Nata de Coco are;

- i. Solid
- ii. Soft
- iii. Smooth surface
- iv. Chewy

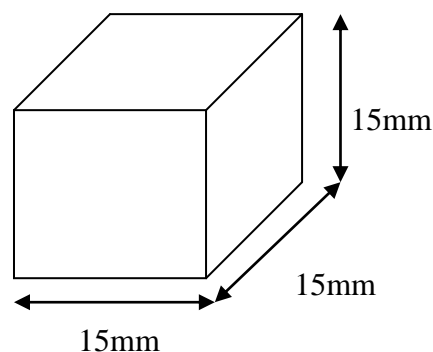


Figure 2.1: Dimension of Nata de Coco

2.3.2 Leaching Process of Nata de Coco

From research study in ANZAG Industries, Nata de Coco leaching process is done by using one tank. The inlet of the tank is connected using hose to the water supply and the outlet is not connected to anything. The outlet of the tank is for draining the acidic water after leaching process. At the start of leaching process of Nata de Coco, the worker pours Nata de Coco into the tank. The inlet of the tank to the water supply by using hose and the valve of the outlet is closed so that water cannot flow out. The leaching tank is stirred in the estimated interval time of every one hour. Each estimated 3 to 4 hours, the worker will drain the water from the leaching tank by opening the valve at outlet and once again the inlet is connected to water supply and water is directed to the tank again to refill the tank as shown in figure 2.2 . This is to drain out the acidic water due to leaching process and refill the tank with clean water. All these stirring, draining and refilling process is repeated for 2 to 3 days until the pH of the water that leach the Nata de Coco becomes neutral, that is pH 7. The leaching process is completed when the pH of the water reaches 7 and it takes about 2 to 3 days to complete.

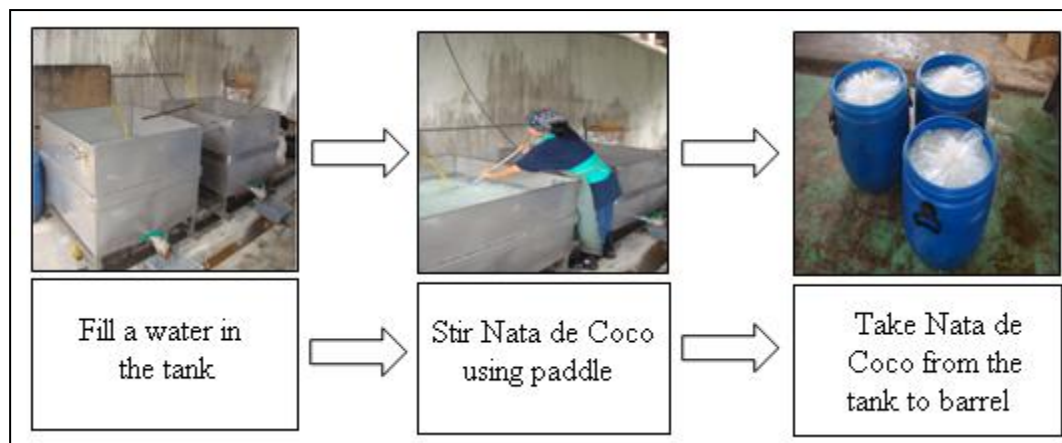


Figure 2.2: Leaching process with manually

2.3.3 Process of Nata de Coco

