

THE DESIGN OF WATER FLOW SYSTEM FOR LEACHING PROCESS

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Laporan ini diserahkan kepada Fakulti Kejuruteraan Mekanikal sebagai memenuhi sebahagian daripada syarat penganugerahan Ijazah Sarjana Muda Kejuruteraan Mekanikal (Rekabentuk & Inovasi)

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THE DESIGN OF WATER FLOW SYSTEM FOR LEACHING PROCESS

ABSTRACT

Leaching is a process to dissolve or filter out unwanted elements present in matter. In the production of nata de' coco, leaching is used to neutralise the acetic acid formed from the fermentation process of nata. In this method, water acts as the neutralizing agent. This is done by soaking nata in water for approximately six to seven hours. The contaminated water needs to be changed regularly and this is done manually. This project is a proposal of revolutionizing this process by using a machine. Improvisation includes a new concept and mechanism and as such includes a new system design which in turn shortens the time consumed in the leaching process thus increasing the productivity in volume and in quality. The approach of the design used in this project uses an integrated computer controller system through the PLC and water treatment using the water circulation system. This is to ensure minimal usage of water and energy resources. But, at the same time making the leaching process easy and effective while operating.

REKABENTUK SISTEM ALIRAN AIR UNTUK PROSES PENAPISAN AIR**ABSTRAK**

“Leaching” adalah proses untuk mengurai dan menapis sebarang unsur-unsur yang tidak dikehendaki di dalam sesuatu larutan. Dalam perusahaan Nata De’ Coco, “leaching” digunakan untuk meneutralkan asid asetik yang terbentuk daripada selepas proses penapaian nata. Dalam process ini, air digunakan sebagai agen untuk meneutralkan asid asetik tersebut. Proses ini dilakukan dengan merendam nata dalam tempoh enam hingga tujuh jam. Air yang telah bercampur dengan asid asetik tersebut perlu ditukar ganti dengan air yang baru dan proses ini dilakukan secara manual. Projek ini mengemukakan cadangan untuk membuat pembaharuan dalam proses konvensional kepada automatic dengan menggunakan mesin. Pembaharuan melibatkan konsep-konsep baru dan mekanisma serta sistem baru di mana ianya dapat mengurangkan kos operasi tenaga kerja sekaligus produktiviti dan kualiti. Pendekatan yang digunakan ialah proses merawat air yang mengandungi asid asetik agar ianya dapat digunakan semula untuk beberapa kitaran sebelum dibuang. Ia juga menggunakan gabungan sistem kawalan logik berkomputer (PLC). Ini dapat memudahkan pengendalian proses “leaching” oleh operator. Selain itu, pada masa yang sama menambah keberkesanan kepada proses “leaching”.

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






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NOTATIONS

WORD	DEFINITION	UNITS
Area	The area of flow diameter	cm^3/m^3
Length	The length of flow from begin to end	cm/m
pH	pointer of Hydrogen	number
Time	second/minute/hour	s/min/hour
Volume	Contains per metric	m^3
X	Power of zooming under microscope	number
AC	Activated Carbon	--
Q	Flow Rate	L/min
M	Concentration of acid (Molar)	mol/kg
V	Volume	ml
m	mass	kg/g
A	area of surface / offset	m^2
t	times	second
mdot	mass flow rate	kg/s

SYMBOLS

SYMBOLS	DEFINITION
	Filter
	Pump
	Valve
	Electric Motor
	Flow Indicator
	Gas
	Air Receiver
	Air Dryer
	Water
	Drain

APPENDIXES A: Gantt chart

APPENDIX B: Patents

APPENDIX C: Drawing

CHAPTER I

INTRODUCTION / OVERVIEW

Leaching generally known as a process to dissolves any unwanted elements in a solution. It is also comes in different kinds and shapes. Leaching process can be in fluid, gas or solid form of matter. Normally, this kind of process has been applied in water treatment industry. Nata de' coco industry applying the leaching process for nata neutralization. After fermentation of nata, the value of pointer Hydrogen (pH) in nata is 3.0 which not consumption. It has a bad smell because it is contains of acetic acid. Leaching process is using to can remove the smell or acetic acid molecules. So it must be neutralizing up to pH 7.0 by using water as the medium for neutralization with a long period. The water needs to be replaced regularly during the leaching process.

The acidic nata put in a stainless steel tank that was filled with water. After an hour later, the pH value of nata increased. This condition happening because of the water slowly absorbed the acid in nata. After that, the water can be replaced in a certain time. This procedure will be repeated until the pH value of nata increase to pH 7.0. Then, the contaminated water that contains the Acetic acid can be draining into the septic tank.

This project shows about water flow system and the mechanism. Also configures the best concept in the process according to characteristic of concept. The process starts from putting the acidic nata into a tank until it existed. Also include a part design and function of mechanism.

The results from this project can be use to develop a new machine with a new concept or method as upgrade to existing process of leaching nata de' coco. So it may be use for an alternative ways in production. The concept that has been selected is one of the several concepts that possibly can use as an alternative. The selected concept also has considered about many factors that has an effective results while running production.

By overall, the project is going to making an improvement of the manual process in manufacturing into an automatic process that using machine technology.

1.1 Problem Statement

The production of nata de' coco increased towards to business expands. Several factors like low price, effectiveness, economical have a big potential to be selected. Without any improvement, nata productivity cannot be increase. The production must be more efficiency, faster, low cost, and capable to produce products in a short time.

Therefore the improvement must consider about manufacturing process and gives a better condition in manufacturing. Also it must be supporting a high mass production in certain times.

1.2 Objective of Study

The objective of this project is to design a water circulation system for leaching and its mechanism.

1.3 Scopes

The scopes that need to study are:

- 1) To study leaching process.
- 2) To design water treatment and the circulation system.
- 3) To design the system functional diagram and its mechanism.

CHAPTER II

LITERATURE REVIEW

2.1 About Nata de' Coco

2.1.1 Definition:

Nata de coco is a chewy, translucent, traditional Philippine dessert which is “coconut gel-product” from coconut water by bacterial fermentation-prepared. Produced by *Acetobacter aceti* ssp. *xylinum* through fermentation of fruit juices. Nata de coco is high in fiber, good for the digestive system, and it is low calories and contains no cholesterol. [1].



Figure 2.1: Nata de' Coco product [1]

2.1.2 History:

The growth of nata de' coco in the early 90s had multiply effects in job and business opportunities in allied industries such as plastic container manufacturing and supply chain, coconut and sugar industries, glacial acetic acid production, and packaging materials.

Producers and processors expressed their need to be informed of recent breakthroughs in nata de' coco processing, current market trends and related issues. The industry proved Philippines to become the largest quality producer of nata de' coco and achieve pioneering leadership in the fields of food and industrial application.

In 1993, Japanese people, especially young people considered nata de' coco a popular dessert, however, the popularity decreased because customers like another trendy dessert. For small farmers or else started coconut production in Philippine have begun to export nata de' coco to Japan. Japan imported 90 percent of the Philippines nata de' coco, its supply did not meet the demand for the dessert in Japan. One year later, the product popularity quieted. Environmental and unemployment problems caused to Japan was importing nata de' coco from Philippines [1].

Nowadays, the industry in making nata has started by many countries. The nata products have been produced in different types, flavours and colours.

2.2 Existing System Design Study

Recently, in local industry, leaching process in nata production was operating with manual process (Fig.2.2, 2.3). After fermentation, nata could be in very acidic because it is containing acetic acid. Normally, the value of pointer Hydrogen (pH) after fermentation is about 2.2 up to 3.0. In neutralizing or can be considered as leaching process, it is using plenty of water to neutralizing nata. The acidic nata must be immersed in water about six to seven hours. So, water must be replaced nearly in every one hour.

They used a rubber pipe to flow water, filling six leaching tanks. Then the leaching tanks were drained, using other pipes direct into a septic tank (Fig.2.4). For details, water must be renewing every an hour (normally) until the pH value reach up to 7.0. So that, the leaching process needs about six to seven times to be completed. After the last drain, leaching process is finish and nata can be carrying out to be cooked. If the volume of each leaching tank is 1 meter³, the whole leaching process requires up to 7 meter³ of water. During leaching process, it must be stirring up twice an hour using a stainless steel stick as a tool. Nata need to be stirred to reduce leaching process period.



Figure 2.2: The wasted water drained through pipe



Figure 2.3: Tank filled with nata de' coco

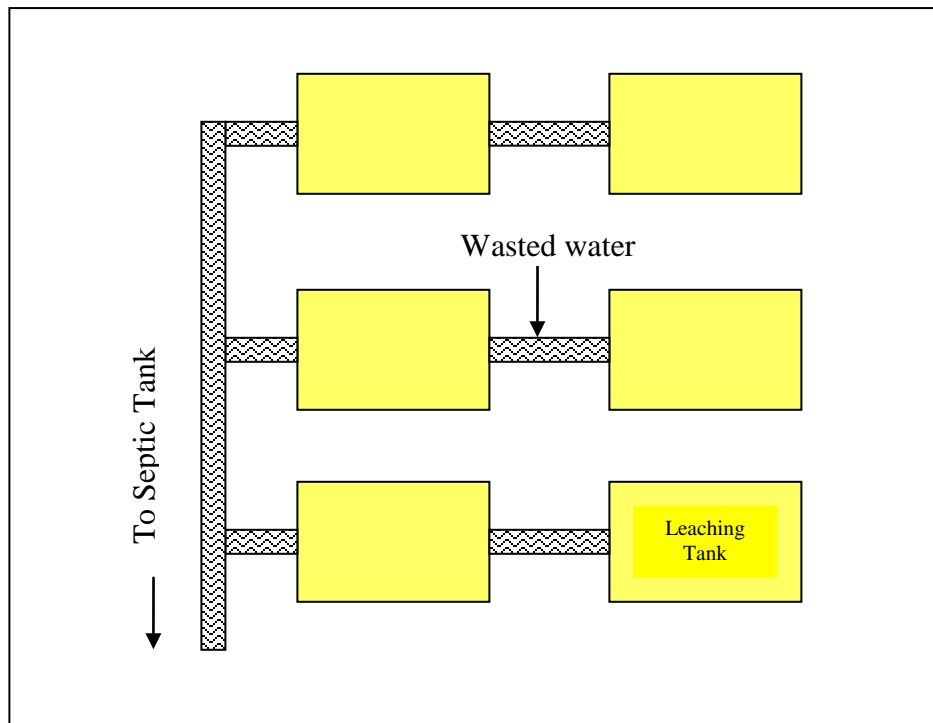


Figure 2.4: The existing system of leaching process.

2.3 Process Flow

The chart below shows about the whole process in nata production (fig 2.5). From this chart, we can see that leaching process is situated between slicing and cooking process. All the process must consider for standard and safety to avoid give any negative affects to other process even after any improvement activities in leaching process.

If any modification can give a negative effect to other process, standardize or setting in the process must be changed. Every improvement in leaching cycle must consider every aspect of nature and chemical reaction.