

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Activities and Processes in Izie Herb Enterprise

4.1.1 Collection of Raw Materials

Izie Herb Enterprise products produced only from fresh, dried or otherwise preserved plants or parts of plants. Most of the plants used for medicinal purposes are cultivated in contracted farms. Some of them however must be collected from the wild or imported from the neighboring countries.

A collection of plants from cultivated sources ensures that the plant collected is highly controlled over quality, purity and pick as the one that is desired. Certain wild plants cannot be cultivate and only grow naturally in their habitats. When plants are collected from the wild, there is a much greater chance that the wrong herb will be picked as they have been incorrectly identified. The advantage to using wild plants is that they are unlikely to contain any pesticide residues. The plants will be imported from Thailand if there are shortages in raw materials supply. The plants will be picked by Izie Herb employee at the Malaysia frontier town, Rantau Panjang.

4.1.2 Production of Herbal Extracts

Garbling refers to the separation and removal of that portion of the plant to be used from other parts of the plant (e.g.; stems and midribs from leaves, seeds from fruit and others), dirt and other foreign matters. Although there are machines that perform garbling, usually

garbling is performed manually in Izie Herb Enterprise. The garbling processing steps are roughly as follow:

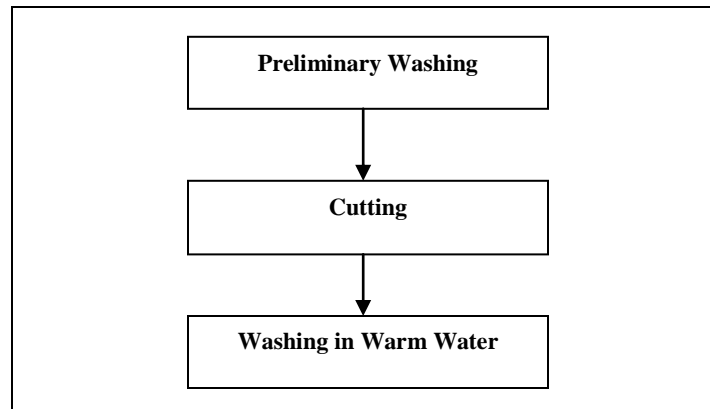


Figure 4.1: Garbling Processing Steps

After the plants are harvested or gathered, they must be cleaned. Preliminary washing is a simple way to flush away the soil, mud, sand, pesticide and other solid particles by a thorough but fast rinse with clean running water. After the preliminary wash, plants are to be cut manually on the cutting table. Cutting may involve peeling, stripping leaves from stems and chopping plants to small pieces. Only the portions of the plant that contain the active ingredients, not the whole plant are used to produce the herbal extracts. Any unnecessary parts are removed prior to next washing and drying process to avoid wasting in time, energy and cost. The cutting plants then have to be cleaned in the water tub at warm temperature, 40 - 50°C mixed with anti-microb agents to ensure any pathogenic organisms (e.g.; mold, fungicides and yeast) and small insects are eliminated and not stick to herbals.

At this time, most herbs have a moisture content of 60% to 85% and must be dried to within 10% to 14% percent moisture before storage. The reasons are:

- a) Drying herbs preserve the active substances and extend the life of their medicinal value.
- b) Allow the herbs to be stored in a smaller area, as dried herbs take up only a fraction of the space of fresh herbs.

- c) Plants must be dried as soon as possible after harvest because they begin to deteriorate immediately and important compounds will break down.
- d) The water will encourage the microorganisms' existence that will contaminate the material.

The type of plant or plant part being used will determine the appropriate drying technique whether it is natural drying or oven drying. Commercially, most plants are dried in the artificial dryer. The natural drying method requires no drying equipment and places the herbs in a non-humid area or uses solar energy (sun-drying), but it requires large amounts of space. In long period, direct sunlight deteriorates the nutrients and active medicinal components in raw herbals. The plants can also be damaged by the weather. This method of drying can take several weeks and is a labor-intensive process. The exact length of time for adequate drying depends on temperature and humidity that can't be controlled by humans.



Figure 4.2: Artificial Dryer

The best method for drying herbs is usually using the artificial dehydrator. In Izie Herb Enterprise, an industrial oven with a good air flow, constant heat setting and protection from sunlight were used. This oven can reduce drying time to several days, able to operate continuously, labor-saving and has high throughput. However, it is quite expensive and has high energy requirements. The length of time for adequate drying is within 1 to 7 days with the temperature of the dryer ranges from 40°C to 90°C, depending on the type of herbals. Proper time and temperature setting ensure that the plant's active substances will not be damaged by overheat.

Grinding or milling process means mechanically breaking down leaves, roots, seeds, flowers, fruits or other parts of a plant into very small units ranging from larger coarse fragments to fine powder. Workers in Izie Herb Enterprise crush the dried cutting herbs into a powder form using spice mills. These machines will break up the materials that are fed into the machine from above. There are four mills that were used to grind the different kind of herbs.



Figure 4.3: Milling Machine

Once milling is complete, powdered herbs are packed and stored in close containers for several days before they are ready to send to contract manufacturer with GMP (Good Manufacturing Process) certified for further processing. The designate GMP manufacturer will provide the safety test, encapsulate process, assistance in killing the germ and bacteria, eliminating contamination, re-milling, packaging, hologram labeling, product registration and others NPCB (National Pharmaceutical Control Bureau) requirements for Izie Herb Enterprise. The NPCB require that the manufacturing process be GMP compliant to make sure the products are safe, high in quality and effective.

4.1.3 Promotion and Marketing

To reach on the potential customers, this enterprise was applied various kinds of promotion and marketing methods including:

- 1) Leaflet distribution. The pamphlets will be delivered to the target randomly using the direct mail, door-to-door and street marketing. Direct mails send the pamphlets to all postal customers in an area or to all customers on a list. Door-to-door is delivering unaddressed pamphlets to homes in certain area. Izie Herb Enterprise pay specialist door-drop delivery person that provides this service. The other way of leafleting is street marketing; the pamphlets are hand delivered to people in the street or at specific crowded place.
- 2) Exhibition and carnival. Exhibition and carnival are valuable because they allow face-to-face communication and offer opportunities for networking. Izie Herb Enterprise sometime involves in the fair, exhibition and carnival that organize by government agencies such as Standards and Industrial Research Institute of Malaysia (SIRIM) and Majlis Amanah Rakyat (MARA).

- 3) Poster at strategic place. Posters were stick at crowded place such as bus stand, restaurant and lift entrance.
- 4) Advertisement in press. Printed newspaper advertising offers a targeted way of spreading Izie Herb Enterprise business message to large numbers of people. This is the most effective method for Izie Herb Enterprise but the cost is high. The advertisement must comply with NPCB requirement to get the Kementerian Kesihatan Lembaga Iklan Ubat (KKLIU) registration number, a permission by MOH (Ministry of Health) to advert medicinal products.
- 5) Online marketing. Advertising on certain internet websites helping to drive traffic to Izie Herb Enterprise website. Bulk e-mail becomes a vital, fast and cheap tool for Izie Herb Enterprise to send regular marketing messages.
- 6) Mobile marketing. This is an important way for Izie Herb Enterprise to send text-message to their customers. Short messaging service (SMS) messages are usually read because mobile phones are always on and they are always with owners. Thus, mobile marketing is direct, cost effective and responsive. Izie Herb Enterprise often has an advantage over big brand names because they already have a personal relationship with customers.
- 7) Appoint the stockiest and distributors. The stockiest, distributors and dealers were designated in certain area to represent, promote and market the Izie Herb Enterprise brands.

4.1.4 Delivering the final products

Most of final products are delivered to customers through national courier company, Pos Laju. The products also send by Izie Herb Enterprise workers to shops or customers nearby

especially in Kelantan states. Handling door to door delivery service to all customers is impossible for small business like Izie Herb Enterprise, but the dealers, distributors and stockiest may help to do that. Table 4.1 summarizes the activities in Izie Herb Enterprise.

Table 4.1: Activities in Izie Herb Enterprise

Activities	Descriptions
Collection of raw materials	<p>The raw plants material are collected from:</p> <ol style="list-style-type: none"> 1) Contracted farms. (Produce 80% of raw materials) 2) The wild habitats. (Produce 5% of raw materials) 3) Neighboring countries. (Produce 15% of raw materials)
Production of herbal extracts	<p>The processing steps are:</p> <ol style="list-style-type: none"> 1) Preliminary washing. 2) Cutting. 3) Washing in warm water. 4) Drying: <ol style="list-style-type: none"> i) Natural Drying. ii) Oven Drying. 5) Grinding or milling. 6) Storage and send to GMP contracted manufacturer for further process.
Promotion and marketing	<p>Various kinds of promotion and marketing methods including:</p> <ol style="list-style-type: none"> 1) Leaflet distribution. (30% of activities) 2) Exhibition and carnival. (5% of activities) 3) Poster at strategic place. (5% of activities) 4) Advertisement in printed newspapers. 5) Online marketing. (25% of activities) 6) Mobile marketing. (10% of activities) 7) Appoint the stockiest, distributors and dealers. (25% of activities)
Delivering the final products	<p>Products send through:</p> <ol style="list-style-type: none"> 1) Postage and courier companies. (65% of products). 2) Izie Herb workers to shops or customers nearby. (10% of products) 3) Stockiest, distributors and dealers. (25% of products)

Source: Walkthrough observations

4.2 Audit Finding (Qualitative)

The walk-through observation was done to observe the waste generation, water consumption, energy consumption and working environment in Izie Herb Enterprise. Table 4.2 shows the general observations on waste generation, water consumption, energy consumption and working environment in Izie Herb Enterprise.

Table 4.2: Observations from Audit in Izie Herb Enterprise

Item	Observation	Activity in	Good Practice	Potential for Improvement
Waste Generation	1) Solid wastes generated include papers, leaflets, old newspapers, tissue papers, carton boxes, packaging boxes, plastic bottles, plastic bags, polystyrene, etc.	Production & Promotion.		√
	2) All solid waste generated are collected by staff cleaner twice per day.	Production & Promotion.	√	
	3) Most of solid waste generated by consumers indirectly.	Promotion.		√
	4) Mud, soil, dirt and the unwanted part of herbals generated after the garbling process.	Production.	√	
	5) There is less / not significant chemical waste generated.	Production.	√	
Water Consumption	1) Water used is supplied by Air Kelantan Sdn. Bhd.	Production.		
	2) Overall, water is improperly used in cleaning raw herbs, apparatus, machines floor and other cleaning purposes.	Production.		√
Energy Consumption	1) One of energy being used is fuel.	Collection & Delivering.		√
	2) Main energy being used is electricity.	Production & Promotion.		√
	3) Some equipment operates at 24 hours such as oven and refrigerator.	Production.		√

	<p>4) Computers, printers and scanner are always on during office hour even though there is no person using it.</p> <p>5) Lights are switched on to lighten up the office and manufacturing site during the day time.</p> <p>6) Fans and air conditioner are always on during office hour.</p> <p>7) Equipments and machines are found to be well washed, inspected and maintained.</p>	<p>Promotion.</p> <p>Production & Promotion.</p> <p>Production & Promotion.</p> <p>Production.</p>	<p>√</p> <p>√</p> <p>√</p> <p>√</p>
Working Environment	<p>1) Spillage of powdered herbals is found especially at the area where the milling is conducted.</p> <p>2) Floor is found to be slippery below the rinse area and water tub due to spillage of water during cleaning of raw materials.</p> <p>3) Some of herbal is found to create uneasy odours during the milling process.</p> <p>4) Certain powdered herbs tend to float during the milling process.</p> <p>5) Location of apparatus, machines and working spaces are found to be properly arranged.</p> <p>6) Powdered herbal packaging and containers are well labelled.</p>	<p>Production.</p> <p>Production.</p> <p>Production.</p> <p>Production.</p> <p>Production & Promotion.</p> <p>Production.</p>	<p>√</p> <p>√</p> <p>√</p> <p>√</p> <p>√</p> <p>√</p>

Source: Walkthrough observations

4.3 Audit Finding (Quantitative)

Table 4.3 shows the summary of audit findings on waste generated, water and electricity consumptions in Izie Herb Enterprise based on yearly consumptions. Detailed findings are listed in Table 4.3 – 4.9.

Table 4.3: Summary of Audit Findings in the Izie Herb Enterprise

Item	Quantity generated per year
Waste Generated	
- Chemical Waste	Not significant
- Solid Waste	900 kg
Water Consumption	720 m ³
Energy Consumption	
- Fuel (petrol)	2400 L
- Electricity	62,123.4 kWh

4.3.1 Waste Generated

Generally, various types of activities are conducted in Izie Herb Enterprise start from collection of raw materials to delivering the final products. Based on the walk-through observations, it is found that high amount of waste are generated in Izie Herb Enterprise due to uncontrolled usage of materials by workers, such as papers for writing and printing, old newspapers for wrapping, tissue papers for cleaning, etc. Mud, dirt, soil and unwanted part of herbals generate during the garbling process. Table 4.4 shows types of waste generated in IHE. From the table, it is estimated that 900 kg of solid wastes are generated yearly by workers in Izie Herb Enterprise.

Table 4.4: Waste generated in Izie Herb Enterprise for a year

Types of waste	Quantity generated per month	Quantity generated per year
Papers, old newspapers, tissue papers, plastics, etc.	10 kg	120 kg
Mud, dirt, soil, unwanted part of herbals, etc.	65 kg	780 kg

Most of solid waste was generated by consumers while using the Izie Herb's products. Table 4.5 shows the estimation of waste generated by costumers for a year base on sales

volume. Although these waste generated by consumers, Izie Herb Enterprise share the responsible to produce and reduce the wrapping and packaging materials that turn to waste.

Table 4.5: Estimation waste generated by costumers for a year

Types of waste	Quantity generated per month	Quantity generated per year
Papers, leaflets, old newspapers, carton boxes, packaging boxes, etc.	50 kg	600 kg
Plastic bottles, plastic bags, polystyrene, etc.	10 kg	120 kg

4.3.2 Water Consumption

From the observation, it is found that water is improperly used by workers in cleaning raw herbs, apparatus, machines, floor and other cleaning purposes. From Table 4.6, it is estimated that 720 m³ of water is used per year in Izie Herb Enterprise.

Table 4.6: Water consumption in Izie Herb Enterprise for a year

Quantity consumed per day (m ³)	Average time usage per year (hours)	Quantity consumed per year (m ³)
1.97	300	720

The payment rate for month charged by Air Kelantan Sdn. Bhd. is RM 0.40 for the first 20 m³ water usages, RM 0.75 for the second 20 m³ usages and RM 1.05 for the third 20 m³ usages. From Table 4.7, the price of water usage in Izie Herb Enterprise for a year is about RM 528.

Table 4.7: Price of water usage in Izie Herb Enterprise for a year

Rate payment for months	Quantity consumed per month (m ³)	Price per month (RM)	Price per year (RM)
20 x (0.4 + 0.75 + 1.05)	60	44	528

4.3.3 Energy Consumption

Fuel consumption especially petrol use for transportation of raw materials and final products. Table 4.8 shows the petrol usage in Izie Herb Enterprise. RON95 petrol price is RM 1.85 per liter and used by two vans.

Table 4.8: Petrol RON95 usage in Izie Herb Enterprise

Quantity consumed per month (L)	Quantity consumed per year (L)	Price per year (RM)
200	2400	4,440

During the walk-through audit, observation was done to inventories all equipment used, identified rated power from technical specifications on the equipment and daily operating hours in Izie Herb Enterprise. Electricity usage is mainly higher in the day time because Izie Herb Enterprise operates during office hours which are from 8.30 a.m. to 5.00 p.m. However, employees rarely have to work till night.

Table 4.9 shows the summary of typical appliances being used in Izie Herb Enterprise as 28 June 2010 while Table 4.10 shows power ratings for each appliance and machine. A total 12 lamps are switched on to lighten up the Izie Herb Enterprise working areas even during the day time. Air conditioners and fans also contribute to electricity usage in Izie Herb Enterprise. This is because these appliances are operated for longer hours during office hours for workers' comfort. It is observed that although there are no workers, the lamps, fans and air conditioner are commonly on. Computer, printer and scanner are also compliances that are usually used by workers in Izie Herb Enterprise office where these items are always on during office hours. Further, some equipment in the laboratory operated for 24 hours such as oven and refrigerator.

Table 4.9: Summary of typical appliances available in Izie Herb Enterprise

Types of Appliance	Quantity
Fluorescent Lamp (4 ft)	12
Fan	3
Oven	2
Refrigerator	2
Spray Dryer	1
Water (washing) Tub	2
Milling Machine	4
Exhaust fan	2
Air conditioner	1
Computer (LCD)	1
Computer (CRT)	3
Computer (Notebook)	1
Printer	3
Scanner	1

Table 4.10: Appliances with power rating

Types of Appliance	Power Rating (Watt)
Fluorescent Lamp (4 ft)	36
Fan	72
Oven	5,000
Refrigerator	80
Spray Dryer	2, 900
Water (washing) Tub	1,500
Milling Machine	800
Exhaust fan	300
Air conditioner	1, 500
Computer (LCD)	190
Computer (CRT)	250
Computer (Notebook)	18
Printer	12
Scanner	2.5

Source: Equipment Specification and interview with Mr Razak (Technician)

Table 4.11 shows appliances used by workers as well as their respective power contribution in Izie Herb Enterprise. From the table, it is estimated that a total of 62,123.4 kWh of electricity is used per year by workers in the Izie Herb Enterprise. From Figure 4.4, oven is the highest contributor in electricity usage which is 43,800 kWh and it is equal to 70.5 % of total electricity usage as shown in Figure 4.5. Oven uses the highest electricity because it used 2.5 kW for every hour. Furthermore, oven operates at 24 hours for drying the raw herbals. Milling machine is the second highest contributor in electricity usage which is 4,800 kWh and is equal to 7.73% of total electricity usage. Thus, for each milling machine, it used 0.8 kW for every hour.

Table 4.11: Electricity consumption in Izie Herb Enterprise for a year

Types of Appliances	Quantity	Power usage per appliances (Watt)	Average time usage per year (hours)	Electricity usage per year (kWh)
Fluorescent Lamp (4 ft)	12	36	2400	1,036.80
Fan	3	72	2400	518.40
Air conditioner	1	1,500	2400	3,600
Computer (CRT)	3	250	2400	1,800
Computer (LCD)	1	190	2400	456
Computer (Notebook)	1	18	2400	43.20
Printer	3	12	2400	86.40
Scanner	1	2.5	2400	6
Refrigerator	2	80	8760	1401.60
Exhaust fan	2	300	2400	1,440
Water (washing) Tub	2	1,500	900	2,700
Oven	2	2,500	8760	43,800
Spray Dryer	1	2,900	150	435
Milling Machine	4	800	1500	4,800

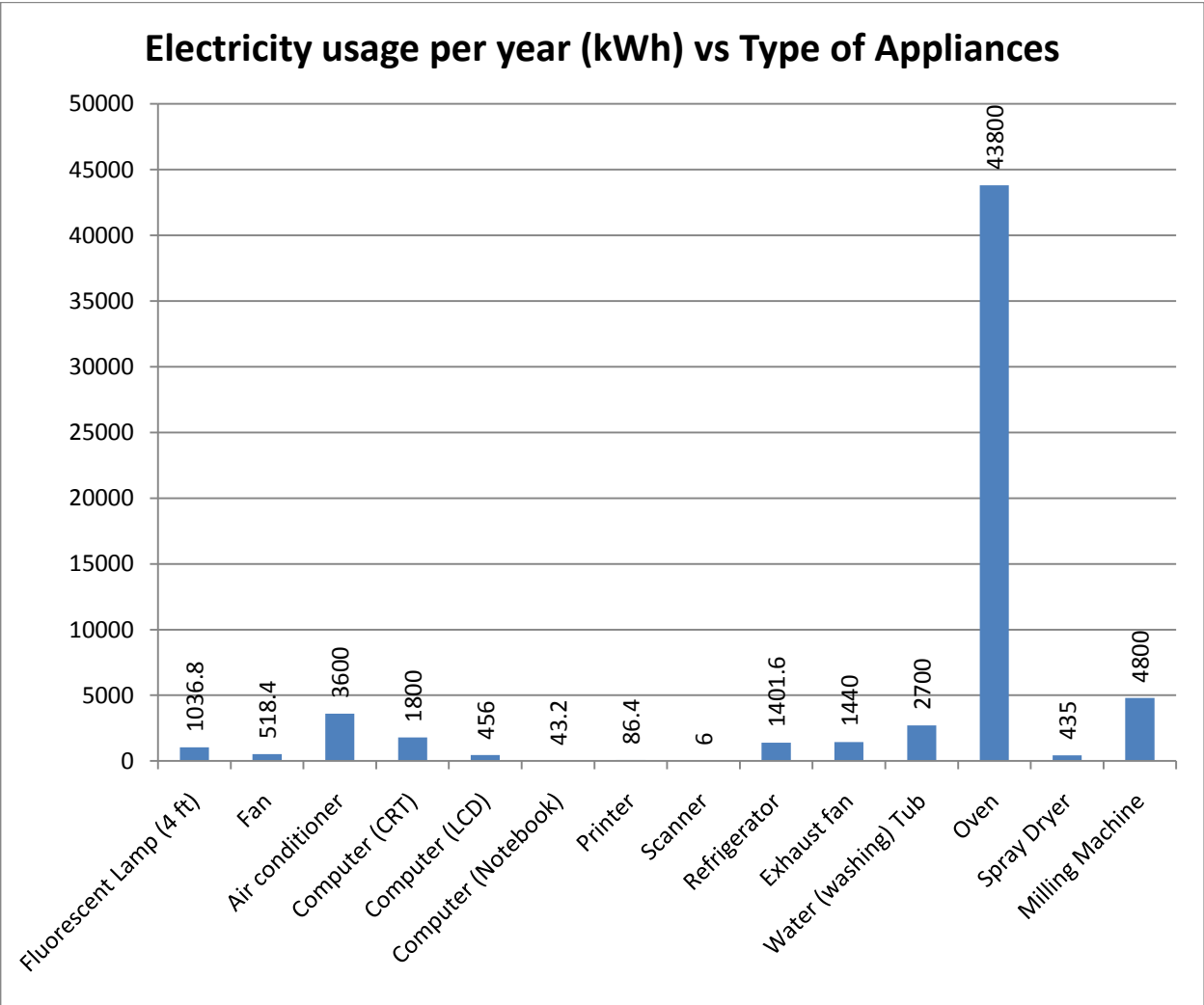


Figure 4.4: Graph of electricity consumption in Izie Herb Enterprise per year

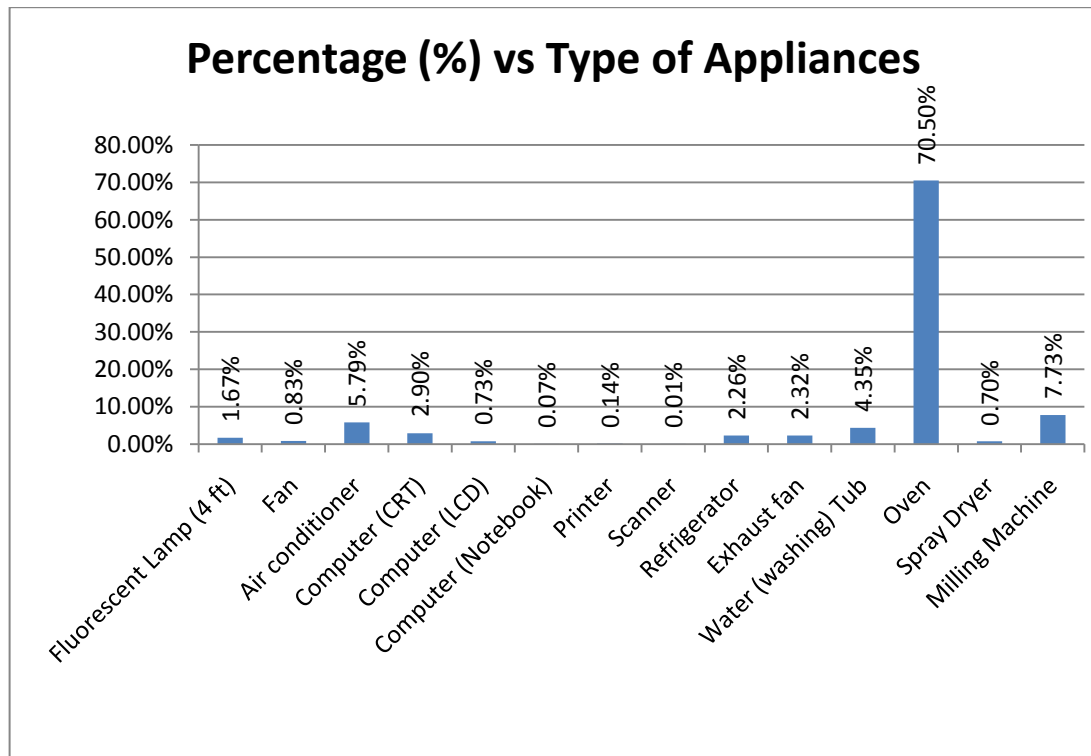


Figure 4.5: Graph of electricity percentage consumption in Izie Herb Enterprise per year

Table 4.12 summarizes electricity usage by workers in the laboratory. As Izie Herb Enterprise is incorporated under commercial consumer by Tenaga Nasional Berhad (TNB), it means that for each kWh of usage, Izie Herb Enterprise has to pay RM 0.23. From this rate, the total of electricity usage for a year is 62, 123.40 kWh and this is equal to about RM 14,288.38.

Table 4.12: Estimation of electricity usage Izie Herb Enterprise for a year

Types of Appliances	Electricity usage per year (kWh)	Percentage (%)	Price (RM)
Fluorescent Lamp (4 ft)	1,036.80	1.67	238.464
Fan	518.40	0.83	119.232
Air conditioner	3, 600	5.79	828
Computer (CRT)	1,800	2.90	414
Computer (LCD)	456	0.73	104.88
Computer (Notebook)	43.20	0.07	9.936
Printer	86.40	0.14	19.872

Scanner	6	0.01	1.38
Refrigerator	1401.60	2.26	322.368
Exhaust fan	1, 440	2.32	331.2
Water (washing) Tub	2,700	4.35	621
Oven	43,800	70.50	10074
Spray Dryer	435	0.70	100.05
Milling Machine	4,800	7.73	1104

4.3.4 Risk Assessment

From the walk-through observations, risk assessment is conducted in order to identify any risk possibility that can occur in Izie Herb Enterprise in order to ensure that all workers have environmental friendly, safe and healthy working conditions. The overall hazards and poor practises identified in Izie Herb Enterprise that can contribute to the environmental problems are:

- 1) Spillage of powdered herbals is found especially at the area where the milling is conducted. Floor is found to be slippery below the rinse area and water tub due to spillage of water during cleaning of raw materials. Spillage of powdered herbals and water on the floor can create possibility of workers to suffer injuries due to slip and fall.



Figure 4.6: Spillage of powdered herbals



Figure 4.7: Spillage of water below the rinse area

- 2) Some of herbal is found to create uneasy odours and tend to float during the milling process. This can lead to possibility of disturbing the nose due to inhalation and vision if the herbal particles strike the eyes.
- 3) Improper usage of Personal Protection Equipment (PPE) such as gloves while working can leads to accidents' possibility such as spillage, splash, cuts, burned, etc.



Figure 4.8: Improper size of glove and wearing ring

- 4) Drinking and eating in the laboratory also provides a mechanism for contaminating the working area and herbals.



Figure 4.9: Milk drop on floor

- 5) There is less environmental awareness and knowledge among workers.
- 6) Equipment like ovens that operates under its' technical specification such as under operational temperature and pressure, can create hazard possibilities such as malfunction, damage or explode.

4.4 Environmental Management Options

Based on information obtained from the audit, environmental management options are generate with aims at making more efficient use of natural resources such as raw materials, water and energy consumption as the inputs, reducing the generation of wastes and emissions as the outputs and at the same time reduce the risk possibility. In adopting an environmental management philosophy, it is important to consider the overall process of Izie Herb Enterprise managements.

In general, the Environmental Management in Izie Herb Enterprise can be classified based on four major elements which are Good Operating Practices, Process Changes, Substitution of Materials and Source Reduction. However, the options generated are not definitely fully depending on these four elements.

4.4.1 Waste Generated

From the audit, it is observed that solid waste generated in Izie Herb Enterprise includes papers, tissue papers, old newspapers, plastics, etc. The amounts of wastes generated are higher due to improper practices by workers. For this reason, Environmental Management options are generate based on these issues. Most of solid waste generated indirectly by costumers such as plastic bottles, plastic bags, packaging boxes, polystyrene and leaflets. The marketing and promotion activities through leaflet distribution and poster also produce the solid waste.

4.4.1.1 Good Operating Practices

Good Operating or Management Practices can often be implemented with little cost. Waste reduction is more cost-effective and easier than recycling because it reduces the amount of item that needs to be collected, transported and processed. Some practices that can be implemented by workers include always try to use both sides of a sheet of paper for writing, printing, copying and drawing for internal documents usage like drafts and meeting agendas. Once-used paper can be reused by manually feeding it into printers, paper fax and scanner.

The probability of human error on even the most straightforward tasks is nonzero and during stressful situations, human error rates rise to between 10% and 100% (R. H. Pope, 1986). Workers also should try to minimise the human mistake that can lead to misprinting and copying error by checking and preview all documents before printing or copying it. Most employees print many useless and unnecessary pages each day, including blank pages. Further, worker needs to monitor the wrapping process and avoid the unnecessary

wrapping in order to reduce the solid waste generation. Solid wastes such as papers and plastics can also be segregated and recycled in order to reduce waste load. Minimization of powdered herbals spillage during the milling process can also reduce tissue papers usage to clean the powder.

4.4.1.2 Process Changes

As written in Copy Paper - Hidden Costs, Real Opportunities by Citigroup and Environmental Defense (2003), reducing paper consumption can be achieved by small changes in customer expectations and employee behavior, such as using on-line statements and duplex printing. While these actions may sound simple, the associated savings are significant. Consider the use of paperless techniques for every activity conducted in Izie Herb Enterprise, which use less paper or wisely used rather than traditional way. Paperless is also about the process changes to uses minimal amounts of paper by converts all forms of documentation into digital forms. One of the simplest ways is to print the document to PDF. PDF is a digital and universally portable document format that can be attached to a Microsoft Word document or an e-mail.

Minimize the promotion and marketing process through leafleting or poster and concentrate more on online and mobile marketing. E-mail and SMS can be used to share the ideas and send the business messages to the customers. The digitization of postal mail allows online access to its contents by users around the world. Going paperless can save cost, save working space, make information and electronic documentation sharing easier and reduce the environmental damage.

4.4.1.3 Substitution of Materials

In order to reduce the amount of tissue papers generated in Izie Herb Enterprise, the usage of tissue papers in cleaning the apparatus and spillage herbals can be eliminated and substituted with a cloth where the usage of cloth can be repeated. The plastics and polystyrene that have been used to wrap the product can be substitute with paper based wrapper. The paper bags will be a good solution to substitute the plastic bags. To go paperless, the old computers and scanner must be substitute with the new, high speed and lots of memory for saving and scanning large volumes of paper documents.

4.4.1.4 Source Reduction

A 1996 study by J. Powell et al., showed that the transport distances can quickly undermine the benefits of recycle, and in some cases the social and environmental cost of collecting, sorting and transporting a recovered material may be greater than the savings that can be made by avoiding the production of primary materials.

Source reduction and waste minimisation for the Izie Herb manufactured products can most easily be done at the early design stage. Consider the quantity of waste that will be generated and adjust the products design to minimize it. The designers can reduce the amount of components used in a product to ensure the resource is maximizing without compromising the quality and standard of the final products. The early design on source reduction makes the product easier to be terminated or recycled at the end of its useful life. Design the smaller bottles and leaflets size for Izie Herb product may mean smaller packaging size, reduce the wrapping material and postage charge, save space and easier to be terminated.

4.4.2 Water Consumption

From the audit, it is observed that water is improperly used in cleaning the apparatus, machines, raw materials and other cleaning purposes. For this reason, several options have been identified which are as follows.

4.4.2.1 Good Operating Practices

The water consumption can be reduced by implementing appropriate way of handling water usage. Rinse waters can be used for lower priority cleaning applications and the raw material should be cleaned with wet cloth before go to the preliminary wash. The water discharged from the preliminary wash also can be reused for the other cleaning purpose. The proper ratio adjustment of water to cleaning agent will ensure the water be used efficiently and at the same time, try as far as possible to minimize the use of cleaning agents.

For cleaning of floor purpose, pre-clean the floor with a broom or if possible, the usage of non-water based cleaning systems such as vacuum can be introduced before hosing down by using water. Regular maintenance is required to inspect for leaks, check the running water on taps and a proper system which enables workers to report any leakage promptly should be set up in Izie Herb Enterprise. Monitor and keep track the water meter or water bill to spot any increased use and fix the problem quickly.

4.4.2.2 Process Changes

1) Use high pressure water flow for cleaning activities

In order to reduce water consumption, the usage of high pressure spray washer for cleaning activities is strongly recommended. Other expected benefit by implementing this option includes saved money on water, better cleaning performance and also reduced washing time and cleaning agents' usage.

2) Use more efficient devices.

To switch the conventional flush toilet, low-flush toilets should be mandatory. Current toilet in Izie Herb Enterprise uses about 14 liters per flush. The average person flushes four times per day, which is 56 liters. Most low flush toilets use 6 liters per flush as opposed to the usual 12 to 14 liters. Referring to Act Government Website, there are Low-flush toilet that features two buttons that use 3 liters and 6 liters. Four low flushes use 12 to 24 liters water per day, which results in a savings per person, per day of 32 to 44 liters.

The installation of automatic shut offs on water supplies such as hose nozzles and sinks will keep them from being left on accidentally by workers.

3) Designing a water balance

If possible, one of the most effective ways to begin using water more efficiently is to introduce a water balance system. A water balance describes the flow of water in and out on whole site, in certain buildings, systems or operations. It can be very detailed or cover

only major uses to show how and where the water is being used and how much water is being discharged of.

Although it is not possible to account for every drop, the water balance can help designers plan equipment layouts to identify opportunities for greater efficiency, help workers to identify leaks, possible misuses and other losses.

4.4.3 Energy Consumption

Based on the information obtained from the audit, it is observed that the petrol usage in Izie Herb Enterprise is low but the electricity usage is relatively high due to the usage of certain appliances that operates for 24 hours per day. Further, some improper practices by workers are also contributed to the higher electricity consumption. For this reason, Environment Management options are generated for electricity usage in order to overcome these issues.

4.4.3.1 Good Operating Practices

In order to reduce electricity usage, some practices that can be implemented by workers are as follows.

1) Lighting

There are 12 fluorescent lamps with 4 ft long in Izie Herb Enterprise are required to be switched on even though during day time. To save the electricity usage, one of options that can be useful is the lamps should be turned off whenever workers leave the office and working area. The natural daylight for lighting needs should also be used whenever possible.

2) Computer

Based on the audit, it is observed that computers, printers and scanner are always on during office hour even though there is no person using it. To reduce this unnecessary electricity usage, Environmental Management options that can be applied here is by turn off the printers and scanner if it is unused. For the computers, it is recommended to turn off the monitors when they are left for more than 20 minutes. Another option is to install the screen savers although it is found that screen savers are also consuming electricity (Roberson, et al. 2002).

3) Air conditioner

Air conditioner is one of the contributors to electricity usage in Izie Herb Enterprise because it is installed to comfort workers even though there is usage of fans in the working area. Reducing the electricity consumption of electrical appliances reduces the heat they produce, and hereby reduces the burden on the air conditioning system. This study found that the heat of electrical equipments increases the load on air conditioning system to uses an extra energy to keep working area cool.

The thermostat should be set between 22 to 26°C or to a temperature which everyone still feels comfortable with or installing a digital programmable thermostat to regulate the temperature more efficiently at certain time. Other options such as curtains and blinds should be closed to prevent direct sunlight let into the working area, avoid the blocking of outdoor unit air intake to maximize air circulation, air filter should be cleaned regularly to avoid dirty air filters which cause the air conditioner consumes more electricity and finally

the air conditioner should be turned off whenever workers leave the working area can be useful in order to minimize electricity consumption due to usage of air conditioner.

4) Other Appliance (Milling Machines, Exhaust Fan, Ovens)

The usage of milling machines is one of the major contributors to the electricity consumptions in Izie Herb Enterprise. In order to reduce energy requirement, the herbs should be cut in smaller size and dried well in ovens before they are fed into the milling machines. Regular cleaning and scheduled switching of milling tooth will ensure the efficient, quick and quality powdered herbal production and at same time reduce the electricity usage.

Operating duration of the exhaust fan can be reduced where they can be used only when there is milling process conducted in the working area. Furthermore, electricity savings of exhaust fan usage can be achieved through regular cleaning of fan blades to ensure they work smoothly and efficiently.

The usage of ovens is the highest contributors to the electricity consumptions in the overall of Izie Herb activities where they operate for 24 hours and have high power rating. Further, it is found that there are 2 ovens being used in the Izie Herb Enterprise. For this reason, options that can be useful are eliminate the use of all ovens at the same time by ensuring the storing of the cutting herbals in the ovens is properly arranged. Further, the operating temperature of the ovens could be optimised in order to reduce energy requirement and protect the active substances.

4.4.3.2 Substitution of Equipments

1) Lighting

According to Energy Star Website, in order to reduce electricity requirement due to the usage of lightings, compact fluorescent light bulbs (CFLs) should be used where it is found that CFL use less than 25 percent of the electricity standard bulbs use, last 10 times longer and more efficient.

2) Computer

It is recommended that CRT computers should be replaced by LCD display or laptop computers. On average, CRT monitors require $0.53\text{W}/\text{inch}^2$ energy and LCD monitors require $0.23\text{W}/\text{inch}^2$ energy (Roberson et al., 2002). Laptop computers consume less energy since they are small and transferred into low power mode more quickly in order to preserve battery power. The study by Kawamoto et al., (2001) calculated that on average laptops require 15W when active, compared to 55W for active desktops. Another study by Roberson et al., (2002) found similar results; laptop computers require 19W when active, whereas desktop computers use 70W when active.

3) Air conditioner

For the same purpose to reduce electricity consumption the usage of air conditioner can be substituted by install the ceiling fans to force the heat to stay out from ceiling or by fans whenever possible, where both are expected to use less energy than air conditioner.

4.4.4 Risk Assessment

Table 4.13 summarizes environmental management options generated to reduce risk possibilities in Izie Herb Enterprise.

Table 4.13: Environmental management options generated to reduce risk

Hazard/ Poor practices identified	Environmental Management Options generated
<p>1) Spillage of powdered herbals is found especially at the area where the milling is conducted. Floor is found to be slippery below the rinse area and water tub due to spillage of water during cleaning of raw materials. Spillage of powdered herbals and water on the floor can create possibility of workers to suffer injuries due to slip and fall.</p> <p>2) Some of herbal is found to create uneasy odours and tend to float during the milling process. This can lead to possibility of disturbing the nose due to inhalation and vision if the herbal particles strike the eyes.</p> <p>3) Improper usage of PPE such as gloves while working can leads to accidents' possibility such as spillage, splash, cuts, burned, etc.</p> <p>4) Drinking and eating in the laboratory also provides a mechanism for contaminating the working area and herbals.</p> <p>5) There is less environmental awareness and knowledge among workers.</p> <p>6) Equipment like ovens that operates under its' technical specification such as under operational temperature and pressure, can create hazard possibilities such as malfunction, damage or explode.</p>	<ul style="list-style-type: none"> ▪ It is strongly recommended that regular housekeeping is required to promptly report and clean the spillage of herbals and water on the floor in order to reduce injuries due to slip and fall. ▪ A document detailing the working safety and environmental procedures should be drawn up. It should detail relevant controls according to the types of herbal handling procedures. It should also give instructions and telephone numbers in case of emergencies such as slippery and injury. Workers should be made aware of the procedures and any other requirements. Staff with specific responsibility for supervision of environmental and emergency procedures, is strictly required to receive proper training. Proper ventilation systems are also needed. ▪ Training on equipment handling and PPE usage must be regularly conducted in order to ensure workers are well understands on the operation of the equipments and PPE importance. ▪ Regular inspections are needed to ensure that the temperature and pressure in the ovens are as close to the manufacturers' specification as practicable and that ovens are not maintained at higher or lower pressure than that recommended by the manufacturer or over-heated.

4.5 Environmental Management Options Evaluation

At this stage, a number of environmental management options have been identified. The next step is to identify those options benefit and their barrier in Izie Herb Enterprise.

4.5.1 Waste Generated

Table 4.14 summarizes evaluations of environmental management options suggested in reducing waste generation in Izie Herb Enterprise.

Table 4.14: Environmental Management Options Evaluation on Waste Generated in Izie Herb Enterprise

Environmental Management Options suggested	Benefit	Barrier
<p>Good Operating Practices</p> <ul style="list-style-type: none"> ▪ Waste reduction; use both side of sheet, reuse paper, avoid unnecessary wrapping and reduce tissue papers usage ▪ Minimization of human mistake during printing and copying. ▪ Recycling and segregating of solid materials such as papers, plastics, etc. 	<ul style="list-style-type: none"> ▪ Resources conservation through minimizing usage of raw materials. ▪ Reduction in waste generation to the environment. ▪ Save cost. 	<ul style="list-style-type: none"> ▪ Resistance to change within company culture. ▪ Lack of awareness of the business environmental impacts.
<p>Process Changes</p> <ul style="list-style-type: none"> ▪ Going paperless; print the document to PDF, go online and use mobile marketing instead of leafleting and poster. 	<ul style="list-style-type: none"> ▪ Save cost, save working space, make information and electronic documentation sharing easier and reduce the environmental damage. 	<ul style="list-style-type: none"> ▪ Lack of technical knowledge.
<p>Substitution of Materials</p> <ul style="list-style-type: none"> ▪ Usage of tissue papers substitute with a cloth, plastics and polystyrene substitute with paper based wrapper. 	<ul style="list-style-type: none"> ▪ Reduction in waste generation to the environment. ▪ Positive impact on profit, 	<ul style="list-style-type: none"> ▪ Lack of awareness of benefits. ▪ Wrong perceptions of the perceived

<ul style="list-style-type: none"> ▪ Introduce the new, high speed and lots of memory computers and scanner for saving and scanning the files. 	<p>operations efficiency and company image.</p>	<p>cost.</p> <ul style="list-style-type: none"> ▪ Lack of technical knowledge.
<p>Source Reduction</p> <ul style="list-style-type: none"> ▪ Design the smaller bottles and leaflets. 	<ul style="list-style-type: none"> ▪ Smaller packaging size, reduce the wrapping material and postage charge, save space and easier to be terminated. 	<ul style="list-style-type: none"> ▪ Disbelief of the benefits of environmental initiatives.

4.5.2 Water Consumption

Table 4.15 summarizes evaluations of environmental management options suggested in reducing water consumption in Izie Herb Enterprise.

Table 4.15: Environmental Management Options Evaluation on Water Consumption in Izie Herb Enterprise

Environmental Management Options suggested	Benefit	Barrier
<p>Good Operating Practices</p> <ul style="list-style-type: none"> ▪ Rinse waters used for lower priority cleaning, raw material cleaned with wet cloth before the preliminary wash and reuse water. ▪ Proper ratio adjustment of water to cleaning agent and pre-clean the floor with a broom or vacuum cleaner before using water. ▪ Regular maintenance and monitoring to inspect for leaks, check running water on taps and keep track on water meter or water bill. Set up the proper 	<ul style="list-style-type: none"> ▪ Reduction in water usage and amount of waste water generated to the environment. ▪ Save cost. 	<ul style="list-style-type: none"> ▪ Resistance to change within company culture. ▪ Lack of available time and human resources. ▪ Low environmental literacy.

system to report leakage.		
Process Changes <ul style="list-style-type: none"> ▪ Using high pressure water flow for cleaning activities. ▪ Use more efficient devices. ▪ Designing a water balance. 	<ul style="list-style-type: none"> ▪ Reduction in water usage and amount of waste water generated to the environment. ▪ Save cost. 	<ul style="list-style-type: none"> ▪ Lack of available resources. ▪ High perceived effort required. ▪ Inconsistent top management support.

4.5.3 Electricity Consumption

Table 4.16 summarizes evaluations of environmental management options suggested in reducing electricity consumption in Izie Herb Enterprise.

Table 4.16: Environmental Management Options Evaluation on Electricity Consumption in Izie Herb Enterprise

Environmental Management Options suggested	Benefit	Barrier
Good Operating Practices <ul style="list-style-type: none"> ▪ Turn off the lamps whenever workers leaving and use natural daylight if possible. ▪ Turn off the unused printers and scanner. Turn off the monitors when the computers are left for 20 minutes or install screen saver. ▪ Turn off air conditioner and other electrical appliances whenever not in use. Install the thermostat to regulate the temperature. Curtains and blinds should be closed to prevent direct sunlight into the room, air filter should be cleaned regularly and avoid the blocking of outdoor unit air intake. ▪ Cut herbs in smaller size and dry well. Regular cleaning and scheduled switching of milling tooth. Regular cleaning of fan blades and reduce the operating duration. Eliminate the use of all ovens at the same time and 	<ul style="list-style-type: none"> ▪ Resulting in savings of energy usage. ▪ Save cost. 	<ul style="list-style-type: none"> ▪ Lack of awareness of their business environmental impacts, low environmental literacy and lack of awareness of benefits. ▪ Inconsistent top management support and resistance to change within company culture. ▪ Assume that business and environmental impacts are separate ▪ Lack of available resources.

always adjust the operating temperature.		
Substitution of Materials <ul style="list-style-type: none"> ▪ Installation of Compact Fluorescent Light Bulbs (CFLs). ▪ Replacement of CRT computers by LCD display or laptop computers. ▪ Install the ceiling fans or use only fan when possible instead of air conditioner. 	<ul style="list-style-type: none"> ▪ Resulting in savings of energy usage. ▪ Save cost. 	<ul style="list-style-type: none"> ▪ Lack of available resources. ▪ High perceived cost required. ▪ Inconsistent top management support.

4.5.4 Risk Assessment

Table 4.17 summarizes evaluations of environmental management options suggested in minimizing risk possibilities in Izie Herb Enterprise.

Table 4.17: Environmental Management Options Evaluation on Risk assessment in Izie Herb Enterprise

Environmental Management Options suggested	Benefit	Barrier
Training on safety and environmental procedures, herbal and equipment handling and PPE usage.	Reduce health risk, accidents and environmental impacts due to improper procedures, handling and usage.	Inconsistent top management support and negative attitudes towards environmental initiatives.
Proper ventilation systems.	Eliminates uneasy odours and reduced health risk due to inhalation and strike of floating herbal particles.	High perceived cost and effort required.
Proper housekeeping.	Reduced accidents possibilities due to improper housekeeping such as water and powdered herbal spillage.	Lack of available resources.
Regular inspection and maintenance schedules for equipments.	Reduced hazards possibilities such as damage and explosion due to malfunctioned of equipments.	Lack of technical knowledge and human resources.