DETERMINING MOISTURE AND ASH CONTENT OF DEVELOPMENTAL FEED WITH DIFFERENT RATIOS OF FISH MEAL AND SUN-DRIED CASSAVA (*Manihot esculenta*) LEAF MEAL

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APPROVAL SHEET

This research paper herein entitled:

DETERMINING MOISTURE AND ASH CONTENT OF DEVELOPMENTAL FEED WITH DIFFERENT RATIOS OF FISH MEAL AND SUN-DRIED CASSAVA (*Manihot esculenta*) LEAF MEAL

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Determining Moisture and Ash Content of Developmental Feed with Different Ratios of Fish Meal and Sun-dried Cassava (*Manihot esculenta*) Leaf Meal

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ABSTRACT

Fish meal is recognized as a valuable animal protein supplement and is added to feeds to obtain efficient diets, particularly for poultry and aquaculture. The high biological value of fish meal for many species has resulted in high costs and dependence in commodity. Cassava (*Manihot esculenta*) leaf meal has been a dietary protein source to both terrestrial and aquatic animal studies. This study determined what would be the moisture and ash content of developmental feed with different ratios of fish meal and sun-dried cassava leaf meal. The sun-dried cassava leaf meal was mixed with fish meal in different proportions using a blender and was bound using glucose in a syringe. The moisture content was determined using oven-drying method and ash content by ashing. There is a significant difference in the moisture content of the developed pellet with different ratios of cassava leaf meal and fish meal. Highest moisture and ash content was recorded from pellets with 1:1 ratio of cassava leaf meal and fish meal. It is concluded that sun-dried cassava leaf meal can be used as an alternative protein source to fish meal using the 1 part cassava leaf meal and 2 parts fish meal ratio.

Keywords: fish meal, cassava leaf meal, moisture content, pellets

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CHAPTER I

INTRODUCTION

A. Background of the Study

The use of fish meal in aquaculture feeds has become a major issue as the global industry continues to grow. Fish meal is an excellent source of protein and it enhances the feed consumption and feed efficiency. Moreover, fish meal has been reported to offer major benefits to animal health, including immunity against disease, higher survival and growth, and reduced incidences of deformities. It is highly digestible, which leads to increased growth and is considered to increase feed appeal.

Fish meal can be made from almost any type of fish but is generally manufactured from two main types. The first type includes a group referred to as "lean fish". In this species the oil is stored primarily in the liver. The flesh (fillets) contains very little oil. While the second type of fish used to manufacture fish meal stores oil in certain parts of the flesh. They are commonly referred to as "industrial fish".

The high biological value of fish meal for many species has resulted in high costs and dependence in commodity. Many studies have been conducted to substitute fish meal either wholely or in part, which often resulted in adverse effects on growth. Substantial substitution with plant protein requires proper processing and amino acid supplementation to enhance biological value.

Cassava (*Manihot esculenta*) is one of the leading food and feed plants of the world. Its leaves contain high level of crude protein (over 308 g/kg DM) and are relatively inexpensive to produce. Cassava leaf meal has been a dietary protein source to both terrestrial and aquatic animal studies. Proximate composition of cassava leaves tends to vary widely due to differences in cultivars, stage of maturity, sampling procedures, soil fertility and climate.

Pelleting is a common technique in feed manufacturing. Pelleting of feed provides the benefits of: (1) increasing the bulk density of feed; (2) improving feed flowability; and (3) providing opportunities to reduce feed formula costs through the use of alternative feed ingredients.

Feeds and forages are variable in composition. Feed analysis provides information for farmers to optimize nutrient utilization in animal feeds; for feed compounders to prepare feed mixtures suitable for different animal production systems; for researchers to relate animal performance to feed characteristics; and for plant breeders to optimize the nutritive value of new varieties.

A. Statement of the Problem

This study determined the moisture and ash content of developmental feed with different ratios of fish meal and sun-dried *Manihot esculenta* leaf meal.

B. Objectives of the Study

General: This study aimed to determine what would be the moisture and ash content of developmental feed having different ratios of plant protein source (*Manihot esculenta* leaf meal) and fish meal.

Specific:

- Produce a developmental feed from fish meal and sun-dried cassava leaf meal
- Measure the moisture and ash content of the developmental feed with different ratios of fish meal and sun-dried cassava leaf meal
- Determine what proportion would be the best to use as an alternative protein source to fish meal.

C. Experimental Design

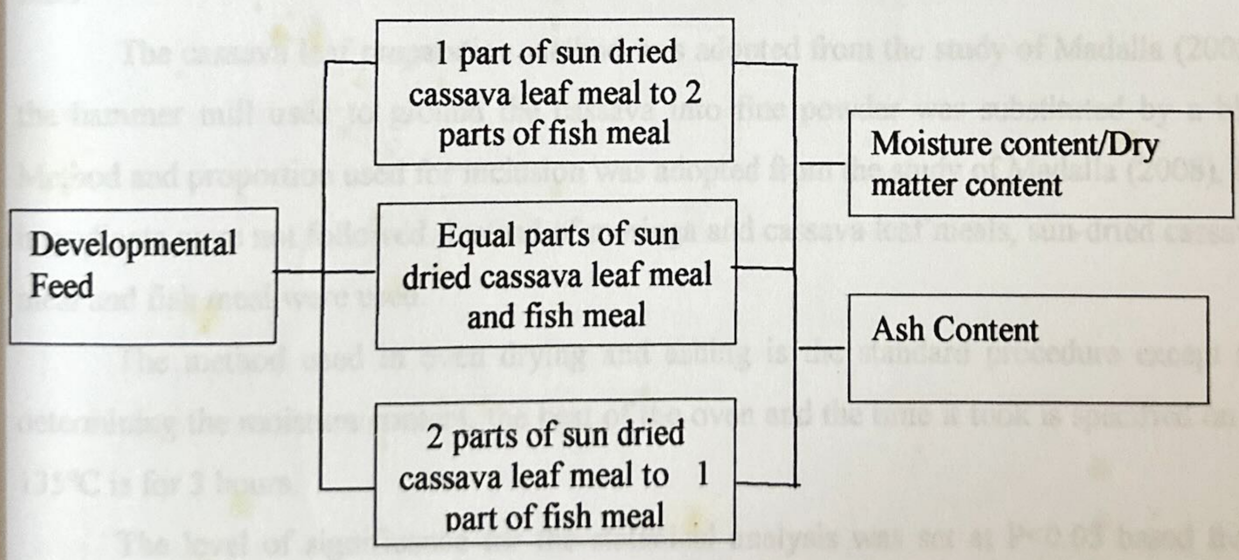

Figure 1. The Research Paradigm

D. Significance of the Study

A search for cheap and locally available feedstuffs cannot be over emphasized. Many developing countries are endowed with many by-products from agricultural processing, which are usually not utilized for human consumption, but may have a high potential as fish feed like the cassava leaves (BOMOSA, 2007).

The demand for fish meal is continually increasing and so fish meal prices are expected to do the same. It is therefore necessary to find alternative sources of protein for use in aquaculture. Since cassava leaves are rarely consumed by people, economical and have high protein content thus it can be available for use as alternative protein source in aquaculture feeds.

This study can be helpful to feed manufacturers. This can add to their knowledge about feeds and can give them information on making a compounded feed with cassava as a plant protein source. This can also help aquatic animal growers increase their fish production and lessen the price of what they pay therefore helping the consumers to buy fishes with lesser price. This can also help the economy since we make use of the things we rarely utilize such as cassava leaves.

E. Scope and Delimitations

This study aims to measure and determine the two properties of the developmental feed, the moisture and ash content, having different ratios of sun-dried cassava leaf meal and fish meal.

The cassava leaf preparation method was adopted from the study of Madalla (2005), but the hammer mill used to ground the cassava into fine powder was substituted by a blender. Method and proportion used for inclusion was adopted from the study of Madalla (2008), but the ingredients were not followed. Instead of moringa and cassava leaf meals, sun-dried cassava leaf meal and fish meal were used.

The method used in oven drying and ashing is the standard procedure except that in determining the moisture content, the heat of the oven and the time it took is specified on which 135°C is for 3 hours.

The level of significance for the statistical analysis was set at $P<0.05$ based from the study of Keawpeng and others (2007).

The fish meal was obtained from a pet shop in La Paz, Iloilo City. The cassava leaves were taken from Jaro, Iloilo City. The study was conducted in Philippine Science High School Western Visayas Laboratory and the conduct did not exceed two weeks.

F. Definition of Terms

Ash Content – total inorganic matter (mineral) present in a feedstuff

In this study, ash content is one of the feed's properties that were measured by ashing.

Ashing - This method describes the determination of calcium, magnesium iron, zinc, copper and manganese in feeds using dry ashing as a digestion technique.

In this study, ash content was used to measure ash content.

Cassava Leaf Meal – a potential dietary protein source. The potential of this product as ingredient in fish feed formulations lies on the local availability, affordability and relatively good nutritional profile.

In this study, cassava leaf meal was integrated to fish meal to attain three pellet samples with different proportions.

Fish Meal – is the brown flour obtained after cooking, pressing, drying and milling (collectively called 'reducing' or 'reduction') fresh raw fish and fish trimmings (Schipp, 2008).

In this study, different ratios of fish meal and cassava leaf meal were mixed with glucose as a binder.

Moisture Content – amount of moisture expressed as a percentage of the total wet weight of the feed.

In this study, moisture content is one of the feed's properties that was measured using the over drying method.

Oven Drying - drying the pellets in a high-temperature oven at about 120 C

In this study, oven drying was used to measure moisture content

Pelleting – converts a finely ground blend of ingredients into dense, free flowing agglomerate (pellets)

In this study, pelleting was the method used to produce pellets from the mixture of 15 g sample to 2 mL of glucose.

Plant Protein Source – a concentrated source of high quality protein with a high proportion of essential highly digestible amino acids like methionine and lysine.

In this study, cassava leaves were the plant protein source.

CHAPTER II

REVIEW OF RELATED LITERATURE

A. Feeds

A large growth within fish farming in all regions of the world means a corresponding growth in the demand for aquatic feed. Success in breeding fish requires correctly adapted feed formulas with controlled homogeneous content and exact physical properties.

A.1. Feed analysis

Feed's proximate analysis seeks to estimate the diff. components of a feed. The properties of Feed are divided into two, the Moisture and the Dry matter content. Dry matter is a proportion that is the Ash and the Organic matter. The organic matter includes Vitamins and Minerals (nitrogen-free extract), Fats or Oils (ether extract), Crude fibre and the Crude protein which is then separated into three, the degradable protein, digestible protein and the digestible crude protein.

A.2. Uses and importance

Fish feed is important in fish farming because feed represents 40-50 % of the total variable production costs (Shang, 1992).

In any successful aquaculture business, the biggest cost of growing a fish is the feed that you throw in the water. And the importance of selecting the correct diet will give you higher savings. Feed is an important part of growing aquatic animals. Without it, there will be no growth on the animal you are cultivating. It is the basic need of all who are living.

A.3. Storage

Storage life may be affected by both time and temperature. Most dry products have little problem in storage, but low DM content feeds (i.e., high moisture content) may cause problems if temperatures are also conducive to mold growth. Low temperatures may also be a problem in storage if free water is allowed to freeze. Special storage needs for some products should be discussed with the supplier of the feed to determine the proper handling, type of storage and expected storage life (Kammel 1991).

B. Fish Meal

Fish meal has been widely used as a supplemental protein source for many years primarily for monogastric animals. Two basic types of fish meal are produced; 1) produced from fishery waste (salmon, tuna, etc.) that are associated with the processing of various edible human fishery products and 2) when specific fish (herring, menhaden, pollack, etc.) are harvested just for the purpose to produce fish meal. The fish can be dried directly drying or cooking prior to drying and oil extracted.

Fishmeal is the brown flour obtained after cooking, pressing, drying and milling (collectively called 'reducing or reduction') fresh raw fish and fish trimmings. It is made from almost any type of seafood but is generally manufactured from wild-caught, small, bony/oily marine fish which are usually deemed not suitable for direct human consumption (Schipp 2008).

The odor of fishmeal, as would be expected, is that of fish. It is easily distinguished from other ingredients. If an acrid "scorched" smell is present this usually indicates overheating or scorching. If this occurs, a blackish dark-brown color is common and the quality of protein is usually affected in a negative manner (Miles and Jacob 1997).

B.1. Uses

Most commercial fishmeal is made from small, bony, and oily fish that otherwise are not suitable for human consumption and some is manufactured from by-products of seafood processing industries. Approximately 75% of world fish production is used for human consumption and the remaining 25% is used to produce fish meal and oil. Fish meal and fish oil are commodities used as feed for livestock such as poultry, pigs and farmed fish.

Fishmeal of high quality provides a balanced amount of all essential amino acids, phospholipids, and fatty acids (e.g.,DHA or docosahexaenoic acid and EPA or eicosapentaenoic acid) for optimum development, growth, and reproduction, especially of larvae and brood stock. The nutrients in fishmeal also aid in disease resistance by boosting and helping to maintain a healthy functional immune system of aquatic animals. High-quality fishmeal also allows for formulation of nutrient-dense diets, which promote optimal growth of fishes. Fishmeal is a concentrated energy source. With 70% to 80% of the product in the form of digestible protein and fat its energy content is higher than of many other proteins.

B.2. Property Analysis of fish meal

Total protein in fishmeal can be higher than 70%. The oil content in the meal will range from 2% to greater than 14%. The moisture level will commonly range from 6 to 12%. The ash content will range from 18% (more common for an industrial fishmeal) to 25% (more common for a white fish meal). The typical inclusion rate for fishmeal in farm animal diets is 5% of dry matter. Composition (CP, Ash, EE, etc.) of fish meal can vary depending upon what substrate and the method being used to prepare the meal.

There was an inverse correlation between fat, ash and crude protein contents of fish meal i.e. low protein fish meal contained high level of fat and ash and vice versa (Khatoon et al, 2006).

C. Cassava

Cassava is a perennial shrub that grows up to 4 m (12") tall. It is the highest producer of food calories per cultivated area per day among crop plants, except possibly for sugarcane. Cassava tubers are very rich in starch, but poor in protein and other nutrients. In contrast, cassava leaves are a good source of protein if supplemented with the amino acid methionine. The leaves are known to be rich in vitamin A and proteins (Chandrika et al., 2006; Ngudi et al., 2003 a, b). Leaves can be harvested at any stage of the growth of the plant, but typically only the youngest leaves are picked.

C.1. Growth and Propagation

Cassava is a tropical root crop, requiring at least 8 months of warm weather to produce a crop. However, under adverse conditions such as cool or dry weather it can take 18 or more months to produce a crop. Cassava is traditionally grown in a savanna climate, but can be grown in extremes of rainfall; however, it does not tolerate flooding. In droughty areas it looses its leaves to conserve moisture, producing new leaves when rains resume. Cassava does not tolerate freezing conditions, but does tolerate a wide range of soil pH 4.0 to 8.0 and is most productive in full sun.

In general, the crop requires a warm humid climate. Temperature is important, as all growth stops at about 10°C. Typically, the crop is grown in areas that are frost free the year round. The highest root production can be expected in the tropical lowlands, below 150 m altitude, where temperatures average 25-27°C, but some varieties grow at altitudes of up to 1500 m.

C.2. Protein Content

Cassava (*Manihot esculenta*) is a staple food in the tropics and its LEAVES also serve as forage for animals due to its palatability and high protein content.

Cassava, the sixth major staple food in the world, has the poorest protein content in comparison to the five leading food crops: wheat, rice, maize, sorghum and barley. Cassava is the major source of food energy in several tropical countries. As 50-80% of calories consumed by people in these countries are from cassava, their diets are often protein deficient.

Recently attention was given to correcting this protein deficiency either by selecting clones with high protein content or by studying the proper utilization of other parts of cassava such as the seeds or leaves. Some attempts were made to select clones with protein rich tubers but not outstanding success was achieved.

Cassava leaves are considered as a good source of supplementary protein too. They can be used for preparing dishes of cassava leaves adding variety to the diet as well as nutrients. The digestibility of cassava leaves has been investigated by Eggum (6) and Ravendran et al. (10, 12) who found it to be 80% for the protein in young leaves and 67% for the protein of older ones.

D. Cassava Leaves

Cassava leaves, a by-product of cassava root harvest is (depending on the varieties) rich in protein (14-40% dry matter), minerals, vitamin B1, B2, C and carotenes (Eggum, 1970; Adewusi and Bradbury, 1993). Available literature clearly suggest, that apart from lower methionine, lysine and perhaps isoleucine content, the animo acid profile of cassava leaf protein compares favorably with those of milk, cheese, soya bean, fish and egg (Fasuyi, 2005).

Despite their nutritional potential, cassava leaves have limitations, particularly for monogastric animals, as they have high levels of antinutritional factors (hydrogen cyanide and tannins) and a high fibre content (Ravindran et al., 1987a). Hydrogen cyanide (HCN) is released when cynanogenic glycosides, namely linamarin and lotaustralin are hydrolysed in the presence of the enzyme linamarase after tissue damage (Tewe, 1992; Tacon, 1997). Hydrogen cyanide is the most significant antinutritional factor in cassava leaves. Its acute toxicity results in sudden death while less acute toxicity may cause gastrointestinal disorders and growth depression. The amount of HCN is influenced by the cassava cultivar, environmental conditions, culture practices and plant age (McMahon et al., 1995). Several methods, such as ensiling and sun drying, can be used to reduce the HCN content in cassava leaves to safer levels. Ensiling is a process which involves fermentation of forages by lactic acid bacteria under anaerobic conditions (Oude Elferink et al., 2000). Ensiling reduces HCN by causing disintegration of intact glycosides through cell disruption, a fall in pH of the ensiled medium and intense heat generation (Tewe, 1992). Ensiling is convenient during the rainy season when sun drying is not feasible but has high labour demands. In addition, during ensiling unfavourable microbial processes may also lower palatability and nutrient content. Sun drying removes HCN by reducing moisture content together with dissolved cyanogenic glycosides. According to Ravindran et al., 88 (1987a), drying can reduce HCN content by more than 90%. Removal of HCN can be enhanced by grinding the leaves before sun drying to disrupt cell structure and enhance hydrolysis of cyanogenic glycosides to HCN which is volatilized during drying (Madalla, 2008).

E. Feed Properties

E.1. Moisture content

The moisture or water content of feed is a key nutrient that is often neglected but is frequently limiting particularly in tropical situations and especially in lactating animals. Much of the animal's water is likely to come from feed, particularly when animal is grazing or browsing lush vegetation.

Once harvested, feeds with high moisture content are liable to spoil quickly, moistly from fungal contamination. The moulds and more particularly the toxins that are produced by many moulds make the feed unpalatable and can cause illness or even death to both animals and people handling the feed. On the other hand, very dry feeds, while being stable during storage, are less palatable for the animal and also increase the animal's requirement for water.

E.1.1. Oven Drying

With oven drying, the sample is heated under specified conditions, and the loss of weight is used to calculate the moisture content of the sample.

E.2 Ash content

The ash content of the feed contains all the minerals in the feed, but can also contain any soil contaminants associated with the feed as well.

The ash content of the feed is determined by placing a weighed sample of dried feed in a furnace and heating it to 500 °C, typically overnight. At this temperature, all the organic materials in the feed (proteins, carbohydrates, fats and vitamins) are burnt away, leaving just the mineral residue. This residue is then weighed and the ash content of the feed (g ash/kg feed DM) is calculated from: Ash content of the feed = Weight of ash (g)/ weight of dried feed (kg).

Ash is the material remaining after the feed sample is completely burned. Normally, the ash content of good quality fish meal averages between 17% and 25%. More ash indicates a higher mineral content, especially calcium, phosphorus, and magnesium. Calcium and phosphorus constitute the majority of the ash found in fish meal (Miles and Chapman, 2006).

E.2.1. Ashing

The "*ash content*" is a measure of the total amount of minerals present within a food. Ash is the inorganic residue remaining after the water and organic matter have been removed by heating in the presence of oxidizing agents, which provides a measure of the total amount of minerals within a food. Analytical techniques for providing information about the total mineral content are based on the fact that the minerals (the "analyte") can be distinguished from all the other components (the "matrix") within a food in some measurable way. The most widely used methods are based on the fact that minerals are not destroyed by heating, and that they have a low volatility compared to other food components.

Dry ashing procedures use a high temperature muffle furnace capable of maintaining temperatures of between 500 and 600 °C. Water and other volatile materials are vaporized and organic substances are burned in the presence of the oxygen in air to CO_2, H_2O and N_2. Most minerals are converted to oxides, sulfates, phosphates, chlorides or silicates. Although most minerals have fairly low volatility at these high temperatures, some are volatile and may be partially lost,*e.g.*, iron, lead and mercury. If an analysis is being carried out to determine the concentration of one of these substances then it is advisable to use an alternative ashing method that uses lower temperatures.

(http://www-unix.oit.umass.edu/~mcclemen/581Ash&Minerals.html)

CHAPTER III

METHODOLOGY

A. Materials

Equipments

Mortar and Pestle	Digital weighing scale
Blender	Metal tray
Mixing bowl	Furnace
Spatula	Desiccator
Insulin syringe	Crucibles
Ruler	Plastic bag
Cutter	Evaporating dish
Measuring cup	Oven

Chemicals

Fishmeal	Glucose
Sun-dried cassava leaf meal	

B. Sample preparation

B.1. Cassava leaf meal preparation

Freshly Harvested leaves were manually stripped of petioles and the leaves were grounded using a mortar and pestle. The grounded leaves were spread on a plastic sheet to sundry for 5 hours. Sun dried cassava leaf meal was grounded into a fine powder using a blender and was stored in a plastic bag at room temperature (Madalla, 2005).

B.2. Inclusion of sun dried cassava leaf meal

The sun dried cassava leaf meal was mixed with fishmeal in different proportions. The first meal was prepared by blending one part of sun dried cassava leaf meal to two parts fish meal. The second meal was prepared by blending equal parts of sun dried cassava leaf meal and fish meal while the third meal was prepared by blending two parts cassava leaf meal and one part fish meal. Each meal was thoroughly mixed using a blender (Madalla 2008).

C. Manual Pelleting

C.1. Inclusion of binder

Glucose was used as a binder. Each meal was sterilized in an oven for two minutes. A ratio of 15g developmental feed to 2 ml glucose was mixed for each meal. The mixture was thoroughly blended using a spatula in a mixing bowl.

C.2. Compaction

Each mixture was gradually placed inside the insulin syringe until the last grid. It was compacted manually by applying force against a chopping board until the rubber attached to the syringe compacting the mixture cannot push any further. The final pressure was applied to the mixture to shove it out of the other end of the syringe. The pellets were measured with a length of 1 cm using a ruler and were cut using a cutter. The 1 cm pellets were sterilized again inside an oven for a minute.

D. Measuring the properties of feeds

D.1. Moisture content determination

Moisture content was determined using the oven drying method. The empty evaporating dishes were washed thoroughly, rinsed and dried in an oven for an hour at 100°C. After an hour, the evaporating dishes were stored in a clean desiccator at room temperature before use. The evaporating dishes were then preweighed using a digital weighing scale. 2g of each sample was spread evenly across the bottom of the dishes. The dishes were placed on the metal shelf in the atmospheric oven set at 135°C, avoiding contact between the dish and the walls. After 3 hours in oven, the dishes were removed fro the oven and placed on the desiccator for at least 30 min to cool to room temperature. After cooling, the dishes were again weighed using the digital weighing scale.

Moisture content was calculated using this equation:

%Moisture = (Loss of weight x 100)/ (Sample weight)

D.2. Ash content determination

Ash content was measured using ashing.

Clean and labeled crucibles were placed in a muffle furnace 600°C for 1 hour. After an hour, the partially cooled crucibles were transferred into desiccator and cooled to room temp. The crucibles were preweighed. 5g of each sample were placed inside the preweighed crucibles. The crucibles were placed inside the muffle furnace set at 550°C for 12 h. the oven was turned off and was cooled first. the partially cooled crucibles were transferred into a desiccator and were continued to cool to room temp. When cooled, the crucibles were weighed again.

Ash content was calculated using this equation:

%Ash = (weight residue x 100) / (sample weight)

E. Statistical analysis

Significant difference between the groups were measured using the One-Way ANOVA.

CHAPTER IV

RESULTS AND DISCUSSION

This study determined the Moisture and ash content of the developmental feed with different ratios of fishmeal and sun-dried cassava leaf meal. The different proportions were: 1 parts sun-dried cassava leaf meal and 2 part fishmeal, 1 part sun-dried cassava leaf meal and 1 part fishmeal, 2 part sun-dried cassava leaf meal and 1 part fishmeal. The moisture content was determined using the Oven drying method. Percent moisture was measured using the equation %Moisture= (Loss of weight x 100)/ (Sample weight). The Ash content was determined using the Ashing method. Percent ash was measured using the equation

% Ash= (Weight residue x 100)/ Sample weight. The data were compared using ANOVA.

A. Results

The proportion which contains 1 part cassava leaf meal and 1 part fish meal showed the highest mean moisture content percentage and highest mean ash content percentage. The result showed that there is no significant difference in the ash content of the samples. There is a significant difference in the moisture content.

Table.1: Significant difference in the moisture and ash content of the different proportions of sun-dried cassava leaf meal and fish meal

Parameter	Ratio: 1 part cassava leaf meal: 2 parts fish meal	Ratio: 1 part cassava leaf meal: 1 part fish meal	Ratio: 2 parts cassava leaf meal: 1 part fish meal	P value	Interpretation
Moisture Content (%)	12.07	15.47	13.71	0.02517	significant
Ash Content (%)	10.53	14.93	12.96	0.2999	Not significant

B. Discussion

A large growth within fish farming in all regions of the world means a corresponding growth in the demand for aquatic feed. Success in breeding fish requires correctly adapted feed formulas with controlled homogeneous content and exact physical properties.

Cassava (*Manihot esculenta*) is a staple food in the tropics and its leaves also serve as forage for animals due to its palatability and high protein content. The study of Nassar and Marques showed that the protein percentage ranges from 21% to 32%.

The results showed that there is no significant difference in the ash content of the different ratios of sun-dried cassava leaf meal and fishmeal. Ash is the material remaining after the feed sample is completely burned. Normally, the ash content of good quality fishmeal averages between 17% and 25%. More ash indicates a higher mineral content, especially calcium, phosphorus, and magnesium. Calcium and phosphorus constitute the majority of the ash found in fishmeal. (Miles and Chapman, 2006)

There is a significant difference in the moisture content of the different ratios. The 1 part sun-dried cassava leaf meal and 2 parts fishmeal proportion is the best alternative among the three replicates by having the lowest moisture content which is 12.07 %.

Moisture content of an effective meal ranges from 6% to 12 % (Khatoon et al, 2006). Feeds with high moisture content become unpalatable and can cause sickness due to the spoilage brought by fungal contaminations. On the other hand, very dry feeds (very low moisture content) are less palatable for the animal and also increase the animal's requirement for water.

Therefore, sun-dried cassava leaf meal can be used as an alternative protein source to fishmeal using the 1 part cassava leaf meal and 2 parts fish meal ratio.

CHAPTER V

SUMMARY, CONCLUSION, AND RECOMMENDATION

This study aimed to determine what would be the moisture content and ash content of the developmental feed having different ratios of plant protein source (cassava leaf meal) and fish meal.

It specifically aimed to:

1. Produce a developmental feed from fish meal and sun dried cassava leaf meal
2. Measure the moisture content and ash content of the developmental feed having different ratios of sun dried cassava leaf meal and fishmeal.
3. Determine what proportion would be the best to use as an alternative protein source to fishmeal

A. Summary of Results

The highest mean moisture and highest mean ash were found in the proportion with 1 part sun-dried cassava leaf meal and 1 part fishmeal. There is no significant difference in the Ash content of the samples. There is a significant difference in the Moisture content percentage.

B. Conclusion

Sun-dried cassava leaf meal can be used as an alternative protein source to fishmeal using the 1 part cassava leaf meal and 2 parts fish meal ratio.

C. Recommendations

For further studies, it is recommended that:

1. Cassava leaf Meal as Potential Dietary Protein Source in the Practical Diets for Tilapia (*O. niloticus*) fingerlings
2. Comparing Cassava starch, corn starch and duckweed meal as binder for cassava leaf meal and fishmeal ratios
3. Broken rice meal as a possible alternative protein source to fishmeal

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APPENDIX A

ANECDOTAL REPORT

My study is entitled "Determination of moisture and ash content of developmental feed having different ratios of fish meal and sun-dried cassava leaf meal". Its main objective is to see if cassava leaf meal could be a possible alternative protein source to the now expensive fish meal which is added to feeds to obtain efficient diets. Data gathering was conducted inside Philippine Science High School-Western Visayas Campus.

I collected the Cassava leaves in the Metropolis just a few steps away from the guard house. It was a fine afternoon and I chose the leaves that are green, haven't been chewed by some insects and are not withered on some parts. I collected a big plastic full. I did not wash the leaves first. I manually stripped the petioles off and filled the porcelain mortar with the leaves and started to pound the leaves into tiny bits. I did the stripping and crushing for an hour or more. After that, I put the leaves inside a plastic and let it be there overnight. The day after, it was noon and it was sunny; I spread the leaves into a plastic sheet and let the leaves dry outside the Girl's Dormitory beside the front door. After 5 hours, I gathered the sun-dried leaves with my bare hands and again put it inside another plastic. I put the leaves into the blender; clicked the 1, 2 and 3 button randomly to ground the leaves into powder. I took the powdered cassava leaves using a spoon and sealed it in a plastic. I have it weighed in a digital weighing scale in the 3rd floor. I weighed each plastic cups container first and labelled it 1, 2 and 3. '1' is for 1 part cassava leaf meal and 2 parts fish meal, '2' is for the 1:1 ratio and '3' is for 2:1 ratio. I also weighed two plastic cups for the cassava leaf meal and fish meal. I poured the collected sun dried cassava leaf meal into the preweighed plastic cup and weighed it again. I subtracted the weight of the plastic cup from the plastic cup containing cassava leaf meal to obtain the total weight of the cassava leaf meal. The same is what I did to the fish meal. From their total weights, I maximized how much weight would each ratio have. I continued weighing until the 3 cups were filled with the appropriate proportions. I went downstairs carrying the cups covered with foil. I mixed each ratio in the blender. Sample 1 is brownish in colour while in Sample 3, green is the dominant colour. I then worked with the first sample. I put a spoonful of the sample into the mixing bowl and added a just amount of glucose. When the samples are still a little unattached to each other, I add a little more glucose until they can hold each other. It will be then gradually forced inside a pre-cut syringe (The syringe was cut on its nose so that it levelled the horizontal table; It was cut using a cutter) until the last grid. I compacted the mixture manually by applying force against a chopping board until the rubber attached to the syringe compacting the mixture cannot push any further. I shove the compacted mixtures out of the syringe and let it wait by the side of the board exposed to the air where there is a possibility of Moisture absorption. After compaction, I measured the pellets to a length of 2 cm using a ruler and cut it using a cutter. The cutter was quite rusty. I place the pellets inside a microwave oven for a minute and put it inside a plastic after. I'm done pelleting the first mixture. I started the second but did not finish it. The Day after, it was afternoon; I finished the 2nd and the 3rd mixture same procedure I did with the first mixture except that the first was held inside the Girl's dormitory while the other two inside the research laboratory. I now have the pellets ready to be analysed. I borrowed 9 evaporating dishes and 9 crucibles from the SRC (3 trials for each ratio). I washed them with Joy liquid soap and tap water and wiped them with tissue. I labelled them. I set the atmospheric oven to 100°C. When it reached 100°C, I opened the oven and put the evaporating dishes inside to be heated for an hour. Meanwhile, I also put the crucibles (4 at a time) inside the muffle furnace. I closed the furnace and set it to 600°C. I started timing after setting the furnace. After an hour, I opened the oven, used tongs to gather the evaporating dishes and store them inside the desiccator. I turned the furnace off and let it cool for a while (15 minutes or so). After cooling, I took the crucibles using tongs and placed it inside the desiccator. I put the second batch of crucibles inside the muffle furnace. While I wait for the second batch, I hand carry the evaporating dishes and the pellets upstairs. I preweighed the evaporating dishes and recorded it. I weighed 2 grams of each sample pellets and distributed it in the 9 evaporating dishes. The evaporating dishes didn't have covers. I placed the dishes on the metal shelf in the atmospheric oven set at 135°C, avoiding contact between the dish and the walls. An hour has passed to the second batch of crucibles inside the furnace. I turned the furnace off and let it cool for a while (15 minutes or so). After cooling, I took the crucibles using tongs and placed it inside the desiccator. Three hours passed to the atmospheric oven, I opened it and took the evaporating dishes without cover (heated pellets spread into it) using tongs and stored it again inside the desiccator. The pellets were dry. I, together with M, carried the desiccator upstairs for the reweighing of the evaporating dishes to avoid possible moisture absorption. I reweighed the evaporating dishes and recorded it. Now I each other, I add a little more glucose until they can hold each other. It will be then gradually forced inside a pre-cut syringe (The syringe was cut on its nose so that it levelled the horizontal table; It was cut using a cutter) until the last grid. I compacted the mixture manually by applying force against a chopping board until the rubber attached to the syringe compacting the mixture cannot push any further. I shove the compacted mixtures out of the syringe and let it wait by the side of the board exposed to the air where there is a possibility of Moisture absorption. After compaction, I measured the pellets to a length of 2 cm using a ruler and cut it using a cutter. The cutter was quite rusty. I place the pellets inside a microwave oven for a minute and put it inside a plastic after. I'm done pelleting the first mixture. I started the second but did not finish it. The Day after, it was afternoon; I finished the 2nd and the 3rd mixture same procedure I did with the first mixture except that the first was held inside the Girl's dormitory while the other two inside the research laboratory. I now have the pellets ready to be analysed. I borrowed 9 evaporating dishes and 9 crucibles from the SRC (3 trials for each ratio). I washed them with Joy liquid soap and tap water and wiped them with tissue. I labelled them. I set the atmospheric oven to 100°C. When it reached 100°C, I opened the oven and put the evaporating dishes inside to be heated for an hour. Meanwhile, I also put the crucibles (4 at a time) inside the muffle furnace. I closed the furnace and set it to 600°C. I started timing after setting the furnace. After an hour, I opened the oven, used tongs to gather the evaporating dishes and store them inside the desiccator. I turned the furnace off and let it cool for a while (15 minutes or so). After cooling, I took the crucibles using tongs and placed it inside the desiccator. I put the second batch of crucibles inside the muffle furnace. While I wait for the second batch, I hand carry the evaporating dishes and the pellets upstairs. I preweighed the evaporating dishes and recorded it. I weighed 2 grams of each sample pellets and distributed it in the 9 evaporating dishes. The evaporating dishes didn't have covers. I placed the dishes on the metal shelf in the atmospheric oven set at 135°C, avoiding contact between the dish and the walls. An hour has passed to the second batch of crucibles inside the furnace. I turned the furnace off and let it cool for a while (15 minutes or so). After cooling, I took the crucibles using tongs and placed it inside the desiccator. Three hours passed to the atmospheric oven, I opened it and took the evaporating dishes without cover (heated pellets spread into it) using tongs and stored it again inside the desiccator. The pellets were dry. I, together with M, carried the desiccator upstairs for the reweighing of the evaporating dishes to avoid possible moisture absorption. I reweighed the evaporating dishes and recorded it. Now I have the needed data for measuring the moisture content. For the ash content, I preweighed the crucibles while I was waiting for the 3 hours of the atmospheric oven. I weighed 5g of pellets and placed it inside the preweighed crucibles. The crucibles have cover. I put 5 of the crucibles inside the muffle furnace without it touching the walls. I closed it and set it to 550°C and started timing. After 12 hours, it was 3:00 in the morning; I collected the crucibles using tongs and placed it inside the desiccator. I then put the 4 remaining crucibles and waited again for 12 hours. After 12 hours, I collected it and placed it inside the desiccator. SC and SA, my friends, did the reweighing of the crucibles. They recorded it and I have my data for ash content. I solved the moisture content using this equation: %Moisture = (Loss of weight x 100)/ (Sample weight). I added the weight of the preweighed evaporating dishes and 2 grams, then subtracted from it the final weight, multiplied it by 100 and divided the results by 2 grams. I solved the ash content using this equation: %Ash = (weight residue x 100) / (sample weight).). I added the weight of the preweighed crucible and 5grams, then subtracted from it the final weight, multiplied it by 100 and divided the results by 5 grams. I have now the moisture and ash content of the samples. I used one –way ANOVA in the PAST to determine the significant difference.

APPENDIX B

PLATE 1. Sun-drying of cassava leaves

PLATE 2. Mixing the cassava leaf meal and fishmeal

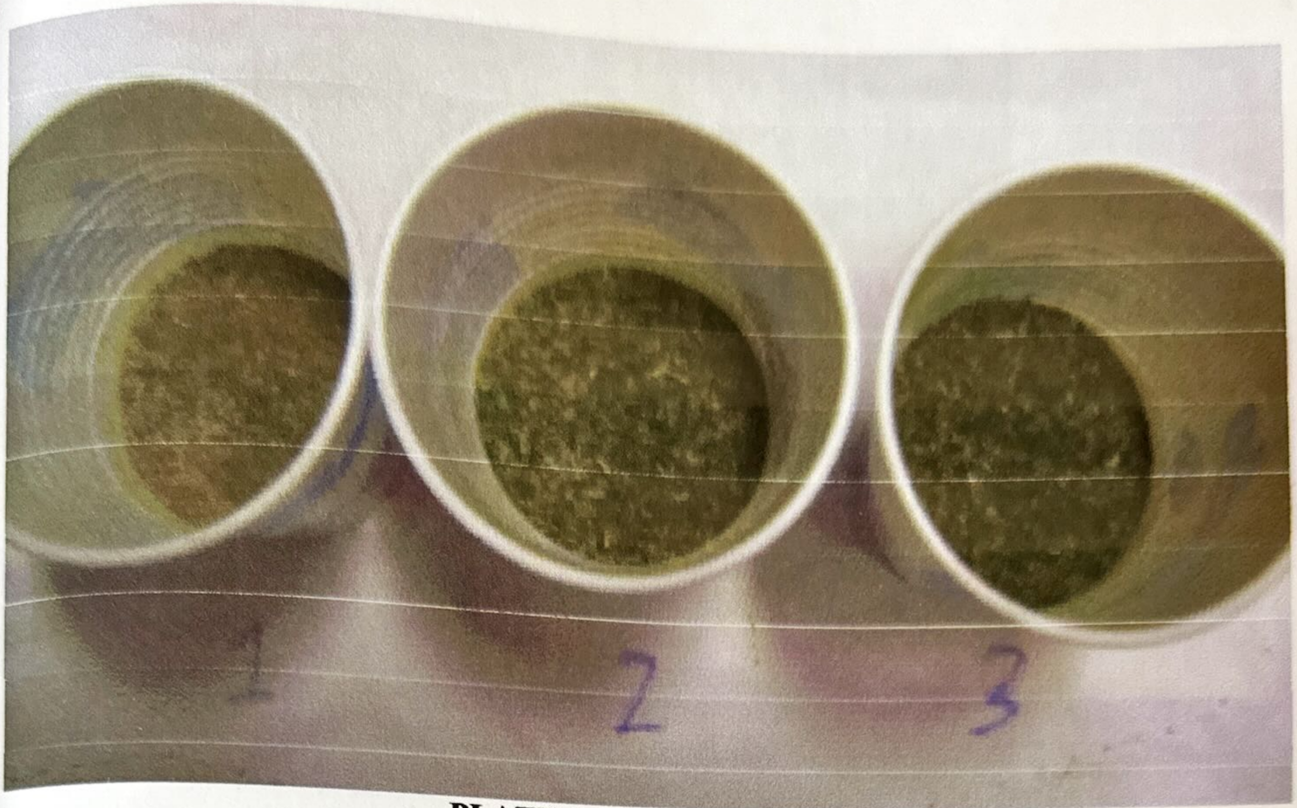

PLATE 3. The three samples
(1 is 1 part cassava leaf meal and 2 part fishmeal; 2 is 1:1; 3 is 2:1)

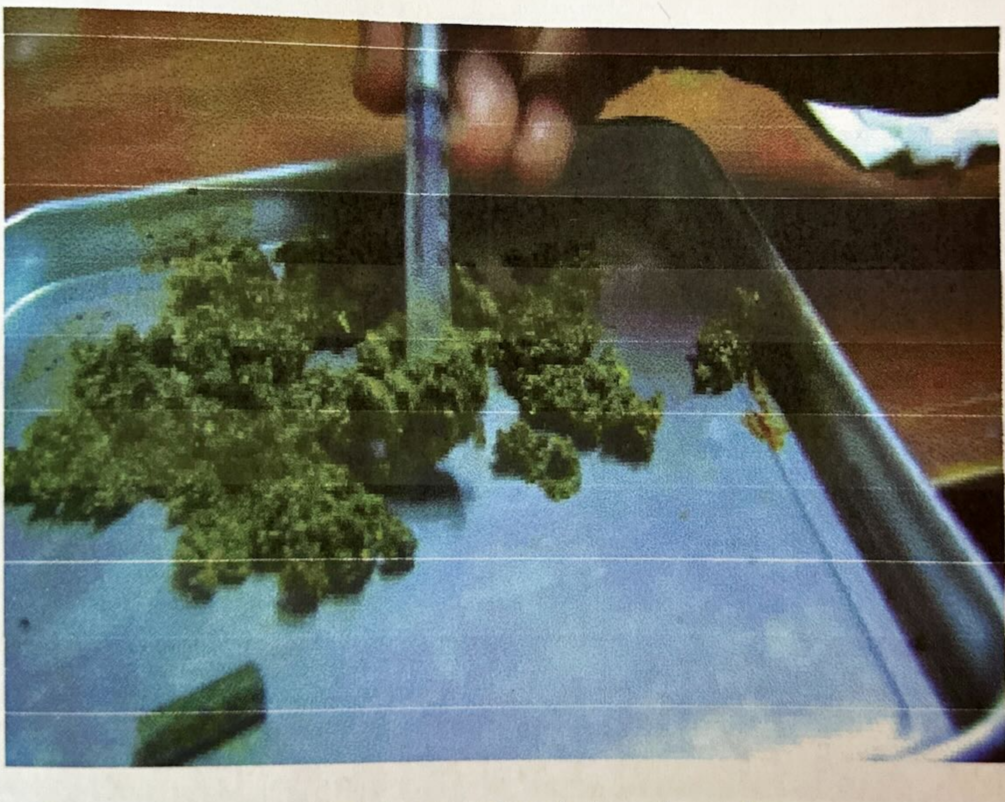

PLATE 4. Manual Pelleting of samples

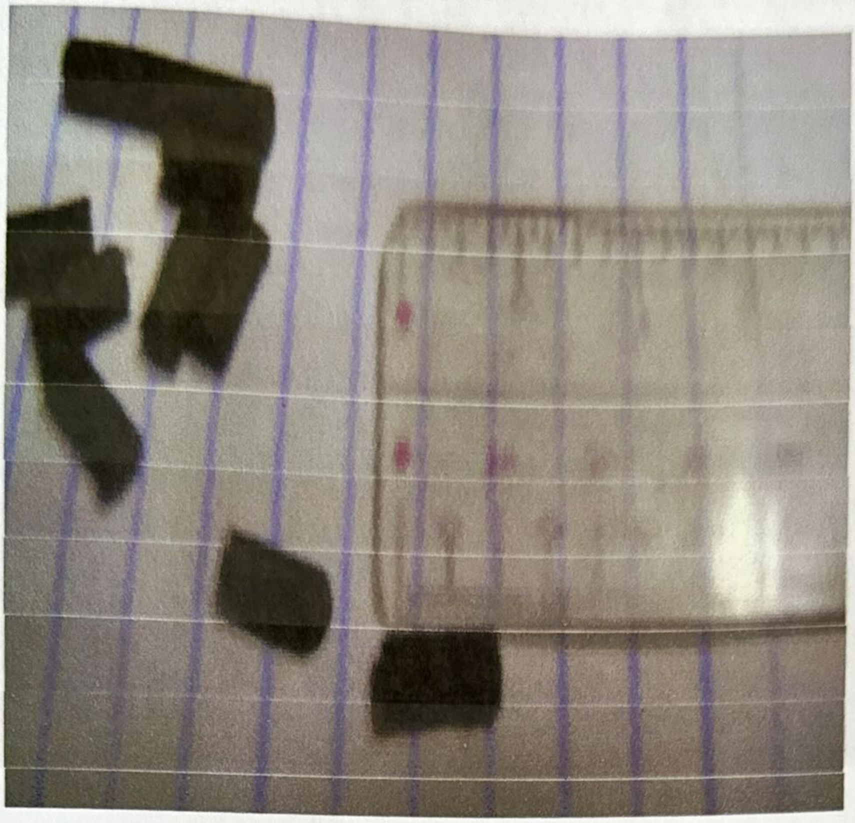

PLATE 5. Measuring the pellets

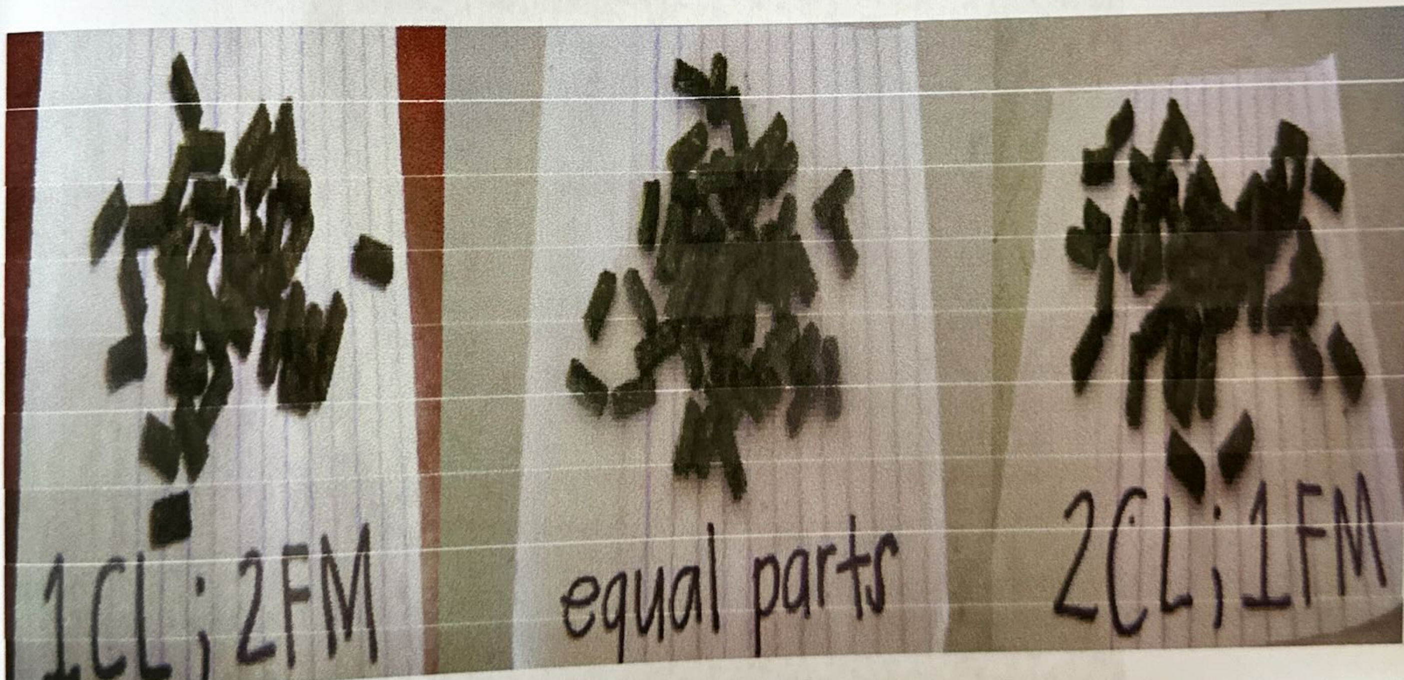

PLATE 6. The three pelletized samples

PLATE 7. Weighing the pellets

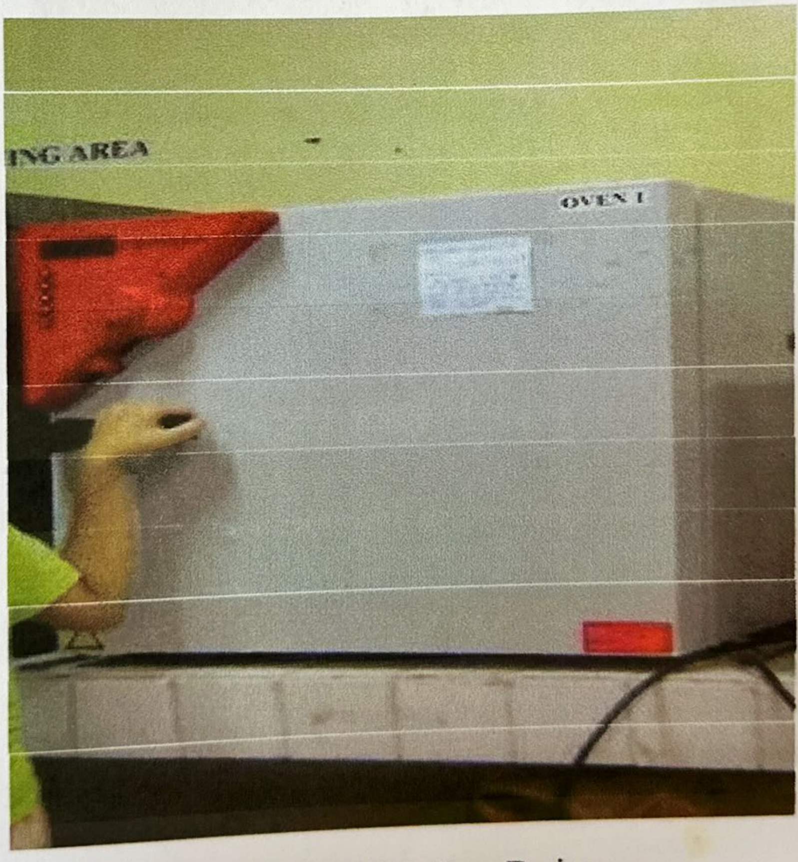

PLATE 8. Oven Drying

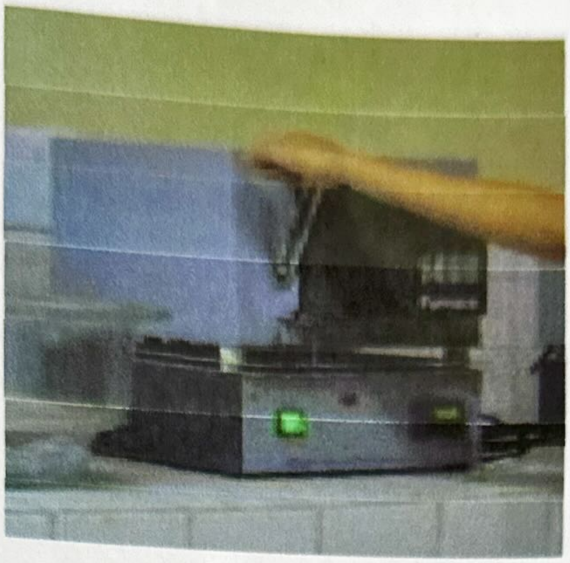

PLATE 9. Ashing

PLATE 10. Storing crucibles, evaporating dishes and samples