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Extraction of resins from *Capsicum annuum* var. longum (*Siling haba*) for the study of their potential anti-microbial activities

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ABSTRACT

This study involves the extraction of resins from Capsicum anuum var. longum(commonly known as siling haba in the Philippines) using the standard extraction methods of maceration, reflux, and percolation in preparation for their anti-microbial testing. Physical and Chemical Tests of the extract from the fruits of Capsicum anuum var. longum confirmed the presences of resins.

Keywords: Extraction of Resin, *capsicum anuum var. longum*, resin extraction, siling haba, extraction methods, maceration, reflux, percolation.

INTRODUCTION

The plant kingdom has been humanity's only drugstore for countless centuries. Today, in a modern drugstore, one can hardly find a sign of the use of plants in medicine. The number of plants used in medicine have decreased, but some have been hidden in the form of pills, capsules, and medicine bottles.

In ancient times, human beings have tried to make use of plants that grew around the earth. These plants could be obtained from jungles, mountains, meadows, plains, and river valleys. In mankind search for medicines the use of roots, leaves, stem, and fruits has served as ways of learning if certain plants could have therapeutic effects by trial and error. Ancient peoples came to use a great number of plants to heal their illnesses and diseases, but they were unaware of the toxicity and other side effects that a certain plant could give.

Today, scientists are paying new attention to the use of plants as sources of medicines for modern chemistry is throwing new light on them. Newer tests have been made of ancient herbal cures. Although many of the plants have turned out to be of little therapeutic value, some of them might turn out to be one of the wonder drugs of tomorrow.

Specifically, one of these plants with potential medicinal value is scientifically known as *Capsicum anuum var. longum* and commonly called *siling haba* or *siling-sigang* in the Philippines and depicted in Figure. 1. This plant originated from tropical America but now, Filipino farmers throughout the country have been planting it for food purposes.

Figure 1. Photo of fruits of *Capsicum anuum* var. longum (Siling haba)

1.1 Background of the Study

According to Dr. Russel of the Department of Horticultural Science, North Carolina State University, *Capsicum anuum* form the *Solanaceae* family. It is an annual herb with with leaves that are arranged alternately and has small white or greenish flowers. The fruit is shiny, tapered berry of various colors. Tropical America is its origin where it can be found as a house plant or interioscape, a landscape in vegetable gardens, and a landscape as cultivated, tender, herbaceous annual. Poisoning from leaves and fruits may occur with symptoms like burning or stinging of lips, tongue, and throat, nausea, vomiting, and diarrhea. Burning sensation of the eyes and skin may also occur. The most edible part of *Capsicum anuum* is the fruit, especially when raw or cooked. It is toxic only if large quantities are eaten.[15]

The familiar pod like fruits called "pepper" are native to tropical America. They belong to the nightshade family (*Solanaceae)* just like as tomatoes and potatoes, which are also of American origin. The plants are of genus Capsicum, a shrubby annual or perennial that grows from two to four feet high. The flowers are white and the fruits are green until they ripen. Ripe fruits range in color from orange to bright deep red.

Different climatic conditions and long cultivation have produced many varieties of *Capsicum*, differing in the size and the shape of the pods and in taste. There are two general types of pepper: the mild or sweet peppers and the hot and pungent varieties. The hot types are used chiefly for seasoning and sauces.

The author decided to focus more on the hot and pungent type of peppers in this plant category. It is believed that chili peppers have a biting taste. The long Mexican chilies are used fresh, added to pasta dishes, and are ingredients in chili sauces.

1.2 Glossary

This subsection defines the various technical terms used in the study:

Anti-microbial. It refers to the inhibition of the growth of microorganism. It also refers to a drug used to oppose growth of microorganism or to a drugs which prevents the growth of microorganisms.[1]

Assay, Microbiological. This is a quick and simple biochemical research technique employed principally for analysis of vitamins, amino acids, and other nutrient. [2]

Carminatives. Substances that have the power to relieve flatulence or colic. [3]

Condiments. Substances that can make the food savory. [4]

Extract. This refers to certain concentrated substances prepared from another. To pull or draw out by force or effort. [5]

Extraction. It is the act or process of extracting, involving of processing or extraction; the separation of medicinally active portion of the plant or animal tissues, from the inactive portion of plant or animal tissues, from the inactive or inert components through the uses of selective solvent and standard extraction procedures. [6]

Extractive. This is the dark-colored insoluble substance produced in the preparation of extract by evaporation. [7]

Fruit. This is a seed containing part of the plant and used as food. [8]

Local irritant. A substance that causes or gives rise to the irritation. [9]

Maceration. This refers to the process of extraction by soaking the properly comminuted drug or substance in the menstruum until the cellular structure is thoroughly penetrated and the soluble portion are softened and dissolved without heating. [10]

Microbiological Test. This refers to the test for the demonstration of the level of effectiveness of any added anti-microbial agent. [11]

Microorganism. This is a minute form of life, individually, too small to be seen by naked eye. [12]

Percolation. This is the process of the slow passage of a liquid through a filtering medium; an operation of filtration which consist in placing any substance, the virtues of which are to be extracted by a menstruum, in a funnel shaped instrument having a septum prepared with holes, or it's tube stuffed with cotton and pouring fresh portions of the menstruum upon it until all its virtues have been extracted. [13]

Percolator. This is an apparatus for extraction of drugs with liquid solvent by downward displacement. [14]

Reagent. This refers to the substances used either as such or as constituents of solutions, a substance used to produce a chemical reaction. [15]

Reflux. This is the process of boiling so that a vapor is liquefied and returned to the boiler. [16]

Resins. These are amorphous substances products with a complex chemical nature. Physically, they are usually hard, or translucent and when heated, they soften and finally melt. [17]

Rubefacient. This refers to any substance that causes redness of the skin; an agent causing redness of the skin, producing a local congestion, the vessel becoming dilated and simply the blood increased. [18]

Solvent. It is any substance where the solute is dissolved.[19]

Stimulant. It is any substance that can cause an increase in the activity of some parts of the brain and spinal cord.[20]

Agar. It is solidifying agent, desirable in microbes which needs a solid medium. This is a complex polysaccharides derived from a marine algae.[21]

Antibiotic. It is an anti-microbial agent produced naturally by a bacterium fungus.[22]

Autoclave. This is an equipment for sterilization steam under pressure, usually operated at 15psi and 121 degree Celsius.[23]

Antifungal. This is the act of destroying or killing of the fungi.[24]

Aseptic. It is free from or doing away with microorganism that produce disease or putrefaction.[25]

Aseptic Technique. It is used in microbiology to exclude contamination.[26]

Candida Albicans. It is an acute or chronic superficial disease producing lesion in mouth, vagina, skin or nails. It can be a systemic disease, sometimes by hematogenic. [27]

Dissemination, involving lungs, heart, kidney, brain and other organ.[28]

Culture. The microbes that grow and multiply in culture medium.[29]

Culture Media. It is any material in which microorganism find nourishment in which they can reproduce.[30]

Escherichia coli. It is a bacteria normal in habitat of large intestine of vertebrates, including human presence is beneficial because it help produce certain vitamin and break down under stable food stuff, the manifestation of E. coli cause bloody diarrhea when it grows in the intestine.[30]

Incubation Period. This is the time interval between the actual infection and first appearance of any sigh and symptoms of disease.[31]

Nutrient. The medium commonly used liquid complex medium that is media for which the exact chemical composition veins slightly from batch.[32]

Nystatin. It is a polyene anti-fungal antibiotic. It was isolated from Streptomycin, noursci in 1950 and originally named "Fungicidin" (Haun & Brocin, 1951). It is used for skin infection, oral candidiasis (thresh) vagina candidiasis, candidiasis of GIT.[33]

Purification. The act or operation of removing impure noxious or foreign matter.[34]

Resistant. The organism that are not inhibited by microbes.[35]

Staphylococcus aureus. This are gram positive, non-motile, non-spore forming spherical cells found on the skin, anterior nares and mucous membrane of the majority of healthy adults.[36]

Statement of the Problem

The problem that this study sought to answer is how to extract resins of *Capsicum anuum var. longum* in preparation for their anti-microbial testing.

Specifically, the study sought to answer the following questions:

1. How was the plant sample collected and prepared?
2. What preliminary test was used to identify the presence of resin in the plant sample?
3. What method of extraction, isolation and purification was used?
4. What tests were used to confirm the presence of resin?

Significance of the Study

Inasmuch as the Philippines is a developing country with an abundance of natural resources, particularly medicinal plants, which can be utilized to address the mounting health needs of the Filipino people specifically for the treatment of human diseases, the identification of medicinal plants and the extraction testing of drugs from these plants have become very important.

Nowadays, natural sources of drugs are very important to men, since prices of most commodities, including drugs are continuously increasing. Hence, the researcher decided undertake the initial step in discovering and isolating drugs from medicinal plants by extracting resins from *Capsicum anuum var. longum* for the investigation of their potential anti-microbial properties.

Past studies have pointed to the potential of the fruit of *Capsicum anuum var. longum*.

So the researcher decided to continue investigating the anti-microbial of the resins of *Capsicum anuum var. longum* fruit in order to provide consumers with a cheaper and effective alternative for to the very costly today's prefabricated anti-microbial medicines.

4. Review of the Literature

4.1 Foreign Studies

This section presents a review of foreign and local studies concerning the *Capsicum anuum var. longum* fruit.

The antimicrobial activity of plant oils and extracts has been recognized for many years. However, few investigations have compared large numbers of oils and extracts using methods that are directly comparable. In the present study, 52 plant oils and extracts were investigated for activity against *Acinetobacter baumanii, Aeromonas veronii biogroup sobria, Candida albicans, Enterococcus faecalis, Escherichia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa, Salmonella enterica* subsp. *enterica* serotype *typhimurium, Serratia marcescens and Staphylococcus aureus,* using an agar dilution method. Lemongrass, oregano and bay inhibited all organisms at concentrations of ≤ 2.0% (v/v)Six. [20]

Oils did not inhibit any organisms at the highest concentration, which was 2.0(v/v) oil for apricot kernel, evening primrose, macadamia, pumpkin, sage and sweet almont. Variable activity was recorded for the remaining oils. Twenty of the plant oils and extracts were investigated, using a broth microdilution method, for activity against *C. albicans, Staph.aureus* and *E. coli.* The lowest minimum inhibitory concentrations were 0.03% (v/v) thyme oil against *C. albicans* and *E. coli* and 0.008% (v/v) vetiver oil against *Staph.aureus.* These results support the notion that plant essential oils and extracts may have a role as pharmaceuticals and preservatives.

In the environment, many microorganisms coexist in communities competing for resources, and they are often associated as biofilms. The investigation of bacterial ecology and interactions may help to improve understanding of the ability of biofilms to persist. In this study, the antibacterial and antibiofilm activities of esxtract *Capsicum annuum* L on the growth and biofilm formation of common pathogenic strains that isolates from the urinary tractinfection were examined. All 6 strains (2 *Klebsiella pneumoniae*, 2 *Pseudomonas aeruginosa* and 2 *E.coli*) isolated from the urine culture of hospitalized patients (Amir Al-Momenin Hospital, Zabol, Southeastern Iran) suffered from urinary tract infections during a period of one months were evaluated. The ESBL producing *Klebsiella pneumoniae*, *Pseudomonas aeruginosa* and *E. coli* were evaluated by disk diffusion test and growth and biofilm formation of common pathogenic strains were determined microtiterplate method. The results showed that different concentration of extract plant had significant effects on the bacterial growth and even at 5and 10mg/ml showed the most restrain in the biofilm formation of the isolate. Furthermore, the data demonstrate the biocontrol potential of *Capsicum annuum* L on the plank tonic growth and information biofilm of *Klebsiella pneumoniae*, *Pseudomonas aeruginosa* and *E. coli* and can suggest it as suitable biocide for the recirculating urine systems. [21]

A study was conducted to determine the antibacterial and antifungal activities of *Polygonum hydropiper* (L.) root extract on chloroform agains both bacteria and fungi using the disc diffusion method. The extract showed significant antibacterial activities against four gram-positive(*Bacillus subtilis, Bacillus megaterium, Stapphylococcus aureus and Enterobacter aerogenes, Salmonella typhi and Shigella sonnei*) bacteria. The minimum inhibitory concentration (MIC) values against these bacteria ranged from 16 to 64 ug/ml. The antifungal activities were found strong against six fungi (*Aspergillus fumigatus, Aspergillus niger, Aspergillus flavus, Candida albicans, Rizopus oryzae and Tricophyton rubrum*). It can be used in the folk medicine at different parts of the world to treat many diseases including bacterial and fungal infections. [22]

According to Liljana et al. (2013), several types of casaicinoids can be present in the oleoresin extracted from hot peppers can be made in many ways. The most appropriate, in our experiments is extraction by Soxlet, and this procedure was compared to extractions with vacuum filtration. We have used an ethanol as appropriate for extraction and quantification of *capsaicin* for food and pharmaceutical grade.

The content of *casaicin* the three different varieties of hot peppers with Macedonian origin was measured spectrometrically and results were compared with the sweet pepper variety as a control. Results of quantification measurements made for Soxlet oleoresins were different in a really special way from the results for vacuum filtration oleoresins, and it's due to conditions used for the procedure of extraction. These results are showing that for extraction of *casaicin* in different aims, conditions should be always adjusted. [23]

The use of natural products with curative aims is a common practive in any culture worldwide. It is mainly due to the activity of some extracts that they contain (terpens, essential oils, coumarines, flavonoids, etc.). The main aim of this chapter is to describe the techniques that allow evaluating the antimicrobial activity of palnts extracts and their essential oils against bacteria and fungi. The different methodologies will be differentiated in: Techniques on broth culture media, techniques on solid culture media, microwell techniques, aromatogram technique and bioauthographies. These techniques also allow establishing the Minimum Inhibitory Concentration (MIC) of the assayed products. [24]

4.2 Local Studies

According to Quisumbing, *Capsicum anuum var. longum*, which is also known as long-pepper, Spanish pepper, or red pepper and being hot is used in pickles and for seasoning. *Capsicum anuum var. longum* comes from the family *Solanaceae.* Its fruit is greenish-yellow or red, oblong *landeolate*, more or less narrowed to the tapering tip, and is growing up to 6 centimeters and 1.5 centimeters across. It is employed in India as a principal ingredient of various curries and chutneys.[14] (See Plate 1)

According to the study made by Toledo, the fruit of *Capsicum anuum var. longum* contains an active principle, capsaicin, alkaloid, citric acid, palmitic acid, volatile oil, and fatty oils, pentosans and picrin. It is excellent source of Calcium, Iron, Phosporus, and Vitamin B. The fruit of *Capsicum anuum var. longum* is powerful local irritant, a heart stimulant, general stimulant and stomachic. It also states that externally, a piece of pepper is used as

rubefacients and as local stimulant for the tonsils in tonsillitis. In diphtheria, its application is said to hasten the separation of false membranes. Internally, the pepper can produce gastroenteritis if taken in large doses.[16]

EXPERIMENTAL SECTION

This section discusses the methods and procedures utilized to extract resins from the *Capsicuum anuum var. longum* fruit, from the collection and preparation of the plant sample to the extraction, purification and testing of the resins. The stands and scientific experimental method was used in this study.

5.1 Collection and Preparation of the Plant Sample

The procedure for the collection of the plants samples and extraction of resins is summarized in the Flowchart shown **Fig.2.**

The fruits of the plant *Capsicum anuum var. longum that were* utilized in this study were gathered from different local communities in the Philippines. The fresh fruits were washed with clean water, cut into small pieces and then air-dried and further dried in the oven until they became crispy.

The dried fruits were then placed in a suitable container in preparation for the extraction testing procedures.

5.2 Extraction of the Resin. The resins were then extracted from dried fruits using the following methods of maceration, percolation, and reflux are following procedure summarized in the flowchart of **Fig. 2**

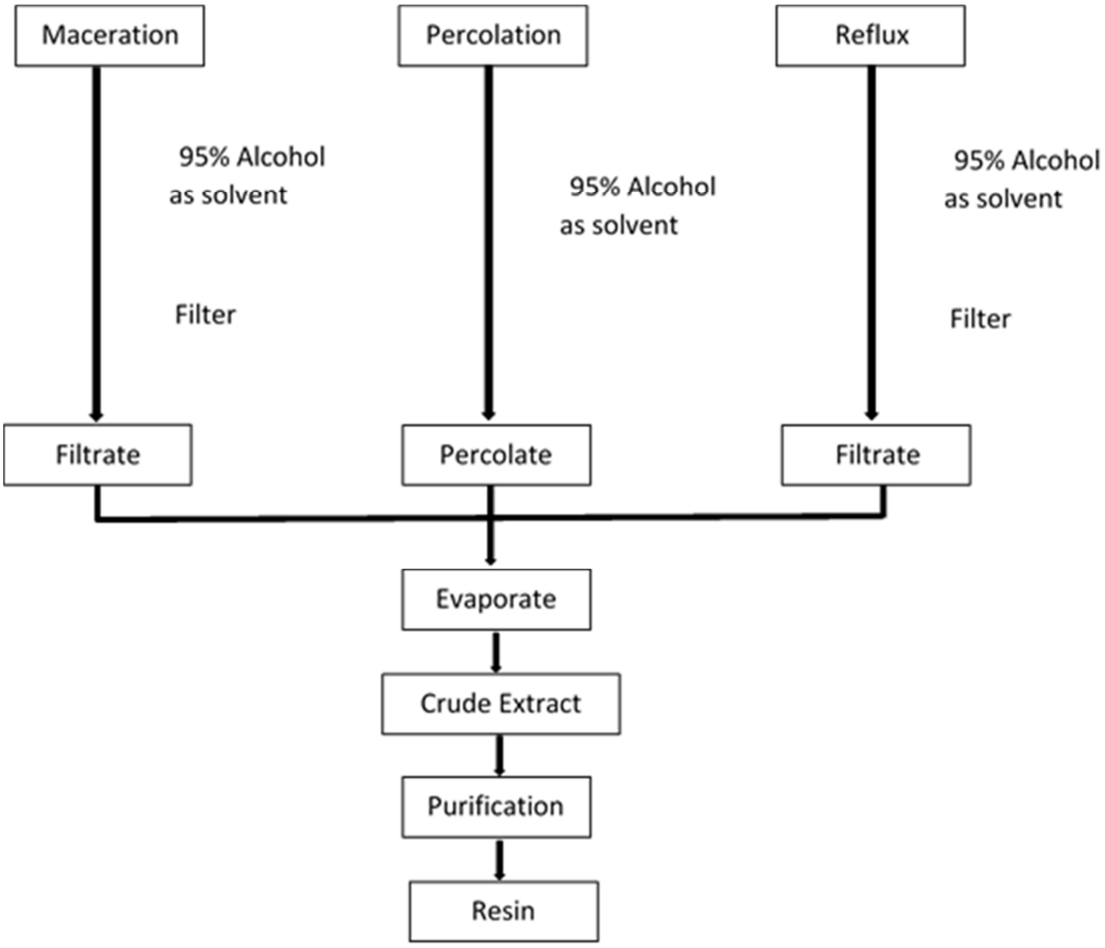

Figure 2: Flow Chart of the Resin Extraction Procedure

5.2.1 Maceration Method. ***Capsicum anuum var. longum*** fruits were washed, cut into small pieces and oven dried. The researcher weighed one hundred grams of the dried fruits and macerated with sufficient amount of ninety-five percent alcohol for one to two days. The extract were evaporated and purified.

In maceration, about one hundred grams of *Capsicum anuum var. longum* fruits was accurately weigh, cut into small pieces and air-dried; placed in a suitable container with sufficient quantity of ninety-five percent alcohol as solvent. Macerated for one to two days. The extract was filtered and the filtrate was places in soxhlet apparatus to recover the solvent needed for another extraction process. The constituent left over after recovering the solvent from soxhlet apparatus was placed in a clean evaporating dish and evaporated to near dryness in water bath. The residue washed with *one-percent (1%) HCl* and distilled water. Collect the purified resin and weighed to determine the percentage yield.
(See Plate 4)

5.2.2 Percolation Method. An accurately weighed one hundred grams of *Capsicum anuum var. longum* fruits were placed on a suitable container and completely saturated with ninety-five percent alcohol. A sufficient quantity of *Ammonia T.S.* sufficient to make the mixture distinctly alkaline is added and thoroughly mixed with the drug. The mixture is then transferred to cylindrical percolator, previously prepared by packing the outlet with purified cotton. A small amount of the solvent is used to rinse the container and rinsing added to the percolator. The drug is allowed to macerate for a suitable period of time. Then the drug is firmly packed with pledged purified cotton placed above it, and percolate slowly with the solvent until it is completely exhausted of its resin contents.

In percolation, about one hundred grams (100g) of *Capsicum anuum var. longum* fruits was placed in suitable contained and completely saturated with ninety-five percent (95%) alcohol. It was transferred to cylindrical percolation, previously prepared by packing the outlet with purified cotton. A small amount of solvent may be used to rinse the contained and the rinsing added to the percolator. Then, the drug was firmly packed with pledged purified cotton placed above it, and percolated slowly with the solvent until it is completely exhausted of its resin contents. The extracts were evaporated and purified with one *percent (1%) HCl* and distilled water. The collected purified resin was weighed and the percentage yield was determined. (See Appendix F Plate 5 for the computation of results). The actual result is shown in Table 1.

5.2.3 Reflux Method. One hundred grams of dried plant sample were placed in Erlenmeyer flask, macerated and added with sufficient quantity of ninety-five percent alcohol. The flask was placed over a water bath and was refluxed for two to three hours.

In reflux distillation, about one hundred grams (100g) of *Capsicum anuum var. longum*fruits was placed in a flask and about ninety-five percent *(95%) of alcohol* was added until the sample was fully submerged. It was refluxed for one hour over the water bath. The resin extract was filtered and collected in an evaporating dish and evaporated to dryness. The remaining residue was purified *with one percent (1%) HCl* and distilled water. Finally, the resin residue left was collected, dried, and weighed.
(See Plate 6 and Figure 2)

5.2.4 The percentage yield result of the three methods of extraction are summarized table 1.

Table 1: Percentage Yield Results

Method of Extraction	% Yield
Maceration	4.6125%
Reflux	2.365%
Percolation	2.7823%

Remarks: The method yields the highest percentage was maceration.

5.3 Purification Process. The alcoholic extractive of the three methods was then transferred into a tarred evaporating dish and allowed to evaporate to near dryness. The residues collected were washed with acidified water 9one percent hydrochloric acid), filtered then washed again with distilled water. The partially purified resin was placed in the oven for complete dryness, cooled and weighed and calculated for its percentage yield using the formula: **(See Appendix F)**

$$\%\ Yield\ (Resin\ extractive) = \frac{Wt.of\ resin\ extractive}{Weight\ of\ plant\ sample} x\ 100$$

5.4 Testing of the Extract
The testing procedure for the identification of the resin in the extract is summarized in the Flow Chart diagram in Figure 3.

5.4.1 Preliminary Test of the Resin Extractive from the *Capsicum anuum var. longum* Fruits

Three drops of Phloroglucinol test solution and few drops of Sulfuric acid were added to the resin extractive. It formed a reddish-brown coloration, which indicated the presence of resin in the plant sample. The actual result was shown on Table 2.

Table 2

Test Performed	Expected Result	Actual Result
Phloroglucinol + Sulfuric acid test	Reddish-brown coloration	Red coloration

Remarks: The actual results conform to the expected results, which indicates the presence of resin.

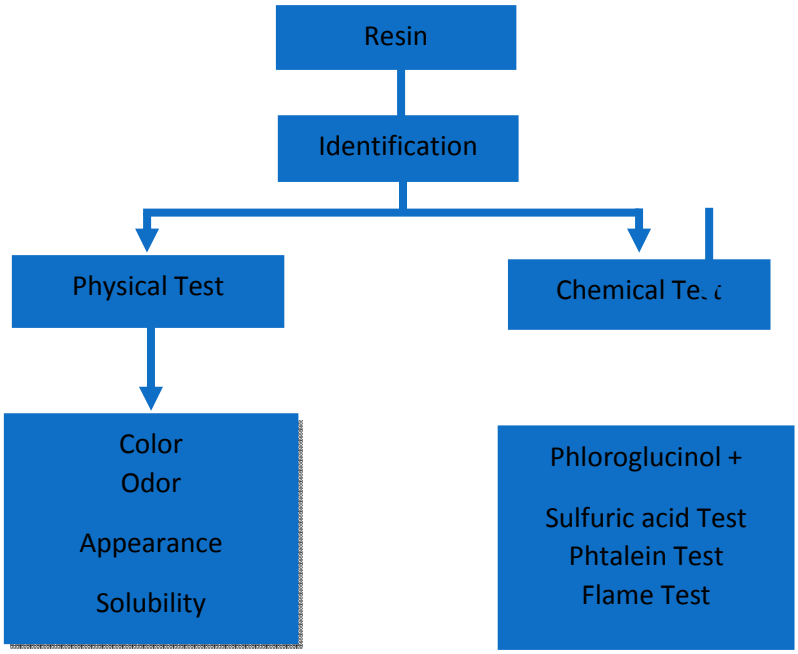

Figure 3: Flowchart of the Testing Procedure for the Determination of the Presence of Resin in the Extract Identification of the Resin

5.4.2Physical Test

The results of the test of the extract are summarized Table 3.

Table 3: Physical Test Result of Resin

Physical Test	Results
Color	Greenish-black
Odor	Pungent odor
Appearance	Sticky mass and syrupy
Solubility	Soluble in organic solvent such as alcohol, ether, benzene, and chloroform but insoluble in water.

Remarks: Results shows the physical test performed.

5.4.3Chemical Test

Phloroglucinol Test - Three drops of phloroglucinol and few drops of sulfuric acid was added to the resin extractive. A formation of reddish-brown coloration indicated the presence of resin.

Phtalein Test – Three drops of resorcinol was added to one milliliters of resin extractive and was heated over a water bath. It made alkaline with NaOH after cooling. Formation of grayish precipitate indicates of resins.

Flame Test – A piece of copper wire was used to dip in the resin extract then it was introduced to the flame. Results of the Chemical Test are summarized Table 4.

Table 4: Results of Chemical Test of Resins

Test Performed	Expected Result	Actual Results
Phloroglucinol Test	Reddish-brown coloration	Red coloration
Phtalein Test	Grayish precipitate	Grayish precipitate
Flame Test	Smoky flame	Smoky flame

Remarks: The actual result conforms to the expected result that indicates the presence of resins.

RESULTS AND DISCUSSION

This section presents the summary of findings as well as the conclusion of the study.

1. Collection and Preparation of Plant Sample

The fruits of *Capsicum anuum var. longum* were gathered and collected by hand picking from the Central markets of Metro Manila and surrounding provinces. The plant sample collected were washed, cut into small pieces and air dried.

2. Extraction and Purification of the Resin

The extraction of resin was carried out using the three methods, of maceration, percolation and reflux using ninety-five percent alcohol as the solvent. The crude extract was evaporated to dryness and partially purified by using one percent HCl acid and distilled water to remove the impurities present in the extract. The percentage yield obtain in maceration, percolation and reflux are 4.6125%, 2.7823% and 2.365% respectively.

3. Preliminary Test of the resin Extractive from the Fruit of *Capsicum anuum var. longum*

The preliminary test for resin was performed by using phloroglucinol and sulfuric acid test, the result was the appearance of a reddish brown color upon addition of the said solution.

The resin of *capsicum anuum var. longum* gave a greenish-black color, a pungent odor and appeared as a sticky mass. The resin extractive was soluble in the following organic solvent s such as alcohol, ether acetone, and chloroform but is insoluble in inorganic solvents such as water. The chemical test used was phloroglucinol and sulfuric acid test, phtalein test, and flame test which gives a reddish brown coloration, a grayish precipitate and a smoky flame respectively.

CONCLUSION

The following conclusions presented below were based on the results of the tests performed from the fruit of *Capsicum anuum var. longum.*

1. The preliminary test shows that crude extract of the fruit from *Capsicum anuum var. longum* contains resin.
2. Maceration, percolation, and reflux are methods which can be used to extract resin from the fruit of *Capsicum anuum var. longum.*
3. Identification test such as phloroglucinol + sulfuric acid test, phtalein test, and flame test confirmed the presence of resin.

Based on the results of the study, the researcher recommend the following:

1. An investigation of the antimicrobial property of the resin of *Capsicum anuum var. longum* fruits should be undertaken.
2. Extraction and isolation of the constituents using different solvents and methods of extraction should be attempted.
3. There should be more cultivation and propagation of *Capsicum anuum var. longum to make the* fruits to be more accessible and available for experimental use.
4. Dosage formulation of *Capsicum anuum var. longum* fruit should be established.
5. A more sophisticated method of analysis should be conducted such as the use of instruments like an infrared spectroscopy, to determine the functional group present in the fruit sample.
6. Higher concentrations of the resin extract should be prepared for use in the antimicrobial test.

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APPENDIX F
Computation of Percentage Yield

The percentage yield of the resin extractive by maceration were calculated:

Data:

Weight of the sample	= 100g
Weight of evaporating dish	= 48.5718g
Weight of evaporating dish + extract	= 53.1843g
Weigh of the resin extractive	= 4.6125g

$$\% \text{ yield} = \frac{Weight\ of\ the\ resin\ extractive}{Weight\ of\ sample} x100$$

$$\% \text{ yield} = \frac{4.6125g}{100g} x100$$

$$\% \text{ yield} = 4.6125\%$$

The percentage yield of the resin extractive by reflux method were calculated
Data:

Weight of the sample	= 100g
Weight of evaporated dish	= 42.287g
Weight of evaporating dish + extract	= 44.625g
Weigh of the resin extractive	= 2.365g

$$\% \text{ yield} = \frac{Weight\ of\ the\ resin\ extractive}{Weight\ of\ sample} x100$$

$$\% \text{ yield} = \frac{2.365g}{100g} x100$$
$$\% \text{ yield} = 2.365\%$$

The percentage yield of the resin extractive by percolation were calculated
Data:

Weight of the sample	= 100g
Weight of evaporated dish	= 48.5718g
Weight of evaporating dish + extract	= 51.3541g
Weigh of the resin extractive	= 2.7823g

$$\% \text{ yield} = \frac{Weight\ of\ the\ resin\ extractive}{Weight\ of\ sample} x100$$

$$\% \text{ yield} = \frac{2.7823g}{100g} x100$$
$$\% \text{ yield} = 2.7823\%$$