Journal of Tikapur Multiple Campus
Vol.6; June 2023
ISSN: 2382-5227
Published by Research Management Cell (RMC)
Tikapur Multiple Campus

Analysis of Pectin and Essential Oil *Citrus L. Lemon* Peel

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Abstract

The most well-known group of aromatic flowers is the genus *Citrus*. One of the most significant fruit crops in the world belongs to this genus and it is widely grown for the market for fresh fruit and processed juice. The phytochemicals were analyzed in the lemon peel essential oil extract. Phenols, terpenoids, saponins, and alkaloids were analyzed in the acetone extract whereas flavonoids, phenols, and saponins were analyzed in the ethanol extract of Lemon peel. The *Fusarium* was inoculated in Petridis and sprayed essential oil over the Petridis. One Petridis was free from essential oil. The essential oil free Petridis was observed spreading fungus with multiplication but the growth of fungus was stopped in Petridis which was sprayed with essential oil after three weeks. The pectin was extracted from lemon peel and calculated equivalent weight of pectin was 200g. It is found that lemon peel has a big application in medicinal and pharmacological benefits. Pinontoan et al., 2019 reported that essential oil extract of Lemon peel have equal effectiveness against both *Trichophyton rubrum* and *Fusarium*. The family Rutaceae is dominated economically by the genus *Citrus L.*

***Keywords*:** *Citrus L. limon* peel, Phytochemicals, Antifungal activity, extraction of Pectin, equivalent weight of pectin

Introduction

One of the most significant fruit crops in the world belongs to this genus (Abouzar & Nafiseh 2016) and it is widely grown for the market for fresh fruit and processed juice (Ollitrault and Luis 2012). The most well-known group of aromatic flowers is the genus *Citrus* (Morton and Telmer 2014)). The plant is known by its scientific name, *Citrus L*. From an economic perspective, the family Rutaceae is

dominated by the genus *Citrus L*. There are about 25 species which are unique to the Southeast's Himalayan foothills (Wu et al., 2018). It is a member of the subphylum Aurantioidea (Rutaceae Family, from the bitter herb Rue) (Hamedi et al., 2019).

Essential oil extracted from *Citrus L.* fruit peel which is typically derived through distillation or solvent extraction is the main product of the genus *Citrus L.* (Mondello et al., 2005). *Citrus* peel essential oil*s* are extracted by cold pressing, and their antifungal effectiveness is determined using an agar dilution method. The effects spotlight the *Citrus* essential oil extremely good antifungal activity. *Pomelo* essential oil used to be as quickly as most exquisite in opposition to *P. expansum*, whereas lime essential oil used to be most immoderate high-quality in opposition to *M. hiemalis and F. proliferatum*. These effects recommend that natural antifungal redress made from *Citrus* indispensable oils can be used in the food, pharmaceutical, and attractiveness industries (Van Hung et al., 2013). The okra disease-causing *Fusariumoxysporum* was prevented from growing in culture by extracts of *Citrus species* (*Hibiscus esculentus*). Peel extracts from *C. reticulata, C. aurentifolia, and C. sinensis* each demonstrated inhibitory effects that were, in turn, 83.55%, 71.10%, and 68.14%. The strongest triclosan, benzetonine, limonin, and nomilin have been determined to include substantial amounts of alkaloids and phenolic phytoconstituents in grapefruit (*Citrus vitis*) and candy orange (*Citrus sinensis*), according to a chemical composition analysis. Both benomyl and the synthetic fungicide *C. sinensis* peel extracts are toxic to fungi (Okwu et al., 2007).

Citrus L. peel essential oil*s* have great therapeutic potential and display a range of biological effects due to their abundance in flavonoids (flavone, flavonol, and flavanone), terpenes, carotenes, and coumarines, which have an antibacterial impact (Tepe et al., 2005). Pharmaceutical companies are frequently using *Citrus L.* essential oil for an antibacterial, antidiabetic, antioxidant, insect repellent, larvicidal, antiviral, antihepatotoxic, and antimutagenic agent (Kanaze et al., 2008). Lemon oil is made from the oil-containing cells of the skin and is rich in bioactive monoterperoids including citral, linalnol, p-limonene, and pinene (Milind et al., 2008).

The three most significant compounds in *Citrus L.* required oils (essential oil), which are complicated combinations, are sesquiterpenes, monoterpenes, and oxygenated monoterpenes. They serve as the plant's main source of aroma and establish its secondary metabolism. A few of the factors that affected the required oil yields and chemical compositions were the season, drying temperature, pretreatment, and extraction methods. Due to differences in their chemical composition, these chemicals have an impact on antifungal, antibacterial, and antioxidant results simultan essential oilusly. The behavior of a single or a small number of molecules cannot completely explain the natural results of complex essential oil mixtures. In addition,

aliphatic hydrocarbons, alcohols (such linalool), and aldehydes are present in *Citrus L.* indispensable oils (like citral).

Worldwide, mycotoxigenic fungi are viewed as major risks to food safety. The fungi can develop lethal mycotoxins that can significantly injure both humans and cattle in addition to causing food spoilage those results in loss and waste (Jing et al., 2014). There were 17 parts found in the lemon peel essential oil, the two main ones being limonene (68.65%) and terpinene (10.81%). Orange peel essential oil contains eight different components, mainly limonene (95.51%) and myrcene (1.98%). (Akarca et al., 2021). Clove ethanolic extract was discovered to be the most powerful antifungal agent compared to acetic acid extract preventing the growth of several molds by 70% to 100%. (Phyllis & James, 2000).

Lemon oil has a variety of physiological purposes that are used commercially, including flavorings and hepato regenerative, anti-cancer, antioxidant, anti-inflammatory, antibacterial, antifungal, and antiviral effects (Bora et al., 2020). Lemon peel is rich in active compounds like pectin, polyphenols, and flavonoids as well as volatile molecules like terpenes, esters, and alcohols (ChengYu et al., 2021).

Pectin is a structural hetero polysaccharide that is integral for the motion of terrestrial flora. The pectin crew of complicated polysaccharides acts as a hydrating agent and a binding agent for the cellulose regional in the transportable partitions of massive plants. Pectin and pectino are the Greek phrases which means "congealed and curdled" (Thakur et al.,1997).

Literature Review

Citrus fruits cultivated in Colombia's peels furnished proof of variants in chromatographic profiles on each a qualitative and quantitative level. The predominant resources are observed in *Citrus* fruits as of proper now have been recognized as coumarins, furano coumarins, and polymethoxylated flavones. The peels of Tahitian limes, Key limes, Mandarin limes, and mandarins incorporate an immoderate attention of coumarins and furano coumarins in contrast to candied oranges, which have a predominance of polymethoxylated flavones. The compounds limetin, isopimpinellin, bergaptene, and bergamottin, which had been as swiftly present in Tahitian and Key limes, have been eradicated. Geranoxy troubles used to be the major trouble with Key lime and Tahitian lime. Tahitian lime fruits dealt with 17 super elicitors over the first ten days no longer extensively a variety of from manipulate in phrases of coumarin and furano coumarin undertaking. The amount of coumarins and furano coumarins in fruits handled with water dropped on 13th and 16th days, whereas it was maintained or increased in fruits handled with controllable. Antifungal recreation (mycelial increase and spore germination) of the remoted compounds confirmed that furano coumarins

had been extra actives than coumarins. bergaptene and limettin exhibited the very best inhibitory outcomes towards *Colletotrichum sp*. being even increased than these of regarded phytoalexins scoparone and umbelliferone. Also, the combination of bergaptene and limettin displayed even increased antifungal impact than the person compounds. The defensive mechanisms of *C. latifolia*, *C. aurantifolia*, and *C. limonia* may become concerned in response to isolated chemicals (Ramrez-Pelayo et al., 2019).

UV-B radiation (UVBR) therapy has already been shown to shield postharvest lemons from the green mold *Penicillium digitatum*. Here, the effectiveness of flavedo extracts from both irradiated and non-irradiated lemons against *P. digitatum* was tested, and components that might be in charge of this action. In comparison to extracts from normal lemons, the flavedo extracts from UV-B exposed lemons (UVBLE) showed greater antibacterial activity (CLE). Conidia exposed to UVBLE exhibited a time dependent reduction of germination and oxygen uptake, as well as a noticeably increased generation of ROS and TBARS and membrane permeability. Two fractions (A and B) that changed as a result of the irradiation were identified through chemical analysis of lemon extracts; Fraction A decreased and Fraction B increased. Compared to Fraction A, Fraction B demonstrated greater antioxidant and antifungal activity. Both fractions contained complex samples that were high in flavonoids. The differences in biological activities and the greater ability of UVBLE to suppress the pathogen in vitro than CLE might both be explained by the unique composition of each fraction. Based on our findings, UV-B radiation treatment can boost the flavedo lemon's natural defenses by, among other things, inducing the creation of phenolic compounds (Ruiz et al., 2017).

The limonene chemical made up the majority of the crucial oils of the 5 species of *Citrus* . Due to the similarity of the constituent limonene's traits in *C. sinensis* (orange) and C. reticulata (ponkan), the critical oils have been divided into three businesses the usage of essential oil elements evaluation and hierarchical cluster evaluation (HCA). *C. medica* (citron) and *C. aurantifolia* (lime) are protected due to the similarities in regard to the factors neral, geranial, terpineol, and p-cimene. limonia (lemon lime) are in relation to the content material cloth of the issue terpinene, (1-8) cineole, and pinene.

All of the essential oils are antifungal activity against the three phytopathogens *F. oxysporum*, *A. alternate* and *C. musae*. The EC50 (Half maximal effective concentration*)* values of the essential oils of *Citrus medica* (citron) and *Citrus aurantifolia* (lime) have decreased as a result of the synergism between limonene, neral, and geranial (de Souza et al., 2013).

Critical oils derived from plant life can efficiently deal with postharvest ailments of fruits and veggies as a choice to artificial fungicides. It was once examined in vitro and in vivo if the imperative oils from the herbs oregano (*Origanumvulgare L. ssp. hirtum*), thyme (*Thymus vulgaris L.*), and lemon (*Citrus Limon L.*) had been high quality in opposition to countless massive postharvest pathogens (*Botrytis cinerea, Penicillium italicum* and *P. digitatum*). According to in vitro tests *P. italicum* did not exhibit mycelium growth in the presence of thyme essential oils at a concentration of 0.13 Î14l/ml. Additionally, the spore germination used to be effectively decreased by way of the usage of three species are quint essential oils. The properly sized efficacy displayed in vitro by using the use of integral oils used to be as soon as supported via the in vivo trials. To reduce the severity of *B. cinera* infected fruit ailments in tomatoes, strawberries, and cucumbers, these oregano and lemon oils have been frequently efficient. Oregano essential oils are 0.30 Î¼l/ml absolutely suppressed *B. cinerea's* grey mildew growth in tomatoes. Additionally, lemon fundamental oils substantially lessened the severity of the gray mildew condition. Lemon vital oils at 0.05 Î¼l/ml absolutely suppressed the increase of gray mildew on strawberries. Additionally, cucumber fruits contaminated with *B. cinerea* had been decreased by way of 39% when lemon integral oils had been used at 0.05 Î14l/ml. According to these findings, fundamental oils should be employed in formulations that are proper for the administration of postharvest ailments added on by means of the Penicillium and Botrytis pathogens (Vitoratos et al., 2013).

The practicable of the use of *C. limon* peel extract for the manufacturing of herbal fungicides looks tempting and acceptable due to its accessibility, safety, pest resistance, lack of damage to nontarget species, lack of harmful outcomes on plant growth, and affordability. The finding proved that *C. limon's* methanolic extract had in vitro fungicidal properties. Therefore, extra lookup is wished to extract and purify bioactive antifungal compounds from *C. limon* and decide how they fight soil borne plant fungal infections (Pallavi et al., 2022).

The disc diffusion and agar dilution strategies have been used to check the antifungal pastime of 4 dermatophyte traces (*Trichophyton rubrum*, *Microsporum canis*, *Trichophyton mentagrophytes*, and *Microsporum gypseum*) for prior to this study between 1.54 and 2.43% (w/w) of EO have been extracted from the *C. limon* peel is greater and summer season yields . Three aspects of EOs encompass limonene (43.45–58.75%), pinene (4.73–13.23%), and terpinene (8.06–11.04%). With inhibition zones ranging from 16.63, 0.38 to 90.00 mm, minimal inhibitory concentrations (MIC) of 0.6 to 5 mg/ml, and minimal fungicidal concentrations (MFC) of 1.25 to 10 mg/ml, *C. limon* peel EO exhibits strong antifungal activity against the tested strains, according to the evaluation of the antifungal activity. Results for MIC (0.6-2.5 mg/

ml) and MFC (1.25-2.5 mg/ml) indicated that spring harvest EO was marginally more efficient. The EO of *C. limon* peel exhibits seasonal fluctuation in chemical composition and antifungal activity as well as substantial antifungal potential, and is effective in treating dermatophyte induced fungal infections (Hadj Larbi et al., 2023).

The antifungal hobby of the oils and its elements (terpineol, terpinen-4-ol, linalool, and limonene) in the direction of two plant pathogenic fungi, *Penicillium digitatum* and *Penicillium italicum* isolated from a vary of internet websites in Tunisia, used to be as soon as assessed the utilization of the poisoned foods technique and the agar true diffusion assay. Nerola oil tested the best diploma of activity, with an inhibition area diameter of 32 mm and an inhibition share of more than 50% for *P. italicum* isolated from Soliman. Leaves critical oils followed, with an inhibition area diameter of 22.6 mm and an inhibition share of 60.7 2.8% for *P. italicum* isolated from *Soliman. Peel* fundamental oils displayed the lowest stage of workout in opposition to all examined isolates. In the past, fungus sporulation was once hastily lowered to 22.5% for *P. italicum* and 25% for *P. digitatum*ata attention of 50 mg/ml of neroli oil, respectively. Additionally, after being uncovered to 50 mg/ml of neroli oil, the weight of *P. italicum* and *P. digitatum* mycelia was once as unexpectedly decreased by means of the use of round forty conditions. Accordance to in vivo tests Neroli oil is famous antifungal action, with a 36% discount in infection incidence after storage. The isolates that had been labeled as fungicide resistant have been susceptible to the results of the oils (Trabelsi et al., 2016).

In addition to assorted concentrations of arabinose, galactose, and glucose residues, all extracted pectins have been particularly focused in galacturonic acid. It is used to be decided that the 4 foremost fractions represent rhamnogalacturonans with solely minor modifications in their nice structure based on the low acetyl concentration, excessive acetyl content, and rhamnogalacturonase degradability, polygalacturonase was once in a position to breakdown the fifth portion which had a greater awareness of galacturonic acid (Ros et al., 1996).

It is decided that jam may be made with both lemon and orange. The low gel strength of the jam can be addressed by adding pectin during processing to achieve the economically acceptable gel strength, or the deficiency can be made up for by using a combination of fruits high in pectin. The flavor and color may also be enhanced by combining with other fruits. It is highly advised to promote the manufacturing of jam at the household level utilizing local raw resources like sugar beet, and stringent conditions must be accessible while making jam at home. On the utilization of natural pectin from regional fruits for the creation of jams, more research is advised (Sulieman et al., 2013).

Numerous fruits and greens naturally include pectin, an anionic carbohydrate. Despite being closely utilized in the meals sector, pectin has additionally been studied for utilization in organic purposes such as most cancers targeting remedy delivery, and wound dressing. In our investigation, we created chitosan/pectin cryogels through mixing extracted pectin (from the albedo of lemon peels) with chitosan (as a herbal polymer). Analyses each qualitative and quantitative have been carried out on the extracted pectin. Cryogelation used to create chitosan/pectin spongy super macro porous cryogels in a range of weight to chitosan ratios (100:0, 80:20, 60:40, and 40:60, w/w). By employing FTIR, it was confirmed that pectin and chitosan had polyelectrolyte interactions and that chitosan had been crosslinked with glutaraldehyde. Cryogels' porosity was identified swelling ratio, degrading behaviors, and mechanical characteristics. Cryogels' average pore sizes and pore shape were revealed by SEM examination. Following thorough study, 40:60 chitosan/pectin cryogel was chosen for cytotoxicity tests. To assess the in vitro cytotoxicity of scaffolds, glioblastoma (U-87 MG) cell line was used. The scaffolds' nontoxicity and ability to support cell adhesion and vitality were verified by MTT assay and SEM analysis (Boluda-Aguilar et al., 2013).

With an extraction period of 141 minutes and a liquid-solid ratio of 29:1, natural citric acid used to be used to extract pectin from pomelo peel. The consequences confirmed best yield of 39.72% and a DE of 57.56% at pH 1.80 and 88 °C. When in contrast to different extraction parameters, pH had the largest have an impact on pectin yield and DE values. The yield and DE values may want to be exactly envisioned by means of the quadratic fashions created from the optimization study. Pomelo peel yields of pectin are equal to these from different sources (Liew et al., 2018).

On a dry weight basis, we decided that the manufacturing of a hundred and fifty grade pectin from smooth peel leached in the lab was once as soon as 65.6 and 55.9% for lime and lemon, respectively. Lemon peel produced yields of 41.1, 41.1, and 25%, respectively, when dried to ultimate moistures of 15-20, 8-12, and 3-7 % (Crandall et al., 1978).

Materials with photocatalytic, adsorption, and antibacterial capabilities have been consistently used in waste water treatment techniques. Through electrospinning, fly ash doped TiO2 nanofibers were made, and they were used to rid water of bacteria and organic contaminants. This technique makes use of fly ash's natural adsorbent properties, the well-known photocatalytic and antibacterial properties of TiO2 , and both (FA). Fly ash and TiO_2 combined to create a nanofiber with outstanding adsorption, photocatalytic activity to break down methylene blue, and antibacterial activity to combat Escherichia coli. The results of the study demonstrated how effective composite nanofibers are in filtering water (Saud et al., 2015).

Methods and Procedures

Fresh lemon peels (*Citrus Limon*) were bought at the Baglung Bazar market and cleaned before being peeled. Before the experiment, the freshly peeled lemon was dried and ground into powder. *Citrus* oils are truly unstable mono terpene hydrocarbons (Essential oils). *Citrus Limon* essential oils are many times hired through skill of organizations in the chemical and pharmaceutical industries due to their antifungal qualities.

Experimental Methods

Methods of Essential Oil Extraction

Fresh lemons were bought from a neighborhood market in Baglung bazar and carefully cleaned with running water. A sterilized knife was used to remove the peels, which were then shade-dried for 4-5 days at room temperature. Using an electric blender, the dried peels were ground into a powder and put into air tight containers for later use. For extraction, ethanol and acetone, two distinct solvents, were utilized. 250 ml of solvent and 10 g of powdered lemon peels were added to a soxhlet (ethanol or acetone). The solvent (acetone or ethanol) was warmed to 78°C. The essential oil was put into a thimble for storage (Hussain et al., 2018).

Antifungal Activity Analysis Techniques

PDA media were created in the botanical laboratory utilizing the supplied PDA powder (1 liter of water, 200 grams of potato, 20 grams of dextrose, and 20 grams of agar). The media were finished after 45 minutes in the autoclave. The spritz cleaned the surroundings. The three plates were smoothly filled with media after a hole was made in them. One of them was sprayed with essential oil in the Botany Laboratory DMC, Baglung, and then the *Fusarium* was dipped into it and incubated for three weeks at 25°C. Clean zones were discovered to exist or not after 48 hours (Pinontoan et al., 2019).

Phytochemical Screening

Mace, Wager, Evans, and Kokate studied phytochemical screening to examine the Alkaloids, Glycosides, Saponins, Terpenoids, Steriods, Carbohydrate, and Protein in accordance with conventional methodology. According to Ramakrishnan et al., proteins and carbohydrates were also analyzed. This investigation identified these chemicals' existence or absence through general reactions. The phyto-chemical qualities of the essential oil were confirmed by the qualitative examination of the oil (hot ethanol extract and hot acetone extract). Analyses of the following phytochemicals were conducted:

Flavonoids Test

Alkaline Reagent Test

Two milliliters of imperative oil have been used to dilute the sodium hydroxide. The presence of flavonoids is established via the truth that the color of the response to an choice adjustments from a seen yellow to colorless when diluted acid is applied.

Lead Acetate Test

Two milliliters of water and two drops of lead acetate were used to dilute the essential oil. The previous golden color of the precipitation may have also played a role in the increased presence of flavonoids.

Test for Flavonoids

0.5 ml of the sample solution and 2 ml of distilled water were blended, and then 0.15 ml of a 5% $NaNO_2$ solution was added. 10% solution of $AlCl_3$ was added after six minutes. 2 cc of a 4% NaOH solution was needed to complete the mixture. Following complete blending, the mixture was allowed to stand for an additional 15 minutes. It was immediately increased to 5 ml by adding water to the capacity. The pink tint of flavonoids serves as a symbol.

Phenol Test

Two milliliters of integral oil extract had been mixed with two milliliters of 5% ferric chloride to detect phenols ($FeCl_3$). A shiny bluish green color indicates presence of phenols.

Saponins

Two milliliters of the filtered extract sample had been mixed in 1 milliliter of distilled water in a test tube, and the test tube was violently shaken to produce a consistent. Three energetic drops of essential oil had been as soon as utilized to the foam. Presence of saponins looks frothy.

Alkaloids Test

2 grams of extract had been brought to a 10 ml combination of methanol and 1% HCl that used to be heated over water earlier than the combination used to be filtered. Orange precipitation suggests that presence of an alkaloid. Alkaloids was detected by Mayer's test.

Mayer's Test

The filtered material used to be as soon as diluted with a few drops of Mayer's reagent to yield 1ml to remove precipitation or turbidity indicates alkaloids.

Test for Proteins

After combining 0.5 ml of essential oil extract with an equal extent of 1% sodium hydroxide, a few drops of copper sulphate was cautiously added and the fluid's transformation to purple indicates presence of proteins.

Methods of Pectin Extraction from Prepared Sample

A beaker (1000 ml) holding 500 ml of water was filled with the 100 grams of dry peels individually. PH was increased to 2.2 by adding 2.5 ml of hydrochloric acid. Next, 45 minutes of independent boiling time were spent on each of the fruits. After that, a filter study using filter paper was used to separate the peels from the extracts. To reduce the amount of heat related pectin degradation, the cake was washed with 250 ml of boiling water and the combined filtrate was allowed to cool to 25°C. 100 ml of the extracted pectin were combined with 200 ml of 95% ethanol while being thoroughly stirred, and the mixture was allowed to stand for 30 minutes to allow the pectin to float to the top. This precipitated the extracted pectin. After that, the flocculants of gelatinous pectin were skimmed out. After being cleaned in 200 ml of ethanol, the extracted pectin was pressed on a nylon towel to get rid of any remaining HCl and universal salt. The resultant pectin was measured, finely chopped, and air dried. The dried pectin was then further crushed with a pestle and mortar into smaller bits, and it was weighed with a digital weighing scale. After determining the initial pectin output from wet peels, both wet and dry weight calculations were made (Bagde et al., 2017).

Equivalent Weight Determination

1 g pattern of pectin and 10 ml of ethanol have been brought to a conical flask with a potential of 250 ml. A few drops of phenol pink indicator, 2 g of sodium chloride, and 100 ml of distilled water were then added to the mixture. Before step by step titrating the answer with 0.1 M NaOH to a purple colour at the endpoint (to keep away from manageable de-esterification), care used to be taken to make certain that all of the pectin had dissolved and that no clumping had fashioned at the aspects of the flask (Bagde et al., 2017).

Results and Discussion

Table two shows that ethanol and warm acetone have been used to extract *Citrus. Limon* peel imperative oil. Numerous phytochemicals can be located in this oil (hot) acetone and alcohol extract. Hot alcohol extract reported flavonoids, whereas hot acetone extract did not.

Table1

Qualitative Investigation of the Phytochemical Constituents in Citrus. Limon peel-

derived Essential Oil

Phytochemicals	Inference of Extracts	
	1	2
Flavonoids	-	+
Phenols	+	+
Terpenoids	+	-
Saponins	+	+
Alkaloids	+	-

Keys: Extract 1: Hot Acetone; Extract 2: Hot Ethanol. + Present, - Absent

The essential oil extract of lemon peel contained the phytochemicals. In the acetone extract of lemon peels, phenols, terpenoids, saponins, and alkaloids were discovered, while the ethanol extract of lemon peels contained flavonoids, phenols, and saponins. The ethanol extract's phytochemical composition of the flavonoids, saponins and alkanoids was similar to that reported John, S. et al.,. by 2017), however cardiac glycosides, diterpene, phytosterols were not found but tannin, glycosides, carbohydrate, proteins were not found were similar to reported by John et al., 2017. Saponins, Phenols and alkaloids were found in acetone extract but saponins and phenols are similar as reported by John, S. et al.,., 2017. saponins, phenols and flavonoids were found in ethnol extract and alkaloids, saponins, and phenols were found in acetone extractas reported by Lawal et al., 2013 in *C. sinensis* peel extract.

The *Fusarium* was inoculated in Petridis and sprayed essential oilover the Petridis. One Petridis was free from essential oil. The essential oil free Petridis was observed spreading fungus with multiplication but the growth of fungus was stopped in Petridis which was sprayed with essential oil after three weeks. Pinontoan et al., 2019 reported that essential oil extract of Lemon peel have equal effectiveness against both *Trichophyton rubrum* and *Fusarium*.

Figure1 (a)

Petridis with Growth of Fungus is Stopped due to Antifungal Activity of Essential Oil Acetone and Alcohol Extract

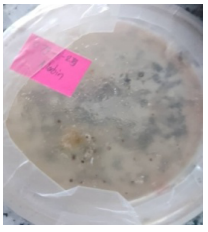

Figure 1 (b)

Petridis with Fungus Growing

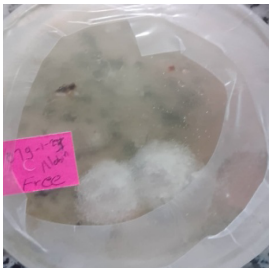

Table 2

Titration Pectin Mixture vs NaOH

S.N.	volume of pectin mixture	volume of 0.1M NaOH	total volume of 0.1M NaOH	calculation of equivalent weight
1	20 ml	1ml	5ml	Equivalent weight = $\frac{weight\ of\ pectin \times 100}{volume\ of\ alkali\ cm3 \times molarity\ o}$ weight of pectin = 1g, volem of NaOH = 5ml, Molarity of NaOH = 0.1M $\frac{1x100}{5x0.1}$ =200
2	20 ml	1ml		
3	20ml	1ml		
4	20ml	1ml		

Equivalent weight of pectin was calculated 200 g which was similar as reported by Bagde et al., 2017.

Conclusion

It is found that lemon peel has a big application in medicinal and pharmacological benefits. Pinontoan et al., 2019 reported that essential oil extract of Lemon peel have equivalent effectiveness against both *Trichophyton rubrum* and *Fusarium*. The critical oil extract from lemon peel contained the phytochemicals. The acetone extract of lemon peels contained extra phenols, terpenoids, saponins, and alkaloids in evaluation to the ethanol extract, which additionally contained flavonoids, phenols, and saponins. The equivalent weight of pectin was to be calculated as 200g.

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