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EXTENDED PREFACE

For this 4th annual conference, the theme is "Agricultural and Environmental Engineering for food, Water and Energy Security through Innovations and Disseminations" We received nearly 160 articles from 13 countries. We were pleasantly impressed by the researchers' enthusiasm and trust in this conference.

Due to the unforeseen circumstances of global pandemic COVID-19, the 4th ICATES 2022 conference was carried out virtually as same as ICATES 2021 by zoom meeting platform. We took this option because this conference was already designated and funded. Keynote and invited speakers were also scheduled for this event. Many delegations and authors requested for this conference to be performed, even virtually, since they need it to cover their publication and sharing knowledge requirements.

The conference itself was run as planned on 10 August 2022 with the support from virtual event organizer started from 8.00 am to 19.00 pm. The ICATES committee members were managed this event in a particular room as a studio along with two appointed MCs. The conference was officially opened by the Rector of Syiah Kuala University, and it is broadcast lively via YouTube platform with recorded participants reach 475 were joined. The discussion session was performed directly once the speaker was completed his/her presentation.

Moreover, parallel sessions were started after all keynote speaker session and participants were divided into 8 breakout rooms in zoom platform based on their related sub-topics. The operator acted as virtual Host and Co-host to manage and ensure all presenters and participants were put in the right place. Each participant and presenter was identified by renaming their name to room number and author full name. Presenter was given about 10 minutes for power point presentation via Screen Sharing and 5 minutes for discussion and shifted to next presenter. During the conference, video capabilities were turned on to ensure dynamic conference.

On behalf of the whole committee we want to acknowledge and express gratitude to the rector of Universitas Syiah Kuala, the dean of Agriculture Faculty of Universitas Syiah Kuala, the head of Research and Community Service Institution Universitas Syiah Kuala and to our partner Universiti Malaysia PAHANG and Universiti Teknologi MARA. We also appreciate endlessly support from Agricultural Engineering alumni organization (IKATETA) and Research center and workshop for agricultural mechanization. Hopefully in the future, ICATES will remain a venue for sharing high-quality research findings.

Chairperson

Dr. T. Ferijal

Keynote Speaker Abstract

Dietary Patterns and Their Impact on the Environment: What Does It Mean For Agricultural Production?

Prof. Dr. Elke Pawelzik

Georg-August-University Goettingen,
Department of Crop Sciences, Quality of
Plant Products, Carl-Sprengel-Weg 1, 37075

Abstract

Food production has different impacts on the environment depending on the specific commodities produced. The increasing demand for Western diets in many parts of the world, which is based on high consumption of animal products, is putting pressure on the global food supply. However, the high consumption of animal products is one of the main reasons contributing to the negative impact of the modern diet on global and individual health and on the environment. On the other hand, for several years, there has been an increasing demand for plant-based alternative products in industrialized countries to replace animal-based foods. This, in turn, may mean that agriculture will increasingly have to produce plant products intended directly for human consumption. Based on the current state of knowledge as well as own studies on nutritional value, sensory properties, and environmental impacts of plant-based alternative products, possible implications for future agricultural production will be presented.

Keynote Speaker Abstract

Sustainable Agromaritime Development in Indonesia

Prof.Dr.Ir. Ari Purbayanto, M.Sc.

Division Head of Resource and Capture Fisheries Area,

Faculty of Fisheries and Marine Sciences,

IPB University Bogor West Java

Chairman, Indonesian Professor Association

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Abstract

The 2030 agenda for sustainable development adopted by all member states of the United Nations in 2015, provides a common blueprint for peace and prosperity for people and the planet, now and in the future. At its heart are the 17 Sustainable Development Goals (SDGs), which are an urgent call for action by all developed and developing countries in a global partnership. They recognize that ending poverty and other deprivation must go hand in hand with strategies to improve health and education, reduce inequality, and spur economic growth—all while tackling climate change and working to conserve our oceans and forests. In connection with the agenda, in a more focused scope on the agromaritime sector, the adoption of the big concept of the 2030 agenda for sustainable development needs to be carried out in a well-planned for community welfare and the sustainability of the Indonesian land and sea environment. The rapid increase in population with various social and economic problems, coupled with the Covid-19 pandemic that has been going on for the last 3 years, is a challenge faced by Indonesia and other countries worldwide. On the other hand, the industrial era 4.0 provides great opportunities for every country to move forward and be able to take advantage of the opportunities and challenges of the era of technological disruption. Through the ICates-4 international seminar forum, I would like to discuss sustainable development in Indonesia's agricultural, marine and fisheries sectors.

Keynote Speaker Abstract

Eco-Innovations for Sustainable Development: Drivers and Barriers in Natural Fiber Composites

[Dr. Siti Hasnah Kamarudin](#)

Eco-Technology, School of Industrial Technology,
Faculty of Applied Sciences
UiTM Shah Alam, 40450 Shah Alam, Selangor, Malaysia

Abstract

Eco-innovation is critical to the successful implementation of sustainable development. The overall goal of eco-innovation is to minimize the environmental impact while also creating new market opportunities, products, services, or processes designed to improve environmental performance. Eco-innovation affects not only businesses but also their surroundings, i.e. existing socio-cultural norms and institutional structures. The purpose of this article is to recognize how eco-innovations can aid in sustainable development, as well as to examine the possibilities and limitations of incorporating them into natural fiber composites. The study demonstrates that eco-innovations are interpreted in the literature not only as a tool for sustainable development in general, as well as in terms of process and as a source of ecological and economic effects. According to the findings of this analysis, eco-innovation is an element of sustainable growth at the enterprise, societal, and state levels that should be used throughout the product or service life-cycle to contribute to the achievement of economic and environmental benefits. Its implementation is contingent on a variety of drivers and barriers. Because eco innovations are connected to different barriers independent of companies, significant state support is required to overcome current difficulties. Changes in economic system can help to support eco-innovations. By incorporating sustainability into a business strategy, the idea of Eco-innovation can help small and medium-sized businesses made up from natural fiber composites become more resilient, even during times of crisis.

Keynote Speaker Abstract

Application of Near Infrared Spectroscopy for Food and Agriculture

Ravipat Lapcharoensuk

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Abstract

Near infrared (NIR) spectroscopy is the study of the interaction between NIR radiation (NIR: 800 – 2500 nm, i.e., 12500 – 4000 cm^{-1}) and vibration of the molecular-based on overtones and combinations, especially hydrogen bonds (C-H, O-H and N-H). NIR spectroscopy is a non-destructive, fast, and environmentally friendly technique for assessing the quality of food and agricultural product. However, we cannot use it directly as spectral information from a NIR spectrometer for monitoring quality of material because the characteristics of the spectra are very complex, broad, and overlapping. Knowledge in the field of mathematics, statistics and computer science has always been used for extracting hidden information from complex chemical data, including multivariate data analysis, chemometric technique and machine learning. NIR spectroscopy can be applied for qualitative and quantitative evaluation. The typical procedures for NIR spectroscopy included the pre-processing of the NIR spectra data, training the mathematical model, evaluation of model performance and deployment of technique in the real world. Many pre-processing techniques were applied in NIR spectroscopy process such as smoothing, multivariate scatter correction (MSC), normalization, derivative, and others. The popular algorithms for modelling NIR spectroscopy such as partial least squares (PLS) regression, support vector machine, artificial neural networks (ANN). The NIR spectroscopy was successfully applied in food and agriculture in previous research such as evaluation of quality of food and agricultural product, assessment of energy of biomass, identification of geographical origin of agricultural product, and determination of adulteration in food and agricultural product. In the future, NIR spectrometer must be developed to be portable, inexpensive, and highly efficient. This information indicated that NIR spectroscopy is interested technique to apply in global food and agricultural industry.

Keynote Speaker Abstract

The Application of Machine Learning in Detecting Damage Structures

Asst. Prof. Ts Dr. Zahrah Yahya

Deputy Vice Cancellor Academic

Kolej Universiti Poly-Tech Mara Kuala Lumpur

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Abstract

The occurrence and development of damage to engineering structures is still not fully understood and is very difficult to detect, locate and quantify. Structural health monitoring (SHM) techniques using vibration-based damage detection (VBDD) are defined as a process to detect, locate and quantify structural damage. However, for a large, complex structure with joints, the VBDD method requires some knowledge of the damage location, which is itself a costly and time-consuming procedure due to the complex behaviour of the structural joints. This research aims to propose an advanced AI-based solution, namely machine learning (ML), to detect the presence of damage in the jointed structure. The newly developed algorithm of ML, which uses artificial neural networks (ANNs) and modal testing techniques, is used to effectively and accurately predict the presence of damage in the structure. The algorithm ML is used to build the new prediction model and establish maximum correlation with the target response of the frequency response function (FRF) associated with the ensemble parameters. ML can learn from the data itself and find the optimal set for the given target. This leads to significant savings in terms of experimental effort, computational efficiency and faster decision making in detecting damage in the jointed structure. The result of the research, the development of the ML algorithms, will be able to learn from the data of the damaged structure itself and make predictions based on the learned data of the generated model.

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Solvent extraction of Amla (*Phyllanthus emblica*) seed oil using hexane

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Solvent extraction of Amla (*Phyllanthus emblica*) seed oil using hexane

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Abstract. This study investigated the effect of extraction time on yield, phytochemical content in the form of phenolic and flavonoid compounds, and functional groups contained in amla seed oil extract. The research was conducted by extraction using hexane solvent equipped with a stirrer at a speed of 400 rpm at 60 °C for 30 and 120 minutes. The results showed that the extraction time affected the yield of amla seed oil. The highest yield was obtained by using an extraction time of 120 minutes. It can be proven by the morphological structure analysis using scanning electron microscope. Phytochemical analysis showed amla seed oil has high phenolic and flavonoid compounds at the extraction time of 120 minutes compared than 30 minutes. The results of FTIR (Fourier Transform Infrared Spectroscopy) of amla seed oil with different extraction times showed the same functional group content in the form of a hydroxyl group (O-H) indicating the presence of polyphenolic compounds, a ketone group (C=O) indicating the presence of ascorbic acid compounds and an ether group (C-O) indicating the presence of ascorbic acid the presence of flavonoid compounds in amla seed oil.

Keywords: *Amla seed oil, solvent extraction, phenol and flavonoid compounds, functional group.*

1. Introduction

Amla fruit (*Phyllanthus emblica*) is a fruit that comes from India. Amla fruit is widely distributed in tropical and subtropical countries such as China, India, and Southeast Asia. It belongs to the family Euphorbiaceae [1]. In Indonesia, this plant is extensive on the islands of Java, Sunda, Ternate, and North Sumatra. The amla fruit consists of a smooth, yellow-green outer skin and an inner skin and seeds of amla [2]. Many people only use the flesh of the amla fruit, while the seeds are thrown away as organic waste. Whereas amla seeds have high nutritional value as antioxidants that have free radical scavenging properties (damaged cells) [3]. The seeds have been tested for antimicrobial properties on human pathogens showing that they have strong antimicrobial compounds that can be used to kill pathogens and have antibacterial and antifungal properties. There is no toxicity or allergy associated with the use of seeds as food or medicine so they have the potential to be used as a source of vegetable oil [4]. Amla seed oil is rich in fatty acids such as unsaturated fatty acids



with the main component being linoleic acid [5]. Amla seed oil can be used to develop high economic value products such as traditional medicines and cosmetic products which have been reported by Kumar et al [6].

Research information related to the process of extracting oil from amla seeds is still finite. This research needs to be carried out to obtain a better process for the characteristics and properties of phytochemicals extracted on laboratory and industrial scales. Many researchers report that amla seeds have many health benefits. Bhandari et al [7] reported that Amla has therapeutic potential against disease and is also rich in vitamin C, polyphenols such as tannins, gallic acid, ellagic acid, and flavonoids such as quercetin and rutin. Dasaroju and Krishna [8] evaluated the pharmacological perspective of amla in the prevention and treatment of various diseases. Meanwhile, Anbuselvi and Manas [9] reported the phytochemical and antimicrobial activity of amla seed extract to maintain human health. The presence of phenolic compounds in amla causes it to quickly brown due to the oxidation of phenolic group compounds when exposed to oxygen [10].

Extraction includes several methods, one of which is solvent extraction. Solvent extraction is the most commonly used method for materials with low oil content. There are still very few studies related to the extraction of oil from amla seeds. This research was carried out to provide additional information about reducing waste by utilizing the seeds to produce amla seed oil which has the potential to develop products of high economic value such as being used to manufacture cosmetics, foodstuffs, and pharmaceuticals.

2. Materials and Methods

2.1 Ingredients

Amla seed was obtained from amla fruit from Blang Bintang, Aceh Besar District. Hexane $\geq 96\%$ (Merck KGaA, Darmstadt) was purchased from local distributor.

2.2 Pretreatment Sample

Amla seed was separated from the flesh and shell. Then it dried in the electric oven to reduce the moisture content. The drying temperature was carried out at $50\text{ }^{\circ}\text{C}$ for three days until the amla seeds reached a constant moisture content below 10% . Furthermore, the amla seeds were reduced in size with a food blender to obtain material sizes $\leq 0.25\text{ mm}$ using Tyler sieves.

2.3 Solvent Assisted Extraction

Amla seed powder and solvent were prepared according to the ratio of raw material to solvent (1:30). Then they were put into a three-neck flask on an infrared electric stove. The extractor is equipped with a stirring motor speed of 400 rpm to maximize extraction and a condenser to prevent the solvent from evaporating. The extraction was conducted for 30 and 120 minutes at extraction temperature $60\text{ }^{\circ}\text{C}$. The mixture of extraction product was filtered using filter paper to separate the amla seed powder that has been removed from the fat and miscella. The solvent was separated from the amla seed oil by evaporation using a vacuum evaporator to obtain amla seed oil as final extraction product.

2.4 Analysis of Extracted Amla Seed Oil

The analysis carried out includes analysis in the form of yield. The experiments were repeated twice to ensure yield data reproducibility. The average value for the collected data was used. For the whole experiments, the experimental errors obtained to be less than 5% . These results indicated that the experimental errors among the data were negligible.

Scanning Electron Microscopy (SEM) was used to analyze the morphological characteristics of amla seed powder before and after the extraction process using a TM 3000 (Hitachi) with a magnification of $5000\times$. The functional group content of the sample was analyzed using a Shimadzu Prestige 6400 Fourier Transform Infrared (FTIR) spectrometer.

Phytochemical analysis to determine the levels of phenolic compounds and flavonoids contained in the sample using a UV-Visible Spectrophotometer (Shimadzu 1700). The phenol content was analyzed using a Folin-Ciocalteu reagent with a wavelength of 725 nm . Flavonoid compounds were calibrated against standard quercetin and expressed in mg QE/g (Quercetin) with a wavelength of 435 nm using a UV-Visible Spectrophotometer (Shimadzu 1700). To ensure data reproducibility, the phytochemical analysis in the form

of phenols and flavonoids was carried out three times using the same sample by taking the average value. For the whole experiments, the experimental errors obtained to be less than 5% indicated that the experimental errors among the data were negligible.

3. Results and Discussion

The yield of amla seed oil extract obtained at the extraction time of 30 minutes and 120 minutes was 5.46% and 10.97%, respectively. Figure 1 shows that the extraction time of 120 minutes obtained higher yields than the extraction time of 30 minutes. The longer the extraction time, the greater the opportunity for contact between amla seeds and the solvent so that the solvent takes longer to extract the desired compound which causes the yield. The oil produced is getting bigger until it reaches the optimum point [11].

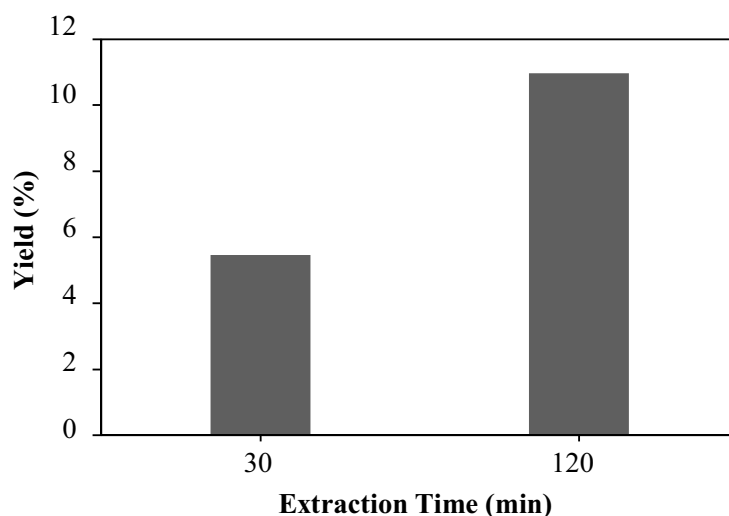
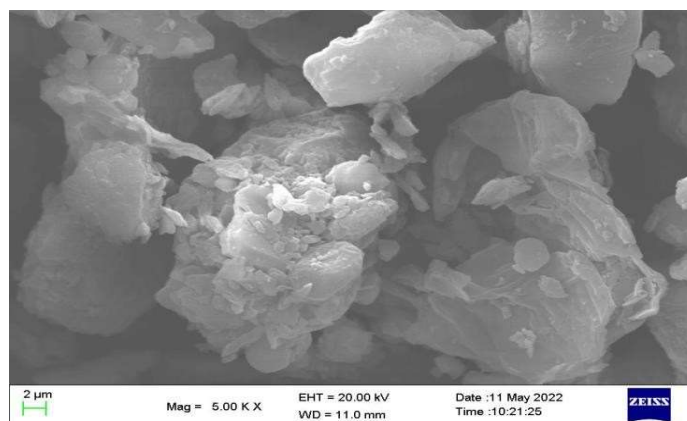


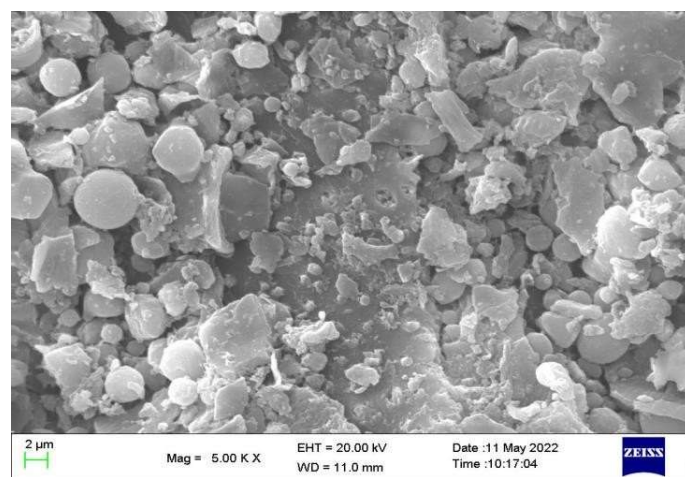
Figure 1. Effect of extraction time on amla seed oil yield

Amla seed oil yield results can also be proven based on surface morphology analysis using SEM (*Scanning Electron Microscope*). Analysis of the morphological structure of amla seed powder at the extraction time of 30 and 120 minutes in Figure 2 shows that the 30-minute extraction treatment still showed a lot of surface structure that is still intact in its original form (Figure 2a). Meanwhile, the extraction time treatment for 120 minutes experienced changes in the surface morphology of the material to be broken to form smaller particles (Figure 2b). The SEM test results show that the extraction time can cause the cell walls to break into tiny particles that greatly facilitate the extraction of raw materials, resulting in higher extraction yields.

The phenol content of amla seed oil obtained at 30 and 120 minutes of extraction was in the range of 30.43 – 61.64 mg GAE/g. Figure 3 shows that the analysis of phenol which has the highest concentration at the extraction time of 120 minutes compared to the extraction time of 30 minutes. This is following the opinion of Wong et al [12] that the time spent in the extraction process will affect the results of the extraction process, where the longer the extraction time, the longer the contact between the raw material and the solvent so that the solvent can absorb more phenolic compounds from the material.



(a)



(b)

Figure 2. Surface morphology of amla seed powder at extraction time: (a) 30 minutes; and (b) 120 minutes.

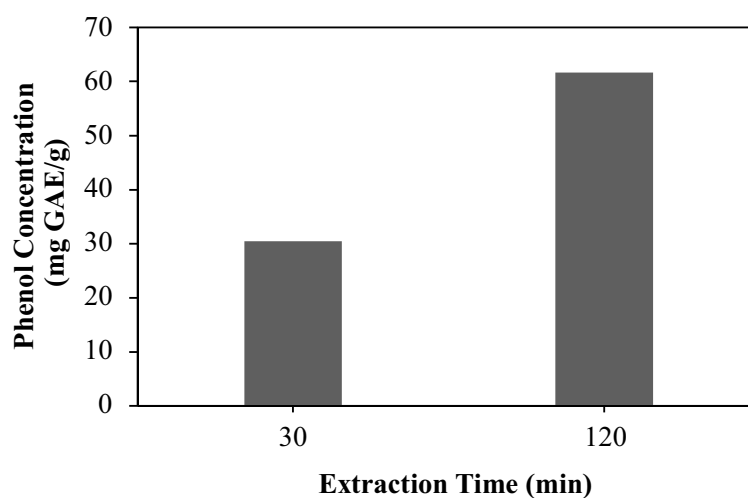


Figure 3. Total phenol compounds of seed oil as function of extraction time.

The flavonoid content of amla seed oil obtained at 30 and 120 minutes was 52.86 – 89.15 mg QE/g. Figure 4 shows that the extraction time of 120 minutes obtained a higher flavonoid concentration than the extraction time of 30 minutes. This is because the opportunity for contact between amla seeds and the solvent will be greater so that the solvent's ability to absorb flavonoids into the material is also optimal until it reaches the saturation point [13].

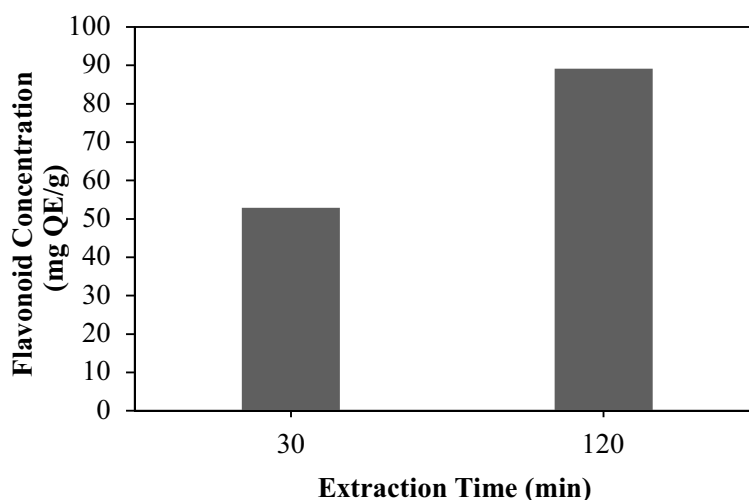


Figure 4. Total flavonoid compounds of seed oil as function of extraction time.

Figure 5 shows the FTIR results of amla seed oil. The oil produced with variations in extraction time has the same functional group content. The extraction time has no influence on the functional group content. Functional groups of amla seed oil showed the presence of hydroxyl group (O–H) at wave number 2700–3200 cm^{-1} , the presence of ketone group (C=O) at wavenumber 1600–1690 cm^{-1} , and the presence of ether group (C–O) the wave number 1400–1500 cm^{-1} . The existence of O–H, C=O and C–O groups indicated that the presence of polyphenol, ascorbic acid and flavonoid are contained in amla seed oil (Dinesh et al. [3]).

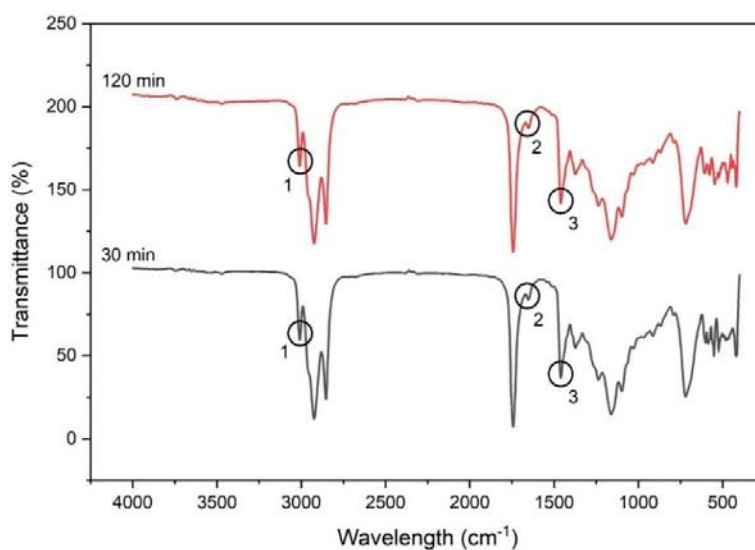


Figure 5. FTIR spectrum analysis with different extraction times.

4. Conclusion

The yield of oil and the content of phenol and flavonoid compounds were influenced by the extraction time. Extraction time of 120 minutes has a higher yield compared to 30 minutes. The highest content of phenolics and flavonoids compounds was obtained at the extraction time of 120 minutes. FTIR analysis with different extraction times showed the same functional groups in the form of hydroxyl groups (O–H), ketone groups (C=O), and ether groups (C–O) which indicated the presence of polyphenolic compounds, ascorbic acid, and flavonoids in amla seed oil. Surface morphology analysis showed that the amla seeds have more broke cell walls with increasing extraction time.

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