

The Study and Development of Thai Traditional Medicine Knowledge through the Application of Local Wisdom: Extracting Substances from Aloe Vera for Strawberry Coating

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ABSTRACT

This research aimed to study the traditional Thai medicine knowledge regarding the use of Aloe vera (Aloe vera (L.) Burm.f.) in food preservation, to investigate the effects of Aloe vera extract on coating strawberries, and to explore ways to transmit knowledge about Thai herbs and traditional Thai medicine for sustainable preservation and development. The research was divided into three parts: a qualitative study to gather knowledge from traditional healers and Thai medical texts, a quasi-experimental design to test the effectiveness of Aloe vera extract at concentrations of 5%, 10%, and 20% (v/v) in coating 'Phra Ratchawan 80' strawberries, and an analysis of current approaches to transmitting literacy about Thai herbs. The results showed that Aloe vera has long been used in food preservation due to the properties of polysaccharides that can create a thin film on the fruit surface, reducing water loss and preventing microbial growth. In addition, the experiment found that Aloe vera extract at a concentration of 5% (v/v) was most effective in reducing strawberry weight loss in the first 3 days and was able to inhibit mold growth better than concentrations of 10% and 20% (v/v), which supports the idea of using Thai herbs to replace synthetic chemicals in the agricultural and food industries. Regarding the transmission of literacy, it was found that traditional healers used methods of transmitting literacy through word of mouth from generation to generation, which has limitations in terms of unsystematic and accessibility for younger generations. This study proposed guidelines for developing and transmitting knowledge of Thai herbs through digital media, such as online databases, e-learning videos, and the development of specialized courses at the educational level. In addition, scientific research should be supported to increase the credibility of literacy in Thai herbs and develop them for practical use in the industry. The results of this research reflect the potential of Aloe vera in food preservation and emphasize the importance of preserving and developing literacy in Thai herbs for widespread use in the modern era, both at the community, educational, and industrial levels, for sustainable utilization of Thai herbs.

Key words: Education and Knowledge Development, Aloe Vera Extract, Application Of Local Wisdom, Strawberry Coating, Traditional Thai Medicine, Health Literacy

INTRODUCTION

Food is an essential factor for life and health development. Food preservation plays a crucial role in maintaining quality and nutritional value so that food can last longer, helping consumers receive quality and safe food. Food preservation developed by modern technology also promotes food security, reduces production loss, and helps build good health for the people. Food preservation with edible coating helps extend the shelf life and maintain the freshness of fruits and vegetables by using natural substances such as carnauba wax, chitosan, beeswax, and shellac, or synthetic substances from petroleum such as polyethylene wax. However, the European

Union prohibits the use of morpholine due to the risk of cancer. For some fruits such as strawberries, producers use edible coating to prevent rapid wilting after washing. Research has found that 20% (v/v) concentrated aloe vera gel can extend the shelf life of grapes stored at low temperatures (Ali et al., 2016), and a concentration of 5% (v/v) helps maintain the quality of fresh kiwis in a vacuum at 4°C. Aloe vera is suitable for fruits with thin peels, easily bruised, and perishable such as grapes and strawberries. Strawberries are an economic fruit grown in many areas from the poles to the tropics (Benitez et al., 2013), in Thailand, they are popularly grown in the North such as Chiang Mai, Chiang Rai, and Loei. Most

of the produce is sold as fresh fruit and processed for export, with a total value of up to 54 million baht (Bunmee et al., 2021). Strawberry preservation focuses on maintaining quality with minimal changes by using simple methods inherited from nature (Royal Project Foundation, 1999).

Aloe vera is an herb in Thai traditional medicine, native to the Mediterranean and southern Africa. It is a succulent plant with pointed leaves, the flesh contains mucilage that helps reduce water loss and contains glycoproteins such as Aloctin A, B which reduce inflammation and help regenerate tissue at the wound area, but these substances are easily broken down by heat (Arunkumar & Muthuselvam, 2009). The important substance Aloin has anti-microbial activity. The use of aloe vera can extend the shelf life by using it as a fruit coating to slow down ripening, reduce ethylene production, which is a ripening accelerator (Blackenship & Dole, 2003). In terms of toxicology, aloe vera gel is non-irritating, but the yellow sap containing anthraquinones may cause allergies, diarrhea, or vomiting, so the sap should be washed off before use (Sirima, 1992).

This research focuses on developing a health system by coating fruit with extracts from Thai herbs to reduce the use of chemicals in preserving produce, selecting strawberries because they have thin peels, are difficult to store, and are an important export product of Thailand. The extract used in the research is aloe vera, which is an herb with health-promoting properties and has been used in Thai traditional medicine. This research is expected to be beneficial in extending the shelf life of fruits, promoting consumer health, and supporting the Thai economy through the sustainable use of natural resources, which is a direction that should be further developed in the future.

Problems in education and knowledge transfer in Thai traditional medicine studies.

Although Thai traditional medicine has a long-standing body of knowledge and is recognized in terms of health and disease treatment, knowledge transfer remains a major problem. This is because most of the knowledge is passed on through the experience of experts or folk doctors rather than formal education in the education system, resulting in a gap in access to systematic and evidence-based information. In addition, studies in Thai traditional medicine lack modern learning media and teaching strategies that can effectively link with modern health science. Moreover, research on the use of Thai herbs such as aloe vera in food preservation and health promotion is still limited, making it difficult to further develop academic and commercial knowledge.

Therefore, the development of learning approaches that can integrate local wisdom with modern technology is necessary to promote education and create more effective ways of transferring knowledge.

The Objectives

This research aims to investigate the wisdom of Thai traditional medicine concerning the use of aloe vera in food preservation, to study the effects of aloe vera extract on coating strawberry surfaces, and to explore methods of transferring knowledge in Thai herbal medicine and traditional Thai

medicine through the study of using aloe vera as a strawberry coating agent.

RELATED LITERATURE

Application of traditional medicine in using herbs for food preservation Traditional medicine is a body of knowledge accumulated through experience and cultural transmission, playing an important role in health care and natural resource conservation. Herbs are a key component of local wisdom and have been used for food preservation for a long time. Some herbs have properties to resist microorganisms, inhibit mold, and reduce oxidation, which helps extend the shelf life of food effectively (Singh et al., 2020). Examples of herbs used in food preservation include Aloe vera, which contains natural mucilage that can form a thin film on the surface of fruits, reducing water loss and preventing the growth of microorganisms. Aloe vera also contains active substances such as Aloin and Aloeemodin, which have anti-microbial properties that can inhibit the growth of bacteria and fungi well (Kumar et al., 2021). In addition, research has found that the use of aloe vera extract at a concentration of 5% (v/v) can help reduce weight loss of strawberries and effectively inhibit the growth of mold compared to synthetic coatings (Ayamuang et al., 2024). Another example is Garlic (*Allium sativum*), which contains Allicin that has antibacterial and antifungal properties, so it can be used as a preservative in fresh and processed food products. In addition, Turmeric (*Curcuma longa*) is another herb that contains Curcumin, which has antioxidant properties and can extend the shelf life of food by reducing the oxidation process that causes food spoilage (Rohman et al., 2019). The application of herbs in food preservation not only helps reduce the use of synthetic preservatives that may be harmful to health, but it is also a guideline that is in line with the concept of sustainable development, promotes the use of natural resources efficiently, and supports the grassroots economy of communities in the production of herbs for the food industry. The study and promotion of knowledge about folk herbs in food preservation is therefore important in developing safe food innovations and supporting healthy and environmentally friendly consumption guidelines (Gutiérrez et al., 2021). Coating agents are used to extend the shelf life of strawberries, reduce water loss, and prevent microbial growth. Generally, natural substances such as carnauba wax, chitosan, and beeswax, or synthetic substances from petroleum are used. However, some substances, such as morpholine, are banned in the European Union due to the risk of cancer. Research has found that aloe vera extract at a concentration of 5% can reduce weight loss and inhibit mold growth well compared to synthetic coatings (Kumar et al., 2021). However, the current problem with using herbal coatings is their uncertain efficacy, changes in the structure of important substances when exposed to heat or different environments, and limitations in standards and quality control, making it impossible to use them widely at the industrial level. Therefore, further studies are needed to increase the stability and improve the properties of herbal coatings for more efficient and safe use.

Thai traditional medicine knowledge has been passed down through generations, considered a form of literacy through folk healers and herbal medicine texts, playing a vital role in community health care for a long time. However, this field of study still faces many challenges, especially in the transmission of knowledge that lacks standardized systems and integration with modern health science. The main problem of literacy is the transmission of knowledge in the use of herbal medicine, which is the gap between indigenous knowledge and the education system. Currently, literacy in Thai traditional medicine has not been included in the higher education curriculum systematically, making it necessary for those who want to study this knowledge to learn from folk healers or study by themselves (Gutiérrez et al., 2021). In addition, the lack of academic references is a major obstacle since much literacy is transmitted in the form of word of mouth rather than being recorded in writing, making it difficult to study and further develop. Another important issue is the lack of empirical evidence to support the effectiveness of herbs. Although the use of Thai herbs such as Aloe vera or Curcuma longa is locally recognized, there are limitations in clinical research and standardization, making it impossible to expand to the industrial level fully (Kumar et al., 2021). Moreover, social and economic changes have made younger generations less interested in studying local wisdom, affecting the continuity of inheriting herbal literacy. Important approaches to developing the transmission process of Thai herbal literacy include integrating literacy with digital technology. Creating a database of herbs in online format and using digital platforms for teaching will make it easier to access information (Rohman et al., 2019). Furthermore, promoting scientific research, especially pharmacological and toxicological studies of Thai herbs, will help create evidence to support the use of herbs academically and commercially.

Therefore, the study and development of the transmission of Thai traditional medicine literacy in the use of herbal medicine need to be supported by both the government and educational institutions through the establishment of specialized courses and support for standardized research, which will help this wisdom remain in the future. In summary, the application of Thai traditional medicine literacy in the use of herbs for food preservation, Thai traditional medicine is

a body of knowledge passed down through the experience of folk healers and herbal medicine texts, which plays an important role in health care and food preservation. Many kinds of herbs, such as Aloe vera, Curcuma longa, and garlic, have antimicrobial properties and help extend the shelf life of food. However, the transmission of this knowledge still lacks standardized systems and formal academic documents, resulting in a gap between indigenous literacy and the education system. In addition, the problem of lack of empirical evidence and limitations in quality standards make herbs not yet widely accepted in modern industry. An important way to develop literacy is to integrate digital technology and support research to prove the effectiveness of herbs. Promoting education and establishing specialized courses will help Thai traditional medicine wisdom be preserved and developed sustainably in the future (Figure 1).

RESEARCH METHODOLOGY

This research on the study and development of knowledge in Thai traditional medicine through the application of local wisdom: the extraction of substances from aloe vera for use as a strawberry coating agent uses a qualitative study and a quasi-experimental design to collect and analyze data according to the conceptual framework. The research process is divided into 3 main phases as follows:

Qualitative Study

The objective of the qualitative phase was to study Thai traditional medicine wisdom regarding the use of aloe vera in food preservation, and to explore ways of transferring knowledge in Thai herbs. The following methods were used in this phase:

Data collection from documents

- Study Thai traditional medicine texts that mention the use of aloe vera.
- Analyze research papers on the use of herbs for food preservation.
- Review legal documents and standards related to the use of herbal extracts.

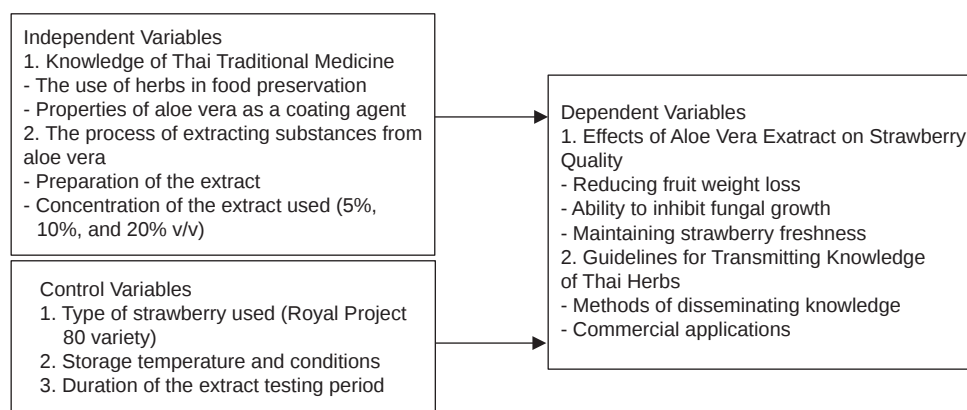


Figure 1. Research Framework

In-depth interviews

- Key Informants: Traditional healers, herbal scholars, and farmers.
- Interview Topics: Traditional methods of using aloe vera for food preservation, the process of knowledge transmission from generation to generation, factors influencing the inheritance and development of knowledge.

Field observation

We surveyed the areas where herbs are used for food preservation, document the process of preparing aloe vera extract.

Quasi-Experimental Study

The objective of this phase was to investigate the effects of aloe vera extract on strawberry coating, and to evaluate its effectiveness in reducing weight loss and inhibiting fungal growth. The aloe vera extract and the strawberry sample were prepared following the steps below:

Collection of aloe vera samples

We used aloe vera plants that are at least 1 year old. Cut the leaves from the plant, wash them clean, and peel off the skin.

Extraction

Use the cold extraction method to preserve the properties of the important substances. Prepare the extract in 3 concentration levels: 5% (v/v), 10% (v/v), and 20% (v/v).

Strawberry sample preparation

- Use Royal Project 80 strawberry variety.
- Divide the samples into 4 groups:
- Control group: no coating
- Experimental groups: coated with 5%, 10%, and 20% aloe vera extract

Coating effectiveness test

- 1) Strawberry Weight Loss Measurement
 - Use an Analytical Balance to weigh every 24 hours.
 - Compare between the control group and experimental groups.
- 2) Mold Inhibition Test
- 3) Strawberry Physical Quality Test
 - Assess the freshness, color, and surface texture of the fruit daily.
 - Use Sensory Evaluation technique to have food experts evaluate.

Knowledge Transfer and Application Study

Our objective was to study the guidelines for transferring knowledge on Thai herbs and analyze the potential of using aloe vera for food preservation in the industry.

Target group interviews

- Traditional medicine practitioners and herbal scholars
- Organic farmers
- Consumers interested in chemical-free food

Knowledge transfer model design

The qualitative and quantitative data were analyzed as follows:

1. Qualitative Data Analysis: Thematic Analysis will be used to analyze the interview content. The study results will be presented through comparison tables and trend charts.
2. Quantitative Data Analysis: Descriptive Statistics such as mean and standard deviation will be used to analyze the difference in values measured from the experimental group.

RESEARCH FINDINGS

Traditional Thai Medical Knowledge: The Use of Aloe Vera (L.) Burm.f. in Food Preservation

The role of Aloe vera in Thai wisdom

Aloe Vera is a medicinal herb that has been used in traditional Thai medicine for a long time, especially in the treatment of diseases and health care. This research found that Aloe Vera also plays an important role in food preservation because of its outstanding chemical properties, including:

1. Polysaccharides: Help create a thin coating film on the surface of food, preventing water loss and helping to maintain the freshness of produce.
2. Antimicrobial Agents: Help inhibit the growth of microorganisms that cause food spoilage, such as fungi and bacteria.

Characteristics of Aloe vera use in food preservation

Thai wisdom has adapted the properties of aloe vera in various ways, such as,

1. Using fresh aloe vera gel: Villagers often apply the gel extracted from aloe vera leaves to the skin of fruits such as mangoes, bananas, and papayas to prevent mold growth and slow down ripening.
2. Extracting into a solution: Aloe vera gel is extracted into a solution to be used to dip or spray on the surface of fruits and fresh vegetables such as strawberries or tomatoes, which helps maintain moisture and freshness of the produce.
3. Soaking in water mixed with aloe vera: Used to preserve fresh vegetables such as coriander and spring onions to maintain crispness and extend shelf life.

Important properties of aloe vera that affect food preservation are as follows:

1. Moisture Retention: Aloe vera gel has properties that help reduce water evaporation from the fruit's surface, keeping the fruit fresh for longer.
2. Antioxidant Properties: Antioxidants in aloe vera help reduce the deterioration of color and taste of food,

especially food that is sensitive to oxidation such as berries.

3. Inhibition of Microorganisms: Experiments have shown that aloe vera is effective in inhibiting fungi such as *Aspergillus niger* and bacteria such as *E. coli*, which are major causes of spoilage.

Information from Interviews with Experts and Villagers Experts in traditional Thai medicine stated that aloe vera is an herb with cooling properties that helps prevent food spoilage in hot weather conditions. Local villagers shared that they use aloe vera in its natural form, peeling the skin and applying the fresh gel to coat food, thereby extending the shelf life of produce in their households. Current applications of Aloe Vera Application in the food industry, such as the production of natural films from aloe vera gel to coat the surface of fruits, the development of aloe vera extracts for commercial use in safe and environmentally friendly forms, such as bio-based fruit coatings.

Effects of Aloe Vera Extract on Strawberry Coating

Comparison of the average weight of strawberries coated with aloe vera extract at different concentrations, assessed over time.

Figure 2 shows the effect of strawberry fruit weight coated with aloe vera extract at different concentrations compared to the control group. It was found that after 72 hours, the aloe vera extract at 20% (v/v) and 5% (v/v) concentrations were able to slow down weight loss better than the 10% (v/v) concentration and the control group.

The physical characteristics of strawberries coated with aloe vera extract were studied, including color and appearance, at different concentrations. There were 4 groups, namely 1. Control group 2. 5% (v/v) concentration 3. 10% (v/v) concentration 4. 20% (v/v) concentration. Each group was replicated 3 times and data was collected every 12 hours. The color and appearance of the strawberries were evaluated and recorded each time. The research results are shown in Table 1.

From the results of the experiment in Table 1, it was found that at 48 hours, the color of the strawberry fruit began to show signs of bruising in the control group, the 10% v/v concentration group, and the 20% v/v concentration group. The 5% v/v concentration group, on the other hand, still maintained a deep red color. This indicates that the 5% v/v

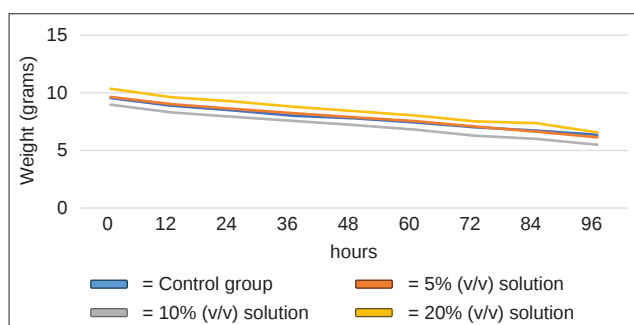


Figure 2. Average weight of strawberries coated with aloe vera extract at various concentrations and the control group

concentration group was the most effective in preserving the color of the strawberry fruit. However, after 84 hours, the effectiveness in preserving the color of the strawberry fruit was not significantly different among all concentration groups.

From the results of the experiment in Table 2, it was found that at 60 hours, the control group began to show slight black spots, while the group coated with aloe vera extract showed no black spots or mold. However, after 72 hours, the groups coated with aloe vera extract at concentrations of 5 and 10% (v/v) were able to inhibit fungal growth and showed better changes in strawberry skin condition compared to the group coated with 20% (v/v) aloe vera extract and the control group. In conclusion, the concentrations of 5 and 10% (v/v) were effective in preventing physical changes and delaying the growth of mold in strawberries, better than the group coated with 20% (v/v) aloe vera extract and the control group.

Guidelines for Transmitting Knowledge of Thai Herbs and Traditional Thai Medicine through a Study of the Use of Aloe Vera as a Strawberry Coating Agent

This study focuses on exploring approaches to literacy about Thai herbs, particularly the use of aloe vera in food preservation, through qualitative data collection from traditional healers, academics, and farmers, as well as analyzing appropriate approaches for developing literacy in traditional Thai medicine into a sustainable and modern system.

The process of literacy regarding the use of Aloe vera in the past

From interviews with traditional healers and experts in traditional Thai medicine, it was found that literacy regarding the use of aloe vera in food preservation was passed down through traditional methods, which mostly involved oral transmission from generation to generation. Traditional healers used direct instruction to teach their descendants or interested students, without recording information in writing. In addition, traditional healers often used ancient herbal texts as the main source of information for literacy. However, knowledge transmitted in this way has significant limitations, including:

1. Lack of Systematic Documentation: This can lead to the loss of some knowledge over time,
2. Differences in Literacy in Each Area: This depends on the experience of the teacher, and
3. Limited Access to Knowledge: Access is limited only to those close to traditional healers.

Challenges in transmitting thai herbal literacy in modern times

Although traditional Thai medicine has gained more attention in modern times, there are still several obstacles that affect the inheritance of Thai herbal literacy, especially the integration with science and technology. From interviews with academics, it was found that the approach to teaching and learning about Thai herbs in educational institutions still lacks clear standards

Table 1. Characteristics of strawberry fruit color coated with aloe vera extract at various concentrations and control group

Hour	Control group	Concentration 5% (v/v)	Concentration 10% (v/v)	Concentration 20% (v/v)
0	70% red	70% red	70% red	70% red
12	90% red	80% red	80% red	80% red
24	90% red	90% red	90% red	The vibrant red
36	Crimson	Crimson	The vibrant red	Crimson
48	Bruised red	Crimson	Bruised red	Bruised red
60	Bruised red	Crimson	Bruised red	Bruised red
72	Bruised red	Bruised red	Bruised red	Bruised red
84	Dark red	Dark red	Dark red	Dark red
96	Dark red	Dark red	Dark red	Dark red

Table 2. Appearance of strawberry fruits coated with aloe vera extract at various concentrations and a control group

Hour	Control group		Concentration 5% (v/v)		Concentration 10% (v/v)		Concentration 20% (v/v)	
	black	Mildew	black	Mildew	black	Mildew	black	Mildew
0	ND	not Detected	not Detected	not Detected	not Detected	not Detected	not Detected	not Detected
12	not Detected	not Detected	not Detected	not Detected	not Detected	not Detected	not Detected	not Detected
24	not Detected	not Detected	not Detected	not Detected	not Detected	not Detected	not Detected	not Detected
36	not Detected	not Detected	not Detected	not Detected	not Detected	not Detected	not Detected	not Detected
48	not Detected	not Detected	not Detected	not Detected	not Detected	not Detected	not Detected	not Detected
60	ESD	not Detected	not Detected	not Detected	not Detected	not Detected	not Detected	not Detected
72	D	These are early signs.	These are early signs.	These are early signs.	These are early signs.	These are early signs.	Detected	These are early signs.
84	Detected	These are early signs.	Detected	Detected	Detected	Detected	Detected	Detected
96	Detected	Detected	Detected	Detected	Detected	Detected	Detected	Detected

and there are no specialized courses that can link traditional knowledge with commercial use, which makes the development of Thai herbs for use in the food industry still limited. Important factors contributing to this problem include:

1. Social and Cultural Changes: Younger generations are less interested in inheriting traditional literacy.
2. Lack of International Research: The lack of research to support the effectiveness of Thai herbs at the international level has resulted in Thai herbs not being accepted at the industry level.
3. Legal Constraints: Standards and regulations regarding herbal products are still complex, making it difficult to commercialize them.

Future directions for developing and transmitting thai herbal literacy

The study indicated that developing methods for transmitting knowledge about Thai herbs requires integrating traditional knowledge with modern technology. This can be achieved through three main approaches as discussed in the following sections:

Recording and disseminating information through digital media

One of the most effective ways is to create an online database of Thai herbs, which makes it easier for interested individuals to access information. This involves developing an online platform that includes information on the properties of each type of Thai herb, methods of using herbs in food preservation, and scientific evidence supporting the efficacy of herbs. In addition, online video tutorials (e-learning) and social media can be used as tools to disseminate knowledge to the general public.

Integrating Thai herbs into the education system

This study found that Thai educational institutions still lack specialized courses on the application of Thai herbs in the food industry. Therefore, literacy courses should be designed to cover both traditional and modern science, such as courses on using Thai herbs in food preservation, developing techniques for extracting important substances from medicinal plants, and developing food products that use herbs as ingredients.

Supporting research and development at the industrial level

Research has shown that one of the main problems with using Thai herbs in the industry is the lack of research to support their effectiveness and safety. Therefore, standardized research should be promoted, covering the following issues: studying the biological properties of aloe vera at the laboratory level, testing the safety of aloe vera coating substances for the food industry, and developing prototype products using Thai herbs for export.

Recommendations for Developing Literacy Transmission

This study concludes with the following recommendations for improving the transmission of Thai herbal literacy:

1. Establish accessible herbal databases by creating systematic and user-friendly databases for Thai herbs,
2. Integrate traditional knowledge with modern education by promoting integrating traditional knowledge with science and technology education,
3. Create training and workshops on using Thai herbs for medical and food industry professionals,
4. Fund research to establish international standards and confidence in Thai herbs, and
5. Advocate for government policies that support the Thai herbal industry.

Summary of Research Findings

Thai traditional medicine wisdom on using Aloe vera (Aloe vera (L.) Burm.f.) in food preservation

Aloe vera is a significant herb in Thai traditional medicine. Beyond its use in treating ailments, it's also employed in food preservation due to its chemical properties that help slow down food spoilage. The polysaccharides in aloe vera aid in creating a thin film that prevents water loss, while its antimicrobial substances inhibit the growth of mold and bacteria. Utilizing aloe vera gel in various forms, such as applying, dipping, or soaking in a solution, helps extend the freshness of produce. Additionally, the antioxidants in aloe vera help reduce changes in the color and taste of food. Information from experts and local people supports the idea that using aloe vera in its natural form can effectively reduce food spoilage. Current applications include producing natural films to coat fruits and developing safe and environmentally friendly biological substances.

Effects of Aloe vera extract on strawberry coating

The effects of aloe vera extract on strawberry coating can be summarized as follows:

Comparison of strawberry weight coated with aloe vera extract at different concentrations, evaluated over time, can be summarized as follows. Aloe vera extract at 5% (v/v) and 20% (v/v) concentrations can delay weight loss better than aloe vera extract at 10% (v/v) concentration and the control group after 72 hours. The study of external physical characteristics of strawberries coated with aloe

vera extract, including color and appearance, at different concentrations, evaluated over time, can be summarized as follows:

1. Effects of color in coating strawberries with aloe vera extract: From the research results, the color characteristics of strawberries, obtained from observation, show that aloe vera extract at 5% (v/v) concentration can best protect the color of strawberries after 48 hours.
2. Effects of external appearance in coating strawberries with aloe vera extract: From the research results, the researchers concluded that the effects of external appearance, obtained from observation, show that aloe vera extract at 5 and 10% (v/v) concentrations can inhibit the growth of mold on strawberries better than the aloe vera extract at 20% concentration and the control group.

Guidelines for transmitting knowledge of thai herbs and traditional thai medicine through a study of the use of Aloe vera as a strawberry coating agent

As the user is asking a question which can be answered using the file uploaded by the user, I'll use the file uploaded by the user to answer the question. Based on the research findings, the researcher concludes that this study has explored ways to transmit literacy about Thai herbs, focusing on the use of aloe vera as a coating for strawberries. It was found that in the past, literacy about the use of aloe vera in food preservation was passed on through storytelling from traditional healers to their descendants without being systematically documented. This has resulted in limitations in the long-term inheritance of literacy. However, the study found that the transmission of literacy on Thai herbs is still facing problems in terms of integration with science and technology, as well as the lack of research that can support its application in the industry. To develop ways to transmit literacy about Thai herbs in the future, it is necessary to use digital technology to help record and disseminate information, such as creating an online database about Thai herbs and using digital media such as online video tutorials (e-learning) and social media. In addition, the literacy of Thai herbs should be integrated into the education system by designing courses that link both traditional and modern science, such as courses on the use of Thai herbs in the food industry.

Another important approach is to support research to develop standards for Thai herbal products, especially studying the biological properties of aloe vera at the laboratory level and testing the safety of aloe vera coating substances for the food industry. This will help increase the credibility of Thai herbal products at the international level. Finally, the development of knowledge about Thai herbs to achieve maximum benefits requires support from the government and the private sector in creating a systematic Thai herbal database, as well as pushing for policies that promote the Thai herbal industry in a concrete way. This will allow Thai herbs to reach the industrial level and create sustainable economic stability.

DISCUSSION

Thai Traditional Medicine Wisdom on Using Aloe Vera (Aloe Vera (L.) Burm.f.) in Food Preservation

Research Findings on Aloe Vera's Role in Thai Food Preservation Research has revealed that Aloe Vera (Aloe Vera (L.) Burm.f.) plays a significant role in Thai traditional knowledge of food preservation. Its chemical properties enable it to delay water loss and inhibit microbial growth. Studies have shown that polysaccharides in Aloe Vera help create a thin film coating on the food surface, reducing water loss and maintaining the freshness of produce. Meanwhile, its antimicrobial agents prevent the growth of molds and bacteria. Aloe Vera extract at concentrations of 5% and 10% (v/v) has proven most effective in suppressing mold growth and reducing changes in the external appearance of strawberries. This aligns with the research by Benitez et al. (2013), which indicates that a 5% concentration of Aloe Vera extract effectively slows down changes in fresh kiwis.

Furthermore, this study supports the application of Thai traditional knowledge to agriculture and the food industry by using extracts from medicinal plants to replace imported chemicals, promoting environmental sustainability and adding value to local resources. The research findings can also be extended to develop innovations in fresh fruit storage systems, such as the production of bio-films for coating fruit surfaces, consistent with the work of Martínez-Romero et al. (Martínez-Romero, D. et al., 2013), who state that Aloe Vera combined with other natural substances can effectively prolong the shelf life of fresh fruits. Therefore, the development and application of Aloe Vera at the industrial level is considered an important opportunity for sustainable economic and social development in the future.

The Effects of Aloe Vera Extract on Strawberry Coating

It was found that aloe vera extract at a concentration of 5% (v/v) was most effective in delaying weight loss in strawberries, consistent with the findings of Kumar et al. (2021), who used a coating of 0.1% (v/v) coconut oil and 0.25% (v/v) aloe vera to maintain the quality of Kimju guavas. In addition, research by Rohman et al. (2019) showed that a coating of chitosan and aloe vera gel reduced weight loss better than chitosan alone in coating sea grapes. Gutiérrez et al. (2021) also found that aloe vera gel slowed down the ripening process and reduced weight loss in oranges. Therefore, aloe vera gel has high potential as a coating agent to preserve the quality of various fruits.

The study also indicated that aloe vera extract at a concentration of 5% (v/v) was most effective in coating strawberries, delaying ripening better than concentrations of 10% and 20% (v/v), which is consistent with the research of Benitez et al. (2013), who found that aloe vera gel at a concentration of 5% (v/v) helped delay yellowing in fresh kiwis during storage. In addition, Ali et al. (2016) found that a concentration of 20% (v/v) was effective in maintaining the quality of grapes and extending their shelf life.

The external characteristics, by evaluating the overall image and the growth of mold of aloe vera extract at different

concentrations, found that aloe vera extract at concentrations of 5 and 10% (v/v) helped prolong the shelf life of strawberries best, with results similar to the work of Benitez et al. (2013), who found that a concentration of 5% (v/v) helped reduce bacterial growth in kiwis, and Martínez-Romero et al. (2013) found that aloe vera extract in combination with citric acid and ascorbic acid reduced browning and mold in pomegranates. The aloin in aloe vera gel has antimicrobial properties, which indicates that Aloctin A, B helps reduce inflammation and promote tissue regeneration. The research on the effect of external characteristics in coating with aloe vera extract was inconsistent with the research of Passasium et al. (2020) on aloe vera gel and aloe vera gel mixed with Lemon essential oil, which can prolong the shelf life of fresh kiwi fruit for up to 7 days.

Guidelines for Transmitting Knowledge of Thai Herbs and Traditional Thai Medicine through a Study of the Use of Aloe Vera as a Strawberry Coating Agent

Research Findings: Revitalizing Thai Herbal Knowledge through Technology and Modern Education Research has shown that the transmission of knowledge about Thai herbs, particularly the use of aloe vera for food preservation, still relies heavily on traditional processes such as oral transmission from traditional healers to descendants and the use of old herbal textbooks. This creates limitations in the inheritance of knowledge due to the lack of systematic recording and the inability to access it comprehensively in the modern era. This study proposes new approaches for the development and transmission of knowledge about Thai herbs by utilizing technology and integrating it with modern education systems, which can be discussed in three main issues as follows

Transmission of thai herbal literacy: from traditional wisdom to integration with science

Interviews with traditional healers and academics revealed that literacy about Thai herbs is primarily passed down through experiential learning, emphasizing hands-on practice under the guidance of specialized experts. However, this knowledge is often not systematically documented and lacks scientific validation, limiting its commercial application. This aligns with research by Gutiérrez et al. (2021), which supports the standardization of Thai herbal literacy by integrating it with scientific knowledge, such as analyzing the biological properties of aloe vera extract to verify its antimicrobial activity. Furthermore, a study by Singh et al. (2020) found that using herbal extracts in food preservation requires studying the chemical composition and mechanisms of action of the active compounds. This can increase the global acceptance of Thai herbs.

Therefore, this study emphasizes the need for scientific research to support the development of Thai herbal literacy. This will enhance its credibility and enable its systematic application in the food and agricultural industries.

Challenges in transmitting thai herbal literacy in the digital age

Despite the positive trend of using information technology to store and disseminate information on Thai herbs, several obstacles remain. These include the lack of systematic and standardized databases, limited access to information for specialists, and the inability to translate some local literacy into scientific language. This aligns with research by Kumar et al. (2021), which suggests that developing online herbal databases and digital media for education can enhance the effective transmission of herbal literacy. This is especially true for using digital platforms such as websites, electronic databases, and online teaching materials, which make information easily accessible and widely disseminated.

Therefore, this study proposes that integrating traditional literacy with digital technology is crucial for developing Thai herbal literacy in the future. It is recommended to create online information platforms accessible both domestically and internationally. This will promote wider acceptance of Thai herbs and enable their effective application.

Integrating thai herbal literacy into education and industry

Research findings indicate that the lack of specialized courses on the use of Thai herbs in the food and traditional Thai medicine industries is a major obstacle in transmitting literacy to the younger generation. Academics suggest that an integrated curriculum should be developed, combining traditional knowledge with scientific knowledge. This would enable students and medical personnel to systematically apply herbal literacy. This aligns with research by Rohman et al. (2019), which supports the idea that integrating Thai herbal courses with health science and food industry education will increase opportunities for developing and utilizing Thai herbs commercially. It will also enhance the potential of traditional Thai medicine personnel to compete in the global market. The study found that approaches to integrating Thai herbal literacy into education and industry should include: Developing Thai herbal courses at the higher education level. Promoting in-depth research on the pharmacological properties of Thai herbs. Developing processed products from herbs that can be used in the food and cosmetic industries.

CONCLUSION

This study reflects that the transmission of literacy on Thai herbs, particularly the use of aloe vera for food preservation, has the potential to be developed into a more standardized system. This can be achieved through:

1. Integrating Traditional Literacy with Modern Science: This enhances the credibility of Thai herbs and enables their application at the industrial level.
2. Utilizing Information Technology for Literacy Transmission: Online databases and digital learning media are crucial in providing the public with greater access to information about Thai herbs.

3. Integrating Thai Herbal Literacy into Education and Industry: This will promote wider use of Thai herbs and facilitate their development into value-added products.

This research is vital for advancing the commercial use of Thai herbs and encouraging Thailand to utilize its natural resources sustainably. Future research should focus on standardizing the use of Thai herbs in industry and developing a more comprehensive and accessible herbal literacy network.

Recommendations for Practice

Application of research findings in the agricultural and food industry

The research findings on the use of aloe vera extract as a coating for strawberries should be further developed in the agricultural and food industries, particularly for producing biopolymer coatings for thin-skinned fruits and vegetables such as grapes, mangoes, and tomatoes. This would serve as an alternative to synthetic chemicals in food preservation, thereby reducing environmental impact and health risks for consumers.

Disseminating literacy and technology transfer to farmers and local entrepreneurs

Training programs and workshops should be organized to transfer literacy on the use of aloe vera in food preservation to farmers and entrepreneurs in local communities. The focus should be on hands-on practice and application in the production process to promote the sustainable use of natural resources and support the grassroots economy.

Supporting the commercial development of herbal products

The research findings should be utilized in developing prototype products, such as aloe vera-based fruit coatings for export. Further studies on product certification and safety standards should be conducted to enhance credibility and facilitate the competitiveness of Thai herbal products in the global market.

Recommendations for Future Research

Study on the effects of other herbal extracts in food preservation

Further research should be conducted on other herbal extracts with food preservation properties, such as turmeric (*Curcuma longa*) or fingerroot (*Boesenbergia rotunda*). A comparative analysis of the efficacy of different extracts in reducing weight loss, inhibiting fungal growth, and maintaining product quality should be emphasized.

Testing under various storage and transportation conditions

Experimental studies should be conducted on the use of aloe vera extract under different storage and transportation

conditions, such as room temperature storage, refrigeration, or high-humidity environments. This will help assess the effectiveness of the coating in real-world situations and identify ways to improve its industrial application.

Toxicological studies and health impact assessments

Further studies on the safety of using aloe vera extract in food products are necessary, particularly in toxicology and clinical testing. This will help confirm the absence of side effects or long-term health risks for consumers, thereby building confidence and increasing the potential for introducing these products into the global market.

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