



Proceeding **CreTech**²⁰¹⁷

International Conference on Creative Technology

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5th International Conference on Creative Technology

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It is a great pleasure and an honor to extend you a warm invitation to attend **5th International Conference and on Creative Technology (UTKCreTech2017)** to be held in **July 19-21, 2017** at **Rajamangala University of Technology Krungthep, Bangkok, Thailand**.

UTKCreTech2017 event is conducted annually. Building on the achievement of the earlier conferences being held in 2013 followed by 2014 until the latest CreTech2017. **We** delightfully welcomes once again all the researchers and developers to share their experiences and ideas through research talks and presentations from diverse fields in creative technology. This event offered a platform in bringing together a forum for students, postdocs and established researcher to exchange their ideas and contributing an integrative approach to Creative, Tourism and Education Research.

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Brain-Computer Interface: Emerging Technology for Life

Abstract

Currently, researches on offline analysis of brain-computer interface (BCI) become widely applicable to both the preventive, assistive technologies and treatment. However, investigation on real-time processing of BCI for many applications is still in progress. Electroencephalogram (EEG) signal has been used in medical field for analyzing the brain conditions and activities. It can also be used to diagnose several brain diseases. Brain signals can be acquired either by invasive type (by implanting electrodes into the skull) or non-invasive type (by attaching probes on the skull surface, EEG). The invasive type is superior in term of signal strength while the non-invasive type does not require any surgeries. In this talk, the recent research in BCI will be illustrated together with the analysis of the secret behind each method. Furthermore, the studies on employing the functional electrical stimulation (FES) with BCI will be illustrated.

Highlight Research

BCI for Rehabilitation and Assistive Technology

- EEG-based Wheelchair Control
- Neuroprosthetic Communication Device (iThink2)
- BCI-based Robotic Arm
- BCI-based Rehabilitation Devices

BCI for Treatment

- Neurofeedback Device for Attention Enhancement
- Peripheral Nerve Localization by Frequency-Based Electrical Stimulation

BCI for Preventive Technology

- Real-time Sleep Analysis System
- BCI in Golf

Haptic Paddle with Scilab for Control System Instruction

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ABSTRACT

The haptic paddle, a one-degree of freedom (DOF) force feedback joystick, has been exploited in teaching system dynamics since the device was first developed in the late 1990s at Stanford University. The haptic paddle allows students not only to touch but to feel dynamic system simulations. Developed from Vanderbuilt haptic paddle (VHP), the current improvements of both hardware and software are made: 1) to reduce the cost of each haptic paddle set to less than 1,500 Baht by using domestic materials, and 2) to exploit Scilab program (open source software) for bi-directional communication between the computer and Arduino microcontroller. In this paper, the three experimental studies are: 1) to measure and to condition signals, 2) to create virtual springs and dampers that students can feel at the handle of the haptic paddle, and 3) to observe the PID controller response of the paddle's angle with various controller gains. It resulted that this currently developed low-cost haptic paddle provides many advantages including the ease for instruction at the university setting.

Key words: Haptic paddle; Scilab; Arduino.

1. INTRODUCTION

User Interfaces (UI) enable users to interact with virtual or remote objects using various human sensory perceptions including vision, hearing and touch. Touch interaction technology is known as haptic feedback which is the necessary force enabling the user to feel actual physical properties such as mass, stiffness and so on. Haptic interfaces typically consist of three main components: 1) the mechanical structure of the device, 2) the sensors to track the position of the device and 3) the actuators to generate force and transmit it to the user through the device. One of the simplest examples of haptic feedbacks is the vibration of mobile phones when the user is alerted by the incoming calls without disturbing other people. There are many applications that exploit haptic feedbacks such as surgical training programs, underwater explorations with tele-robotic system, flight simulators for aviation training, factory manufacturing, and more realistic features of computer games compared to the visual or audio feedbacks alone [1].

In many educational contexts, the exploitation of haptic devices will bring benefits for several reasons such as engaging students in the process of learning and enhancing their learning experience. The haptic paddle is a one-degree of freedom custom-built force feedback joystick, which was first developed in the late

1990s at Stanford University. It provided a hands-on platform for students to physically interact with and “feel” simulated dynamic systems via force feedback [2], and it has been adopted by several universities [3]. The device generally aims for engineering education in engaging students with a variety of learning styles and bridging the gap between theory and practice.

This paper is developed from Vanderbuilt haptic paddle (VHP), in which both hardware and software have been modified and three experimental studies are demonstrated.

2. HAPTIC PADDLE

2.1 Hardware

Using the files provided on the [4], the laser-cut acrylic parts are assembled as the VHP sturdy frame by using solvent acrylic cement. Then, the friction drive components are assembled to transmit torque from the motor to the friction drive mechanism which can be adjusted for contact force. The electronic components which are an Arduino Uno board, a motor driver shield and an A1302KUA-T magnetic angle sensor are then connected. A small magnet is mounted on the drive wheel, and the A1302KUA-T senses the angle of magnet. The A1302KUA-T is connected to an Arduino analog input at pin A4, and Arduino shield receives a motor command signal at pin 6 for PWM and pin 7 for direction of rotation. Finally, the VHP is ready for the

laboratory use as shown in Figure 1. List of materials including price is shown in table 1, which the total cost of one VHP is not over 1,500 baht.

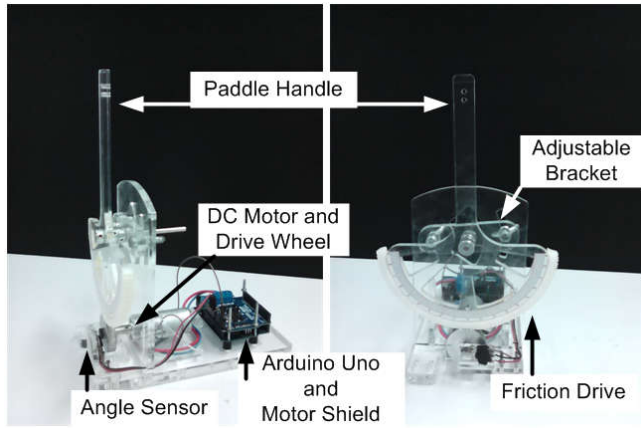


Figure 1: VHP in this study.

Table 1. Mechanical and electronic components

Part Description	Price (Baht)
Laser-cut acrylic	500
Set screw, driveshaft and etc.	150
Arduino Uno	200
Arduino motor shield	350
A1302KUA-T	25
DC motor	250
Total	1,475

2.2 Software: Scilab/Xcos

Scilab is a programming language designed for computing scientific problems with a large collection of numerical algorithms. Scilab is also a free open source software under the Cecill license. Xcos is a platform for a visual programming that can be used to construct block diagram models of dynamical systems. Xcos also interfaces with Arduino, an open hardware project based on an AVR microcontroller chip with free development environment software.

As shown in Figure 2, an Arduino Uno board is used in this study as the data acquisition hardware for bi-directional communication between the computer and the Arduino microcontroller. The ATOMS module manager on Scilab platform is exploited to update the Arduino version 1.1-1 via the internet connection, and Arduino firmware provided on the [5] is then uploaded through the board, which finally provides a set of block

diagrams to interface with the Arduino microcontroller board.

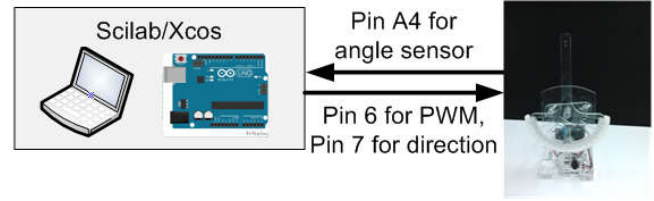


Figure 2: interface signals and input/output pin linkage

2.3 Dynamic system

The aim in designing a VHP is to minimize the mass, spring and damping as much as possible. For the haptic paddle, the variables of VHP report from [1] shows that they are at a very small value, so it will not oscillate when the paddle is displaced and released. In this study, virtual stiffness and damping are therefore added to the paddle to make it an underdamped second order system. The general equation of the haptic paddle motion is of the form,

$$m_{eq}\ddot{\theta} = f(t) - b_{eq}\dot{\theta} - k_{eq}\theta \quad (1)$$

, where m_{eq} is equivalent mass, $f(t)$ is input force, b_{eq} is equivalent damping, k_{eq} is equivalent stiffness and θ is angle of the entire system. This equation can be viewed more easily in Laplace domain by using the equation (2).

$$\frac{\theta(s)}{F(s)} = \frac{1}{m_{eq}s^2 + b_{eq}s + k_{eq}} \quad (2)$$

PID controller is used to control in the feedback loop. A simplified feedback control block diagram of the haptic paddle in Laplace domain is shown in Figure 3, where k_p is proportion gain, k_i is integral gain and k_d is derivative gain.

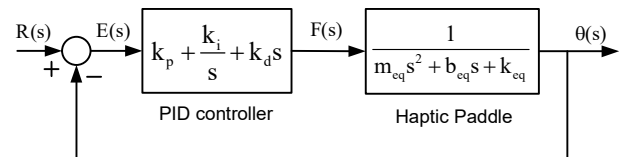


Figure 3: A simplified block diagram of feedback control

3. EXPERIMENT

3.1 Measuring and conditioning signals

The data recorded via the Xcos model varies from 0 to 1,023. The value is achieved from the analog

output of the A1302KUA-T, which corresponds to the range of 0-5 Volts. The constant value of -2.5 is used to adjust signals to positive and negative, when 0 is the signal midpoint. This output signal goes through a number of conversions, which is 66.67 and the position of the paddle is between $\pm 30^\circ$.

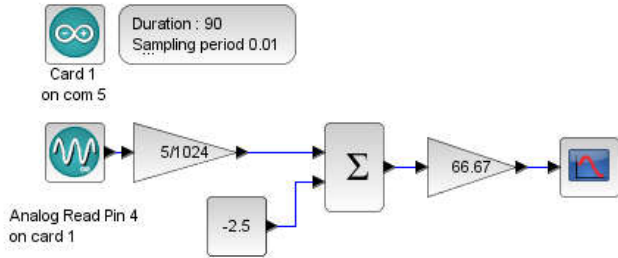


Figure 4: Sensor calibration of the angle position signal

3.2 Creating a virtual spring and damper

To create a virtual spring, it is simply done by multiplying the position signal by a gain, which is the spring constant, and this will “pull” the paddle back to zero with the force proportional to the distance it has moved away from zero. To create a virtual damping, it is simply achieved by multiplying the velocity signal by a gain, which is the damping constant, and this will move the paddle back and forth faster so that the damping effect can be really felt. Based on the concept above, the model of spring and damping elements in Xcos is therefore created as shown in Figure 5, where the input and output blocks handle the communication with the Arduino. The input block receives the data from the angle position obtained from the magnetic sensor via the Arduino, and the output block then sends a signal back to it. These output signals will result in a motor torque, which creates a force you can feel at the handle of the haptic paddle.

3.3 Observing the paddle’s angle step response at various controller gains

The square waves are the reference signals for the paddle. In this study, the response with P, PI, PD and PID controllers with various controller gains are observed, and the trial and error method is then used in tuning the controller gains. The samples of controller gains used in this experiment are in Table 2.

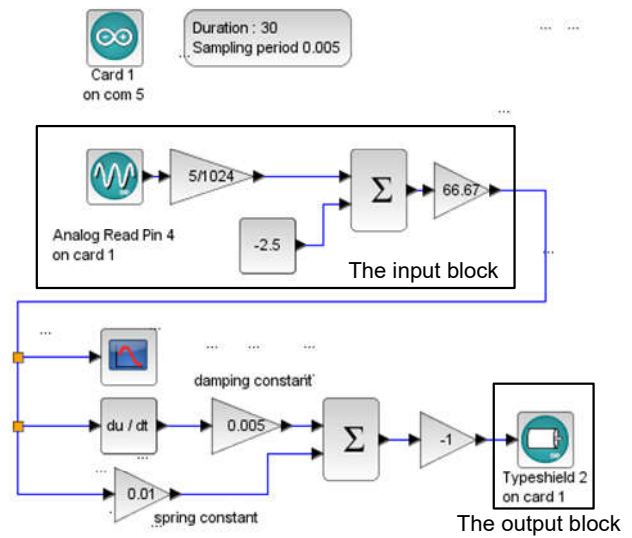


Figure 5: Xcos model with stiffness and damping added to the haptic paddle system

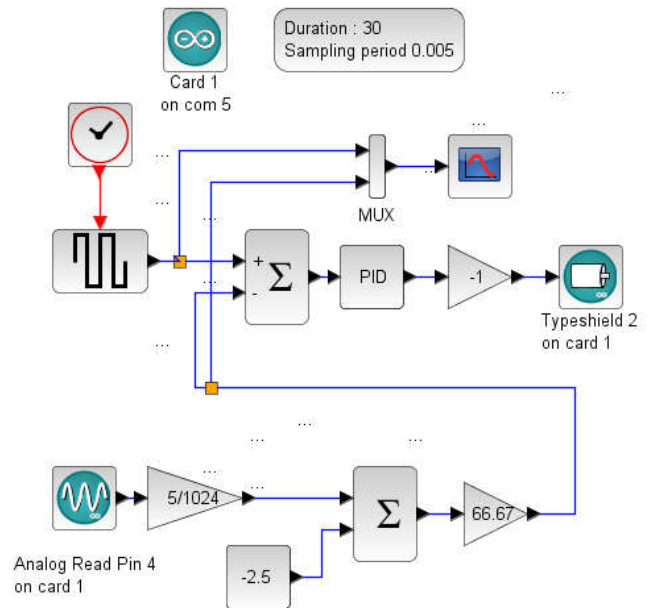
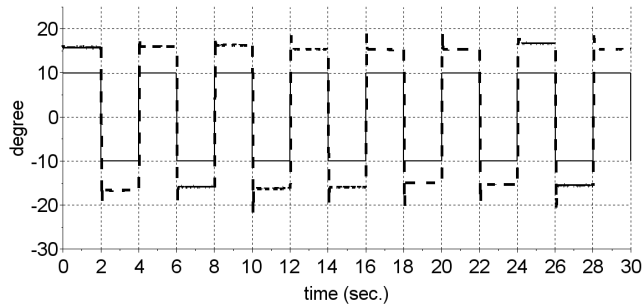


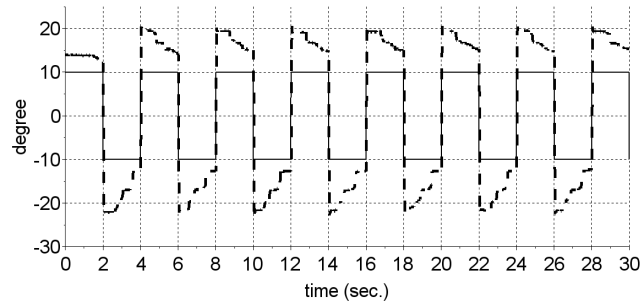
Figure 6: Xcos feedback control with PID controller

Table 2. PID controller gains

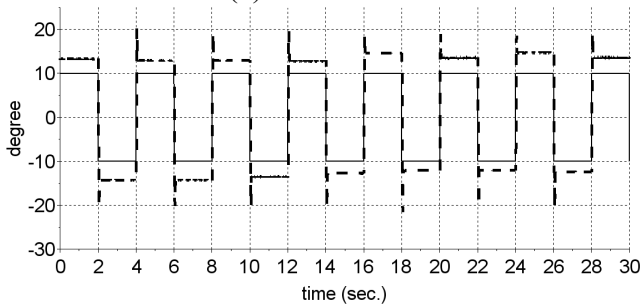
Controllers	k_p	k_i	k_d
P	15	-	-
PI	15	10	-
PD	15	-	0.01
PID	15	10	0.01



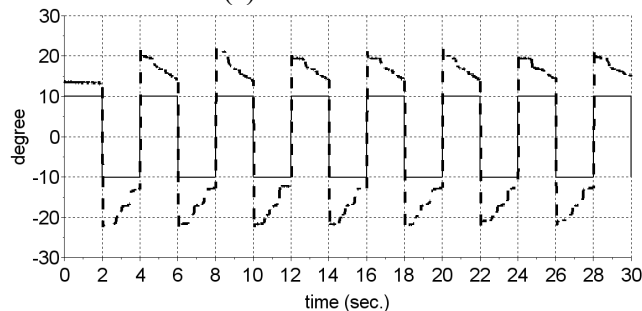
(a) P controller



(b) PI controller



(c) PD controller



(d) PID controller

Figure 7: The experiment results with a solid line as reference signal and a dash-line as angle position

4. DISCUSSION

From the results shown in Fig. 7, PID controller gains obtained from the trial and error tuning method can function in accordance with the theories [6]. The P controllers cause steady-state errors, and PI controllers compensate for the steady-state response, and they also

make the steady-state error decrease. However, the PI controllers can increase overshoot as the process plant order is increased. The PD controllers compensate for the transient response and the PID controllers can help improve not only transient but steady-state responses. Furthermore, the different step responses found in the experiments are simply due to the nonlinear feature of stiffness and damping, which is the nature of the real physical dynamic system, and the electrical system in which the motor and the drive circuit are the major causes of the unsymmetrical rotation.

5. CONCLUSION

For instructors of a control system course, this study reaffirms that the computer program, Scilab, and the microcontroller board, Arduino, are ones of the powerful tools that can be taken into our consideration for undergraduate instruction. This study presented an inexpensive but effective experiment tool, VHP, which can be used to create the virtual stiffness and damping, and make the user not only to feel it, but to be able to control the paddle position. Moreover, its low cost and ease of use make the proposed control system lab set of modified VHP attractive in educational and research settings where budgets are limited.

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Outdoor Design of Access Point Installation of IEEE 802.11b/g 2.4 GHz Wireless LAN Network

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ABSTRACT

This paper proposes the outdoor propagation model for location of access point installation position of WLAN IEEE 802.11 b/g standard. The path loss model was used for access point installation and received power measurement in focused area. Afterwards, difference between the measured and simulation values was investigated and the outdoor propagation model would be adjusted and developed. The new model was applied to predict signal for installation position of access point for outdoor WLAN in other environments in order to cover the service areas.

Keywords: IEEE 802.11, WLAN, path loss model, outdoor propagation model.

I. INTRODUCTION

WLAN system uses the access point for receive and transmit data between destination and main network by frequency is use for link operate of network. Access point installation in order to cover the service areas and considers attenuation of barrier. The propagation model present is usable for access point installation as follow [5], [6], [7], [8] and [9].

This paper present of access point installation for open area, near the lake, dense forest area and near the building area. The model of propagation signal for signal prediction of access point design based on IEEE 802.11 b/g standard. Access point is important of WLAN system because use for interface between wired LAN networks and WLAN as follow figure 1.

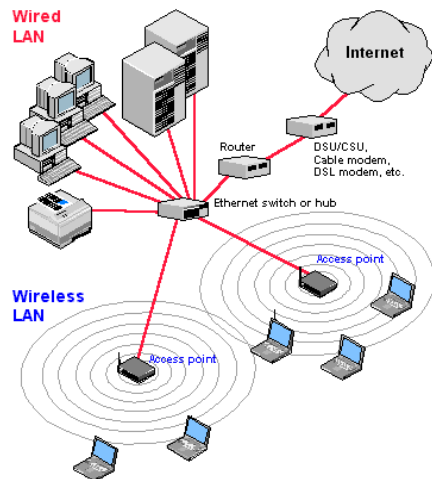


Figure 1 Infrastructure of WLAN system

Later, many researchers proposed the model of propagation signal of access point installation as follow [5], [6], [7], [8] and [9]. The model is device 2 model, empirical model and deterministic model.

II. PATH LOSS MODEL OF MEASUREMENT

A. Free Space Loss Model [5]

In telecommunication, free-space path loss is the loss in signal strength of an electromagnetic wave that would result from a line-of-sight path through free space, with no obstacles nearby to cause reflection or diffraction. It does not include factors such as the gain of the antennas used at the transmitter and receiver, nor any loss associated with hardware imperfections. Free-space path loss is proportional to the square of the distance between the transmitter and receiver, and also proportional to the square of the frequency of the radio signal.

$$PL = 32.4 + 20 \log f + 20 \log d \quad (1)$$

When d is the distance in kilometer and f is the frequency in MHz.

B. Large Scale Fading Model [7]

The model is find rural attenuation of network for WLAN IEEE 802.11g standard in frequency range 2.35 GHz to 2.65 GHz from Indian village.

$$P_L = P_{L0} + 10\gamma \log\left(\frac{d}{d_0}\right) + S(d); d \geq d_0 = 30 \text{ m} \quad (2)$$

When P_{L0} attenuation value in distance $d_0 = 30$ meters, $10\gamma \log\left(\frac{d}{d_0}\right)$ is attenuation median in distance $d_0 = 30$ meters, γ is be in error value of

signal transmit loss and $S(d)$ is lognormal shadow fading.

C. Lopez model [6]

The attenuation model is come from by NS – 2 program in network design for WLAN IEEE 802.11g standard offer to outdoor of Spain University. It regulation the parameter as follows transmit and receive data rate, Average Transmission Delay, Average Queue Delay, Frame Error Rate, Signal to Interference and Noise Ratio. The mathematics model from equation of Lopez model is as following.

$$PL(dB) = 7.6 + 40 \log d - 20 \log h_t h_r \quad (3)$$

When d is distance, h_t is height of access point and h_r is height of receiver.

D. COST 231–Walfisch – Ikegami Model [8]

This empirical model is a combination of the models from J. Walfisch and F. Ikegami. It was further developed by the COST 231 project. It is now called Empirical COST-Walfisch-Ikegami Model.

The model considers only the buildings in the vertical plane between the transmitter and the receiver. The accuracy of this empirical model is quite high because in urban environments especially the propagation over the rooftops is the most dominant part. Only wave guiding effects due to multiple reflections are not considered.

$$PL = 57.9 + \left(29.5 - \frac{1.5f_c}{925}\right) \log_{10} f_c + 38 \log_{10} d \quad (4)$$

When d is distance between receiver and transmitter in meter and f_c is frequency in MHz.

E. Weissberger Model[9]

Weissberger's modified exponential decay model, or simply, Weissberger's model, is a radio wave propagation model that estimates the path loss due to the Presence of one or more trees in a point-to-point telecommunication link. This model belongs to the category Foliage or Vegetation models.

Mathematic equation is defining Foliage factor be device 2 types distances as following.

- Distance 0 to 14 meters as following.

$$PL = 1.33(f^{0.284})(d_f^{0.588}) \quad (5)$$

- Distance more than 14 meters as following.

$$PL = 0.45(f^{0.284})(d_f) \quad (6)$$

When d_f is distance foliage in meter and f is frequency of transmitter in GHz .

III. MATHEMATICS PATH LOSS MODEL

The receive power from effective isotropic radiated power (EIRP), the unit of P_t is dBm . It define the power flux density (P_d) at the radial (r) from the access point propagation location by effective aperture area (A_{eff}) is the area of received signal of isotropic antenna and equal to $4\pi r^2$.

$$P_t = P_d \times 4\pi d^2 \quad (7)$$

$$P_r = P_d A_{eff} \quad (8)$$

When the received power is P_r . Then the received power to received area will be

$$P_r = \frac{P_t A_{eff}}{4\pi r^2} = \left(\frac{P_t}{4\pi d^2} \right) \left(\frac{\lambda^2}{4\pi} \right) \quad (9)$$

When λ is the propagation wavelength, is used to define the received power. The antenna gain (P_d) is G_t and A_{eff} is G_r . Then the new propagation of Friis free – space equation is as following.

$$P_r = \frac{P_t G_t G_r \lambda^2}{(4\pi)^2} \quad (10)$$

The equation (4) is deriving to path loss model shows in dBm unit.

$$PL = P_t(dBm) - P_r(dBm) \quad (11)$$

Friis transmission formula is the equation to analysis the radio path loss. The order made up of Friis free – space equation is the accurate of equation. Exponential term is replace to n which is error of path loss exponent. In the free space then $n=2$ be specific difference as follow to distance. The new mathematics model for attenuation equation can be written as following.

$$PL = 10n \log\left(\frac{d}{d_0}\right) + 20 \log\left(\frac{4\pi d_0}{\lambda}\right) + \chi_\sigma \quad (12)$$

When d_0 is origin distance measure 1 meter, d is distance of measure in meter and χ_σ is log-normal value is replace 0.

Test the signal, signal transmit from access point is $-16.97 dBm$ and antenna gain is $2.2 dBi$.

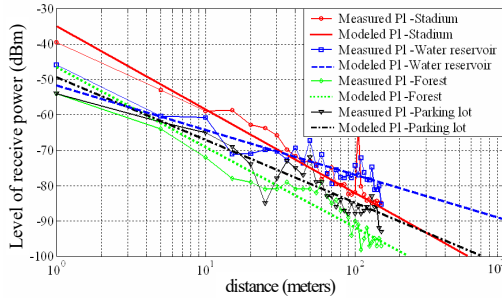


Figure 2. Straight line slope of mean receive power for distances 1 to 150 meters.

As show in figure 2, increase of the distance will decrease the receive power in system. Replace $\chi_\sigma = 0$ in equation (13), which derive to straight line equation, comparison slope of L grape in figure 2 and equation as following.

$$PL = A + B \log d(m) \quad (13)$$

The access point installation 1 to 5 meters height, frequency 2462 MHz, 1 meter distance, plot graph the mean signal and define slope from height.

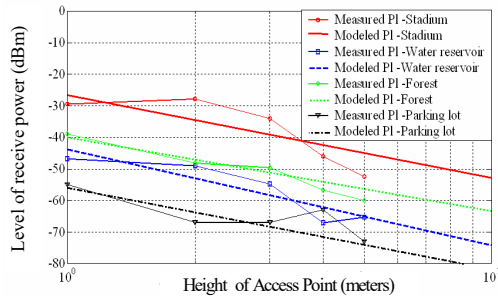


Figure 3. Straight line slope of mean receive power for access point height 1 to 5 meters

From the figure 3, the height of access point increase is because signal level decrease and attenuation increase. Then frequency increase of access point from 2414 MHz to 2462 MHz are channel 1 to 11 follow IEEE 802.11 b/g standard in 5 MHz per step at height 1 meter and

distance 1 meter. This slop graph of mean receive power as follow figure 4.

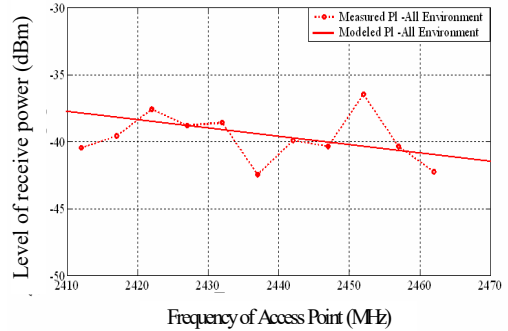


Figure 4. Straight line slope of mean receive power for frequency 2412 MHz to 2462 MHz.

From the figure 4, slop of graph is least because the frequency of WLAN system less than range tests.

TABLE 1. The receive power at distance 1 meter (A_0) and slop value (B) of strength graph for parameter is measure.

Parameter of attenuation in WLAN system					
Area of environment	Attenuation at 1 meter $A_0(dBm)$	Slope of grape			Constant value K
		distance B_d	height B_{ht}	frequency B_{fc}	
Open area	51.17	23.77	26.28	0.075	115.98
Near the lake	68.67	12.52	32.17	0.075	121.68
forest	62.97	23.2	22.60	0.075	121.68
urban	66.27	17.69	19.85	0.075	118.38

This transmitted power of access point is $-16.97 dB$ and the constant value of slop is follow as table 1. Replace value in equation (7) and derive mathematic is create the new model of attenuation for 4 area are follow as.

$$PL = B_d \log d + B_{fc} \log f_c + B_{ht} \log h_t - K \quad (14)$$

When f_r is the frequency in MHz, d is the distance in meter and h_t is

the height of installation access point in meter.

It under condition of antenna gain of access point is 2.2dBi and receive antenna height is 0.1 meter.

IV. PROPAGATION TEST

The attenuation tests in different environments (in figure 6) were operated by received power measurement in dBm .

A. Outdoor Area for signal Test



Figure 5. The area of signal test for outdoor WLAN in other environment.

- Open area for Line of signal (LOS) propagation will be represented at football field area.
- Near lake area for signal absorption due to moisture effect will be represented at dam area.
- Dense forest for study of attenuation from tree block the propagation will be represented at park.
- The urban area for study of attenuation due to mixed obstacle effect i.e. pool, tree and building will be represented at central city.

Find the results receive power from access point in WLAN propagation. There are study three parameters, distance, height and frequency. Level of receive power are measured using by fusion program in handheld computer (Symbol MC3090).

Transmitter for signal receiver is shown in figure 7 and 10 measured it same position. The mean value from measure is applied to plot graph.

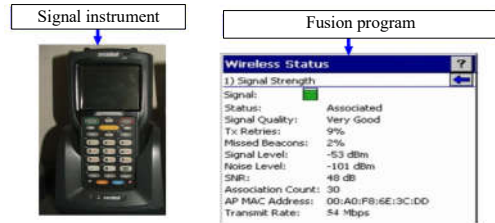


Figure 6. Fusion program of signal receiver model Symbol MC3090 for signal received detail.

B. Attenuation Parameter

The access point model Cisco 1121 b/g is use signal transmitter, transmit power -16.97dBm . The antenna gain of access point are 2.2dBi and is use fusion program base on symbol MC 3090 is signal level measure at antenna receiver height 0.5 meter. The parameter test is following.

- Distance from access point into receiver is meter. The distance begin 1 meter due to increase 5 meter per step into 150 meter, height is 1 meter and frequency is 2462 MHz. Fining the mean of receive power and plot graph in figure 1 and fining attenuation at distance 1 meter (A_0) and slop of graph B from table 1.
- The height of access point 1 to 5 meter, increase the height 1 meter per step, distance 1 meter and frequency 2462 MHz. Fine the mean of receive power and plot graph in figure 2, fining attenuation of parameter is height 1 meter (A_0) and slop of graph B from table 1.
- Frequency of access point is 2412 MHz to 2462 MHz, increase the frequency 5 MHz, distance 1 meter and the height is 1 meter. Fining the

mean value of receive power and plot graph in figure 3. Fine the attenuation of frequency parameter is 1 meter (A_0) and slop value of graph B from table 1.

C. Test result.

This paper is present attenuation of radio propagation model for WLAN standard IEEE 802.11b/g from equation (8). Replace the distance from 1 to 5 meters. Results from the 4 areas are following.

- Graph from figure 7, 8, 9 and 10, when the distance made up is because the attenuation decreases.
- Graph from figure 7, 8, 9 and 10, when the height made up is cause attenuation increase and receive power decrease.
- The open area and near the lake area has lake the difference in figure 2. The slope of strength is less, observe the water is because signal absorb
- The forest area, receive power from measure is not constant and no model for predict receive power be similar to the real value.

Calculate the model from measure and access point installation method following [5], [6], [7], [8] and [9] and plot graph compare is following as.

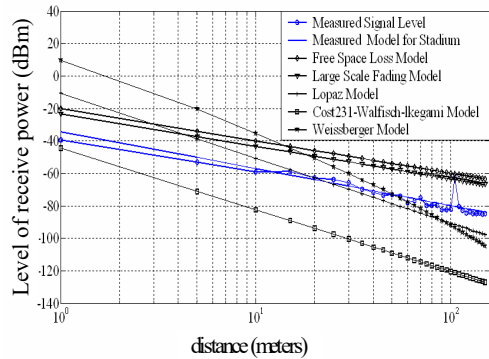


Figure 7. Compare the model between the test signal for open area and the model [5], [6], [7], [8] and [9].

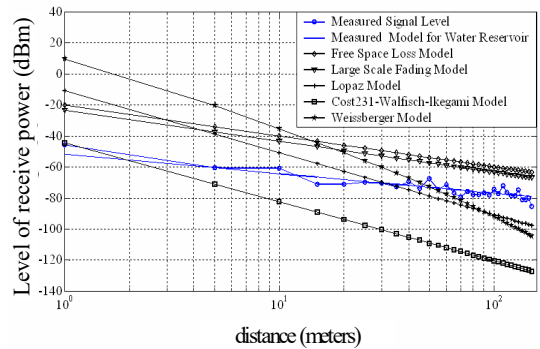


Figure 8. Compare the model between the test signal for near the lake area and the model [5], [6], [7], [8] and [9].

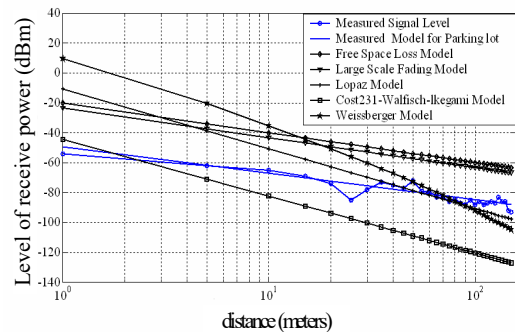


Figure 9. Compare the model between the test signal for urban area and the model [5], [6], [7], [8] and [9].

V. CONCLUSION

This research is study wave propagation for WLAN network based on IEEE 802.11b/g standard in frequency range 2.4 GHz. The present new attenuation model equation (14) to predict signal for installation position of access point for outdoor in other environments. It is use identify access point position to cover the service area of WLAN in open, near the lake, forest and urban area.

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Characteristic of particle on dust explosion property

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ABSTRACT

In industrial plant, the particles of raw materials and products often disperse in the process. If these particles dispersed in ambient air, the dust explosion can be occurred. From the statistic data in abroad indicated that the starch particle had the most frequency accident of dust explosion. The next one are saw dust, resin powder, coal and metal powder, respectively. Thus, this project aim to determine lower explosibility limit (LEL) of industrial particles such as tapioca powder, corn starch, coal, saw dust, resin powder and metal powder. The results showed that the LEL value of coal (75.34 g/m^3) is the lowest compared with other types of particles, followed by corn starch (131.61 g/m^3), tapioca powder (133.75 g/m^3), metal powder (133.93 g/m^3), saw dust (141.78 g/m^3) and resin powder (142.85 g/m^3), respectively. It can be observed that each particle has a specific deflagration of flame when they exploded. Moreover the effect of particle size on lower explosibility limit of coal which has size smaller than $45 \mu\text{m}$, size between $45 - 53 \mu\text{m}$ and $53 - 75 \mu\text{m}$ had the averaged LEL values at 75.33 , 75.35 and 75.40 g/m^3 , respectively. Finally, the effect of moisture content in tapioca powder on LEL was studied. It was found that non-drying powder and drying at 50 , 70 , 90°C powder had the LEL values at 159.84 , 147.45 , 140.82 and 133.93 g/m^3 , respectively. It can be seen that the unique properties of particles, such as type, size and moisture content of the particles affect their lower explosibility limit.

Key Words: Dust explosion; lower explosibility limit; coal

1. INTRODUCTION

There are many type of particle used and produced from manufacturing industries in Thailand. If these particles are dispersed in the air with confine space such as in pipeline, silo, mixer or grinder, they can be explosion with appropriate dust cloud concentration. This called "dust explosion" which make serious damage in the equipment of the process. However, if the operator knows the minimum limit concentration of particle in air that can be explosion. It can prevent the risk and severity of the explosion.

The lack of the data of minimum concentration of particles that can be exploded is the one point that should be considerate. Moreover, the characteristic of powder such as particle size and moisture content in particle should be considerate. The statistic data form abroad [1] informed that the dust explosion occurred mainly caused by the explosion of the starch powder follow by the explosion of saw dust, resin, sulfur, metal and aluminum. In Thailand, there are some accidents in dust

explosion reported [2]. The particle that the most frequency accident was cassava following by corn starch, coal, saw dust, and metal powder. Therefore, the objective of this research is to determine the lower explosibility limit (LEL) of particles in Thailand and studied the effect of particle size and moisture content in particles on LEL values. The testing method was according to ASTM E789.

2. EXPERIMENT

2.1 Calibration of 1.2 L dust explosibility tester with standard method (ASTM E789)

Lycopodium was used as a standard powder for calibration. The lycopodium was dried at 90°C in the oven for 24 hours. After that it was kept in dry container to cool down before testing. Then, it was weighted about $0.5-0.6 \text{ g}$. This weight recorded in 4 significant figures. Lycopodium was putting on the cup located lower the chamber of tester. The testing conditions was used the pressure of the air tank at

0.5 kg/m³ and spark delay time at 0.1 s. The LEL was determined by weight of lycopodium divided by volume of glass chamber (1.2 L). After testing, if the LEL value of lycopodium was in the range of 45 ± 5 kg/m³, it can be confirmed that the dust explosibility tester was calibrated. This calibration step should be employed prior to another experiment.

2.2 Determination of LEL of various type of powder used in Thailand

The particles used to determine LEL in this work were metal powder, tapioca starch, corn starch, saw dust, resin and coal. All of the testing particles were screen on the sieve analysis. The range of particles size was smaller than 45 μ m. The test method was as same as calibration step that was dried at 90°C then kept in a desiccant to cool before testing and weight the particles in the range of 0.9-0.2 g. with 4 digits of significant figures. The test condition was as same as mentioned above. The testing method was repeated to evaluate the lowest explosibility concentration (g/m³) and the LEL data must be repeated at least two times.

2.3 Study the effect of particle size on LEL

In this research, coal was used to study the effect of particle size on LEL. The size distribution of coal was 3 sizes that were smaller than 45 μ m, between 45 - 53 μ m and between 53 - 75 μ m. The testing method was also same as mentioned above.

2.4 Study the effect of moisture content on LEL of tapioca powder

The particle size of tapioca powder was lower than 45 μ m. The tapioca powder was dried at 50, 70 and 90 °C. The percentage of moisture content in powder was determined by weighting method. Moreover, non-dried tapioca powder was also determined. The testing method was also same as mentioned above.

3. RESULTS AND DISCUSSION

3.1 Determination of LEL of various type of powder used in Thailand

The LEL values of particles that were tapioca powder, corn starch, coal, resin powder, saw dust and metal powder with size less than 45 μ m were determined. The LEL results of these particles are shown in figure 1.

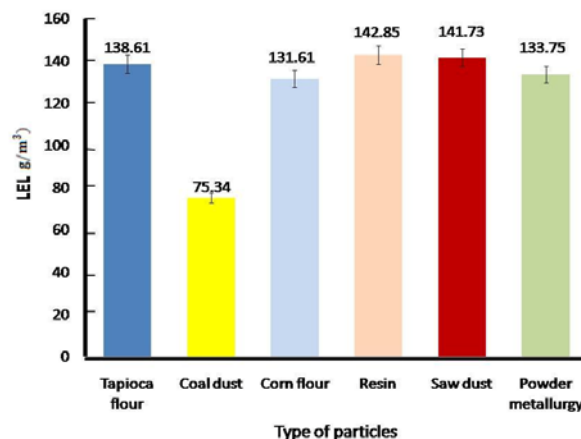


Figure 1 Lower explosibility limit concentration of various type of particles

The LEL concentration informs the sensitivity of dust explosion. The lower of LEL concentration means the higher possibility to be explosion. Form Fig. 1, coal had the lowest LEL concentration that means coal has the highest sensitivity to be explosion with the lowest amount of 75.34 g/m³. From these results, sensitivity to be explosion of particles can sort from the descending order as follow: coal > corn starch > metal powder > tapioca powder > saw dust > resin powder, respectively.

When the explosions were initiated in 1.2 L cylindrical chamber and allowed flame deflagration reached the dust cloud of various type of testing particles. The jet flam ignition of dust cloud in a glass chamber produced rapid rate of burning and associated pressure rise. The deflagration occurred by a competent igniter applied to the suspension where the concentration was sufficient for flame propagation. The necessary conditions for dust deflagration must be met in the same place and at the same time that was deflagrable particles, suspension, sufficient concentration and competent igniter applied to suspension where the concentration was sufficient for flam propagation. Therefore, it can be said that the flame deflagration depended on the suspension LEL concentration. The deflagration liberated quantities of heat, temperature and pressure. The deflagration of various types of particles in this work was shown in figure 2.

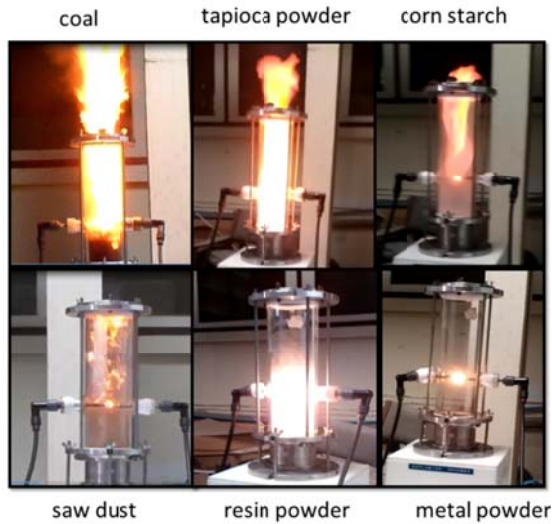


Figure 2 Deflagration characteristic of various kinds of particles.

It can be observed that the deflagration coal and tapioca powder had a wide spread along the cylindrical chamber and fully dispersed inside the chamber diameter. This result was consistent with their high sensitivity to be explosion. In case of corn starch and saw dust, the flame seems to rise up to chamber. On the other hand, the flame deflagration of resin and metal powder had limited spread at the ignition region. The significant characteristic of flame deflagration of each particle corresponded with their LEL concentration. The deflagration of particle depended on the density suspension of particle in air such as metal powder had sufficient density suspension around ignition region. Moreover, the particle density itself acted an importance role on the suspension of particle in air [3].

3.2 Effect of particle size on the LEL

This study was based on the fact that the particle diameter proportion to surface area. As shown in equation (1), surface area (S) of sphere depended on diameter (x). The decreasing of diameter made the increasing of surface area. Thus, the explosion sensitivity such as LEL concentration should be increased with higher surface area of particle.

$$S = \frac{\pi x^2}{(\pi/6)x^3} = \frac{6}{x} \quad (2)$$

However, the relation of particles size of coal and LEL concentration in figure 3 indicated that the diameter of coal particle did not have effect on the LEL concentration. It can be notice that the

combustion of coal had effect from heating flux of the approaching flame, decomposition chemistry and time available for de-volatilization of coal. For small particles and low dust concentration, the combustion process was controlled by gas phase combustion of volatile and air.

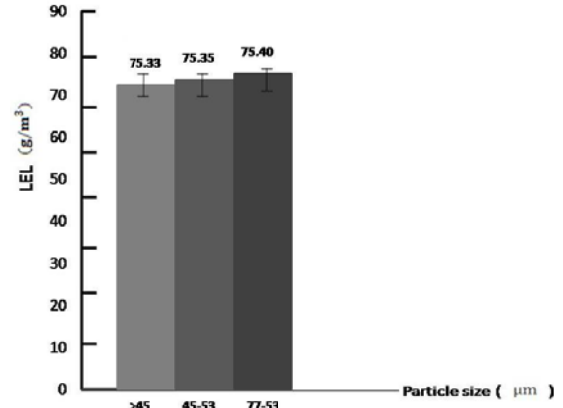


Figure 3 The relation of particle size of coal and LEL concentration

3.3 Effect of moisture content on the LEL

Generally, water content means the amount of water measured by the moisture determination method for an air-dried or constant-humidity sample. In this work, we used the thermal analysis to determine % moisture content that was the amount of water adsorbed in the sample with a certain constant drying temperature at 110°C compared with the particles dried with temperature at 50, 70, 90 °C and no-drying. The results were shown in figure 4.

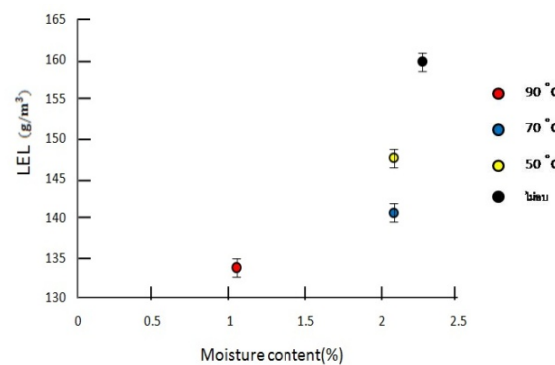


Figure 4 The effect of moisture content of tapioca powder on LEL concentration

It can be observed that the LEL concentration increased with increasing of moisture contents. It may be the adhesive water on the surface increased with increasing of moisture content and then the particle trended to be agglomerated. This may effect on the

dispersion of particle in dust cloud. Therefore, the decreasing of dispersion affected on the increasing of LEL concentration. The drying temperature of particles depends on the existing form of water in the particle. In this case, the physical bonding strength of adsorbed water at outer surface of particles can be removed in heating of 100-130°C [4]. On the other side, if the occluded water retained in a cavity of large crystals of material, the heating temperature is higher at 250-300°C. However, in case of tapioca, this starch will be burned at 100°C. Thus, the drying temperature tested in this work was limited at 90°C.

4. CONCLUSION

The effect of type, particle size diameter and moisture content of particles on the lower explosibility limit concentration (LEL) was studied by using dust explosibility tester according to ASTM E789. The LEL concentration was sorted according to low value to high value as following: coal < corn starch < metal powder < tapioca powder < saw dust < resin powder. This result indicated that coal has highest sensitivity to be explosion. It was also found that the characteristic of flame deflagration of particles had significant character as well as LEL concentration. The coal was used to study the effect of particle size. It can be concluded that particle size did not effect on LEL concentration. Lastly, the LEL concentration of tapioca powder trended to be increased with increasing of moisture content because of the effect of adhesive water on particle agglomeration in dust cloud. Thus, the dispersion of particles affected the LEL concentration.

5. ACKNOWLEDGEMENTS

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DPPH free radical scavenging activity of crude and fractionated extract and stability of *Ruellia tuberosa*'s fractionated extract in cream product

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ABSTRACT

The study of antioxidant activity by DPPH radical scavenging method of crude extract from *Ruellia tuberosa*'s leaves, stems and roots were extracted with two solvents as ethanol and acetone to afford six segmental extracts. The ethanol solvent showed higher efficiency crude extraction than acetone solvent. When, all crude extracts were investigated by DPPH free radical scavenging assay. The antioxidant activity of leaves stems and roots were extracted by ethanol as 79.42%, 79.52% and 54.80%, respectively and acetone as 76.52%, 88.25% and 77.74%, respectively. The DPPH activity of stem extracted with acetone (AS) showed highest activity. Then, acetone extract of stem was fractionated with column chromatography technique by using gradient system of hexane:ethyl acetate to be obtained 11 fractions. All fractions were further to study of DPPH free radical scavenging activity. The fractioned 7 of stems' acetone extract (AS-F7) obtained sticky yellow-brow (48.5 mg), showed percentage of activity at 85.31%. The followed up stability of AS-F7 at 1 and 2% (wt/wt) mixed in skin cream base for 4 weeks ago at room temperature compared with cream base (control). The study result, AS-F7 from *R. tuberosa* showed stability of antioxidant activity in cream base, which lost percentage of antioxidant activity less than cream base without added extract. It can be applied to active ingredient in skin cream products. The customers were satisfaction survey of skin cream products questionnaire by using purposive sampling. The physical property result showed texture, touch, color, senses, viscosity, feeling on skin and overall product satisfaction were 4.69, 4.62, 4.69, 4.62, 4.23, 4.23 and 4.69 respectively.

Keywords: *Ruellia tuberosa*, antioxidant activity, DPPH free radical scavenging assay, skin cream product

1. INTRODUCTION

Ruellia tuberosa L., belong to the family Acanthaceae Thai name: Toi-ting, is a perennial herb and widely distributed in tropical area of India, Taiwan and Thailand. It has different names such as fever root, cracker plant and minnie root. This plant can be easily found in open waste or moisture place. *R. tuberosa* has been great importance due to their nutritive value [1] and externally used in Thai tradition medicine as an antiseptic, anti-inflammatory, anti-ulcer [2]. Previous phytochemical studies, of this plant revealed the presence of antioxidant compounds from *R. tuberosa* were ascorbic acid, lycopene, carotenoid, tocopherol [1]. Phenylethanoid glycoside showed relative scavenging activity in same range of ascorbic acid [2]. In 2006, Chen, F.A. reported antioxidant activities of the different fractions from stem tested decreased in the order of ethyl acetate > chloroform > methanol > water > hexane fraction [3]. The flavonoid which isolated from ethyl acetate extract of dried aerial parts showed cytotoxicity against KB cell and HepG2 [4] and used for ulcer protective activity in male wistar rats [5]. *In vitro* antioxidant activity of petroleum ether, benzene, ethyl acetate, methanol and ethanol extracts of *R. tuberosa* was evaluated by studying 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging activity, hydroxyl radical scavenging activity, superoxide radical scavenging activity, ABTS radical cation scavenging activity and reducing power using standard procedure. Among the solvents tested, methanol and ethanol extracts of tuber of *R. tuberosa* showed potent *in vitro* antioxidant activities. The results

clearly indicated extracts of tuber of *R. tuberosa* is effective in scavenging free radicals and has the potential to be a powerful antioxidant[6].

The effect of free radicals wrathful by various environmental chemicals as well as endogenous metabolism are involved in a number of diseases like tumors, inflammation, gastric mucosal injury, atherosclerosis, shock, diabetes, infertility, and ischemia due to the oxidative damage to DNA, lipids, and proteins and which can result in failure of cellular functions. So, human try to use useful plant material for free radical scavenging applied to dietary supplement and cosmetic product. The present study attempted to estimate the antioxidant activity of *R. tuberosa* was several method by 2,2-diphenyl-1-picrylhydrazyl (DPPH). In this work, we study antioxidant activity of crude extract of leaves, stems and roots from *R. tuberosa* and fractionated extract by DPPH free radical scavenging assay. The active fraction extraction was applied to ingredient skin cream product. All product skin creams were studied stability and customer satisfaction survey of skin cream products questionnaire by purposive sampling.

2. MATERIALS AND METHODS

Plant material

Ruellia tuberosa was collected from Ramkhamhaeng University of Thailand was used as plant material.

Extraction and Column Chromatography

Chemical

Acetone, Ethanol, Ethyl acetate, Hexane (AR grade: RCI Labscan), 1,1-

diphenyl-2-picrylhydrazyl; DPPH
(Sigma Aldrich)

The fresh plant part was washed and picked impurity out of them. The plant material was separated for three parts as leaves, stems and roots. Each part of material was crushed with blender and subjected to extraction by macerating. The extract was taken by soaking the fresh of leaves, stems and roots in two difference solvents (ratio plant: solvent; 1:2) as acetone or ethanol at room temperature for 7 days (3 times). Then, the samples were filtrated through Whatman filter paper No.2. The solvents of the respective combined extracts were evaporated under reduces pressure, using a rotary vacuum evaporator (RotavaporR-210, Heating Bath B-491, Vacuum Pump V-700, CTL 911) at 40 °C to afford 6 crude extracts as ethanolic extract of leaves (EL), stems (ES), roots (ER) and acetone extract of leaves (AL), stems (AS), roots (AR). All crude extracts were determined antioxidant activity by DPPH free radical scavenging assay.

Formulation and Development of Cream Base

Cremophor A-6, Cremophor A-25, Finsolv TN, White oil 2076, G.M.S, Wax-C, Propylene glycol, Unigerm G2 and Alpha bisabol. The oil phase prepare by heating Cremophor A-6, Cremophor A-25, Finsolv TN, White oil 2076, G.M.S, Wax-C to 75 ±1 °C. At the same time, the aqueous phase included water and propylene glycol was heated to the same temperature. The aqueous phase was subsequently added to oil phase drop by drop with continued stirring at 2,500 rpm by a mechanical mixer for 15 min. During this stirring time, Unigerm G2, Alpha

bisabol and the most active antioxidant of fractionated (1, 2% wt/wt) from *R. tuberosa* were homogenized with cream base. The same method was used to formulate the cream base without the addition active fractionated extract of *R. tuberosa*. The viscosity of cream base was measured by Viscometer (LD VD-II+Pro) in centipoise (cPs).

Determination of Antioxidant Capacity

Antioxidant activity (DPPH free radical scavenging assay) crude extracts of ethanol and acetone were determined by using the DPPH method. Briefly, crude extract solution (1,000 ppm) mixed with DPPH solution (0.2 mM) ratio 3:1 and incubated in the dark at room temperature for 30 min. The absorption of sample was measured at 517 nm (UV-VIS SPECTROPHOTOMETER series V-650 spectrophotometer). Decreasing of the DPPH solution absorbance indicates increase of the DPPH radical scavenging activity. The highest antioxidant of crude extract was selected to fractionate by using column chromatography with gradient solvent system (hexane:ethyl acetate; 100:0 to 0:100). All fractionates were test antioxidant activity. The highest antioxidant activity was selected to ingredient in cream product at 1% and 2% wt/wt. After that, the products with/without fractionated extract were determination activity by DPPH method for 4 weeks ago at room temperature. The percentage of antioxidant activity by DPPH assay was using the following equation:

$$Activity(\%) = \frac{(Abs_{DPPH} - Abs_{sample})}{Abs_{DPPH}} \times 100$$

Where Abs_{DPPH} = Absorbance of DPPH
 Abs_{sample} = Absorbance of sample

Customer Satisfaction Survey

The customer satisfaction survey of skin cream product was purposive sampling. The titles of testing were physical property as texture, touch, color, senses, viscosity, feeling on skin and overall product satisfaction.

3. RESULTS AND DISCUSSION

The fresh leaves, stems and roots from *R. tuberosa* were extracted with ethanol and acetone solvent to afford six segmental extracts as ethanol leaves (EL), ethanol stems (ES), ethanol roots (ER), acetone leaves (AL), acetone stems (AS) and acetone root (AR). The fresh plants weight (wt.), weight of crude extract and percentage yield of crude extract showed in Table 1.

Table 1. Weight of fresh plant, extraction and %yield of *R. tuberosa*'s leaves, stems and roots.

Part of fresh plants (solvent)	Plants wt. (g)	Extract wt. (g)	% yield of extract
Leaves (ethanol)	1020.00	25.32	2.48
Stems (ethanol)	390.00	14.00	3.59
Roots (ethanol)	1000.00	78.76	7.88
Leaves (acetone)	250.00	3.87	1.55
Stems (acetone)	300.00	6.28	2.09
Roots (acetone)	200.00	4.44	2.22

The efficiency of ethanol solvent could be extract fresh leaves, stems and roots gave higher %yield crude extracts than acetone solvent.

Determination of Antioxidant Capacity

All crude extracts (EL, ES, ER, AL, AS, AR) were investigated by DPPH free radical scavenging assay indicated in Table 2, 3 and Figure 1.

Table 2. The percentage antioxidant activity of ethanol extract at 1,000 ppm.

Sample No.	Absorbance value at 517 nm		
	leaves (EL)	stems (ES)	roots (ER)
1	0.4637	0.4866	1.0414
2	0.4927	0.4795	1.0199
3	0.4690	0.4403	1.0426
average	0.4751	0.4688	1.0346
S.D.	0.0017	0.0032	0.0022
C.V.	0.3597	0.7000	0.2122
% Activity	79.2437	79.5203	54.8017

The antioxidant activity of crude extract showed high to low activity as AS (88.25%), ES (79.52%), EL (79.24%), AR (77.74%), AL (76.25%), ER (54.80%). The AS crude extract showed higher activity, then choose for fractionated by column chromatography.

Table 3. The percentage antioxidant activity of acetone extract at 1,000 ppm.

Sample No.	Absorbance value at 517 nm		
	Leaves (AL)	Stems (AS)	Roots (AR)
1	0.5478	0.2695	0.5204
2	0.5304	0.2690	0.5105
3	0.5528	0.3685	0.5105
average	0.5437	0.2690	0.5097
S.D.	0.0020	0.0020	0.0026
C.V.	0.3688	0.7587	0.5152
% Activity	76.2497	88.2487	77.7350

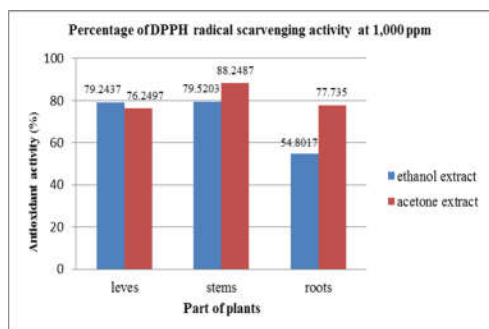


Figure 1. Antioxidant activity of crude extracts

Column Chromatography

The acetone extract of stem (AS) crude extract was separated by using column chromatography technique with gradient solvent (hexane:ethyl acetate, 100:0 to 0:100) system detected and collected of fraction by thin layer chromatography to obtain 11 fractions. The AS-F1 to F11 fractions were weight as 49.4, 7.5, 244.8, 76.1, 120.4, 75.0, 48.5, 2.8, 3.5, 29.2 and 7.7 mg, respectively. Then all fractions were prepared 1,000 ppm concentration and tested antioxidant activity show in Table 4.

Table 4. The percentage antioxidant activity of AS-F1 to AS-F11 at 1,000 ppm

ID Code	Wt. (mg)	Absorbance value at 517 nm				S.D.	C.V.	% Activity
		1	2	3	average			
AS-F1	49.4	0.8058	0.806	0.806	0.8059	0.0001	0.0129	60.7495
AS-F2	7.5	0.3302	0.3304	0.3308	0.3304	0.0003	0.0876	83.9041
AS-F3	244.8	0.5329	0.5329	0.5328	0.5328	0.0001	0.0143	74.0439
AS-F4	76.1	0.7512	0.7511	0.7511	0.7511	0.0001	0.0100	63.4092
AS-F5	120.4	0.6606	0.6609	0.6612	0.6609	0.0003	0.0429	67.8034
AS-F6	75.0	0.7095	0.7093	0.7095	0.7094	0.0001	0.0143	65.4406
AS-F7	48.5	0.3019	0.3015	0.3013	0.3016	0.0003	0.1048	85.3072
AS-F8	2.8	0.2583	0.2582	0.2584	0.2583	0.0001	0.0333	87.4166
AS-F9	3.5	0.4947	0.4952	0.4954	0.4951	0.0004	0.0759	75.8805
AS-F10	29.2	0.3161	0.3166	0.317	0.3165	0.0005	0.1426	84.5813
AS-F11	7.7	0.1028	0.1026	0.1026	0.1027	0.0001	0.1425	94.9968
DPPH (0.2 mM)	664.9	2.0532	2.0527	2.0523	2.0527	0.0005	0.0224	-

Table 5. The percentage antioxidant activity of AS-F7 in base cream at 1,000 ppm

Sample	Absorbance value at 517 nm				S.D.	C.V.	% Activity
	1	2	3	average			
1 st week							
0 %	0.7044	0.7051	0.7053	0.7049	0.0005	0.0650	47.8291
1 %	0.6910	0.6904	0.6892	0.6902	0.0009	0.1330	48.9195
2 %	0.6720	0.6711	0.6706	0.6713	0.0007	0.1024	50.3232
DPPH (0.2mM)	1.3510	1.3541	1.3486	1.3512	0.0027	0.2029	-
4 th week							
0 %	1.4162	1.4159	1.4153	1.4158	0.0005	0.0321	43.2909
1 %	1.3837	1.3829	1.3821	1.3829	0.0008	0.0593	44.6087
2 %	1.3112	1.3107	1.3101	1.3107	0.0006	0.0442	47.5019
DPPH (0.2 mM)	2.4966	2.4973	2.4959	2.4966	0.0007	0.0280	-

The five fractions, AS-F2, AS-F7, AS-F8 AS-F10 and AS-F11, showed higher activity (>80%). Whereas, AS-F7 has more weight than another fraction in this group so, AS-F7 fraction (sticky oil yellow-brow; 48.5 mg) was selected to mix with cream base and to study stability of antioxidant activity in cream base (Table 4).

Formulation and Development of Cream Base

The physical property of cream base was white color emulsion. The viscosity was measured 71,085 cP by viscometer (LD VD-II+Pro) needle no 4(64), speed 6 rpm for 2 min at room temperature 24 °C. The physical property of skin cream product has ingredient AS-F7 at 1 and 2% (wt/wt) were yellowish but 2%wt/wt has more color 1% (wt/wt). Determination of skin cream product's antioxidant stability: the followed up stability of AS-F7 at 1 and 2% (wt/wt) mixed in skin cream base for 4 weeks ago at room temperature compared with cream base (control). After that, check the pattern of UV absorption of samples in first time exhibited in figure 2.

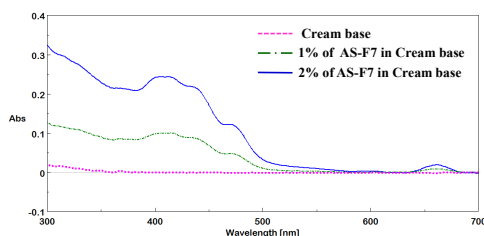


Figure 2. UV spectrum of cream base and cream base mixing with AS-F7 extract at 1, 2% wt/wt.

The cream base lost percentage of antioxidant activity as 4.54 whereas cream base was mixed with AS-F7 at 1

and 2 %wt/wt have lost percentage of antioxidant activity at 4.31 and 2.82, respectively, after followed up stability for 4 weeks ago at room temperature. (Table 5).

Customer Satisfaction Survey

The customer satisfaction survey of skin cream products by purposive sampling found that physical property as texture, touch, color, senses, viscosity, feeling on skin and overall product satisfaction were 4.69, 4.62, 4.69, 4.62, 4.23, 4.23 and 4.69 respectively.

4. CONCLUSION

In this research the ethanol solvent had efficiency extraction than acetone, and all crude extracts were tested the antioxidant activity by DPPH assay. The stem crude acetone extract has been showed higher activity than another them. Then, stem crude acetone extract was separated by column chromatography technique to afford 11 fractions. The five (AS-F2, AS-F7, AS-F8 AS-F10 and AS-F11) from eleven fractions showed antioxidant activity more than 80%. The AS-F7 obtained sticky yellow-brow showed percentage of activity at 85.31% was selected mixing in cream base at 1, 2% wt/wt. The stability of antioxidant of AS-F7 was studied for 4 week. It found that 2%wt/wt has low lost percentage of antioxidant than 1%wt/wt and cream base. The skin cream product has *Ruellia tuberosa* extract in ingredient, was tested by customer satisfaction survey questionnaire of skin cream products by purposive sampling average all questions at level 4.54.

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Removal of reactive dyes using activated carbon beads from macadamia shell

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ABSTRACT

This research aimed to removal of reactive dyes using activated carbon beads from macadamia shell. The adsorption experiments were conducted in a batch setup. Parameters affecting the colour adsorption including pH of a solution, adsorption time, adsorbent dose and colour shade were investigated. With the 1 mg/L dyes solution of pH 9, adsorption time of 3 days and 3.0 grams of activated carbon beads, about 55% of reactive dyes were remove from the solution. The adsorption isotherms could be well explained by Lanmuir and Freundlich models. The adsorption capacities (Q) of activated carbon beads from macadamia shell was 0.1486 mg/g for Langmuir isotherm and the sorption capacities (Kf) was 0.3189 mg/g for Freundlich isotherm. The results showed that the activated carbon beads from macadamia shell could remove colour from dyeing wastewater.

Keywords

Reactive dye, Activated carbon beads

INTRODUCTION

Synthetic dyes are widely used in various branches of the textile industry, leather, paper printing, plastic, pharmaceutical and other industries. (1–3). The discharge of dye-containing effluents into receiving waters causes serious environmental problem (4–6). Moreover, many of dyes are carcinogenic, mutagenic and teratogenic, so they are toxic to human and aquatic organisms. Therefore, removal of dyes from industrial effluents is currently of great interest (7). Several methods of wastewater treatment such as advanced oxidation process (8), aerobic or anaerobic digestion (9) coagulation (10,11) and adsorption (12) have been applied for the removal of dyestuff from aqueous solutions. All these methods have advantage and disadvantages in terms of their effectiveness, cost, and environmental impact (13). Thus, there is a need to develop new effective decolourization and decontamination methods. Among them, adsorption process is widely used because of high efficiency, ease of operation and low cost. A number of materials such as activated carbon, charcoal, graphene and biosorbents have tested to reduce dyes concentrations from aqueous solutions (7). Activated carbon (AC) is a widely known adsorbent material because of its high surface area and surface reactivity (14). It can be used in wastewater treatment to absorb various toxins such as organic compounds, heavy metals and dyes (15–21). However,

the use is limited by the dispersion of AC powder and its low affinity to hydrophobic organic contaminants. (17). Thus, several authors (14,22,23) have proposed the entrapment of AC powder onto biopolymer beads such as alginate. Sodium alginate as a natural polymer, which is abundant, biodegradable, hydrophilic and low-cost, has gained much attention as an adsorbent material for wastewater treatment. It is a linear anionic copolymer composed of β -D-mannuronic acid (M) and α -L-guluronic acid (G) linked by 1-4 glycosidic bonds. The carboxyl and hydroxyl functional groups on the backbone of sodium alginate molecules are hydrophilic and can be easily modified (22). The introduction of alginate as an immobilizing material has highlighted the possibility for the application of AC in industrial processes, such as the removal of organic pollutants (17,22,24), heavy metal (Cd^{2+} , Cu^{2+} , Zn^{2+} , Pb^{2+} , Cr^{3+} , Hg^{2+}) (17,25). In addition, the research report of Devesa-Rey (26) experimented by using activated carbon bead to absorb color in the wastewater from the winemaking process. The results showed that it is effective at removing nearly 100%. The objective of this study was to preparation AC beads from macadamia shell which is agricultural waste. Prepare bead using an alginate gel mixed with activated carbon. Study properties of AC beads and the of dye removal efficiency.

EXPERIMENT

Materials and methods

The activated carbon from macchadamia shell was obtained from DoiTung Chiengrai, Thailand. Reactvie dyes (Sumifix HF Yellow 3R, Red 2B and Blue BG gran) were purchased from Sumitomo Chemical Co. Ltd. Other reagents include ($C_6H_7NaO_6$)n, H_2SO_4 , NaOH, $CaCl_2$ were analytical grade. Instruments employed for the work include spectrophotometer (PG instruments, T110+model), weighting balance (Metler Toledo, XS204), pH meter (Eutech CyberScan PC300) and sieves of about 300-425 μ m size.

Preparation of adsorbent

The AC was prepared by simultaneous carbonization and activation of macchadamia shell using sodium hydroxide as activating agent. Sodium alginate (1-3%w/v) was mixed with 400 mL of DI water at 60 °C under stirring condition. Activated carbon (300 μ m, 1.5-2 grams) was then poured into the alginate solution and mixed with a magnetic stirrer for 3 hr to obtain a homogeneous mixture of the AC and alginate. AC beads were synthesized by introducing the gel matrix into 10% calcium chloride solution. The beads were left in the $CaCl_2$ solution for 12 hr for complete gelation ane were washed with DI waster to remove excess calcium from the beads.

Preparation of adsorbate

The dye stock solution was made to aconcentration of 1 gL^{-1} . The working solutions wereobtained by diluting the dye stock solution in accurate proportions to needed initial concentrations (2-32 mgL^{-1}) and were used to obtained a calibration curve.

Adsorption experiments

Batch adsorption experiments were carried out in 250 mL flasks and the total volume of the reaction solution was kept at 100 mL. The effect of adsorbent dosage on the removal of reactive dyes was studied with different adsorbent dosage (0.05-0.20 g) in a 100 mL dye solution of 2 mgL^{-1} concentration, pH 6.0 and shaken till equilibrium time.

The effect of pH on the removal of dyes was investigated over the pH range of 4.0-10.00 with 3 g of the adsorbent for 1 Hr in a dye solution concentration of 2 mgL^{-1} . The initial solution pH was adjusted using 0.1 M H_2SO_4 or 0.1 M NaOH.

Effect of contact time was studied by using 0.10 g of the ACbeads at ambient temperature and pH 6.0 at different time. The equilibrium data were analysed using the Langmuir, Freundlich isotherms and the characteristic perameters for each isotherm were determined.

After adsorption, the adsorbent and the supernatants were separated by settle for 30 min and samples for analyses (5mL) withdraw with a clinical syringe and analyzed for residual dye concentration using a UV-Visible spectrophotometer by monitoring the absorbance changes at maximum wavelength. The amount of dye adsorbed per gram of adsorbent (q_e) is given as

$$q_e = \frac{V}{m} (c_o - c_e) \quad (\text{Eq1})$$

And the percentage removal (R) was calculated using Eq2

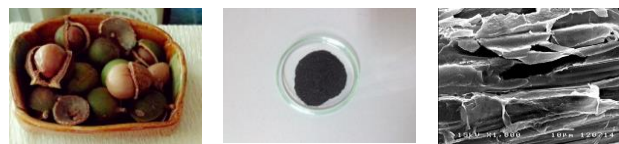
$$\%R = \frac{c_o - c_e}{c_o} \times 100 \quad (\text{Eq2})$$

Where C_o and C_e are the initial and equilibrium dyes concentrations, respectively (mgL^{-1}), V is the dyes solution volume (L), m is the mass of the adsorbent (g)

RESULTS AND DISCUSSION

Synthesis of AC beads from macadamia shell.

The characteristics of AC from macadamia shell are shown in Fig 1.



Macchadamia
shell

AC 300 μ

Morphological
characteristics

Figure 1 Macchadamia shell and AC from macchadamia shell

Factors that affect the production of activated carbon bead.

Study on factors affecting the production of bead such as the amount of AC and sodium alginate. Weigh 1, 2, and 3 grams sodium alginate powder, add 100 ml of water to dissolve homogeneously. Then add 1.5-2 grams AC (300 μ m) into 10% calcium chloride solution. Measured the diameter and observed the

characteristics of beads. The results were shown in Fig 2-3.

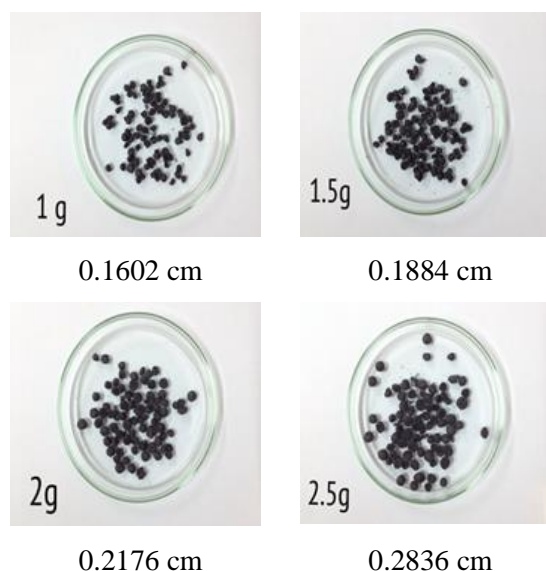


Figure 2 Effect of the amount of AC on the beads characteristics. (1% 20mL sodium alginate and 10% 100mL CaCl_2)

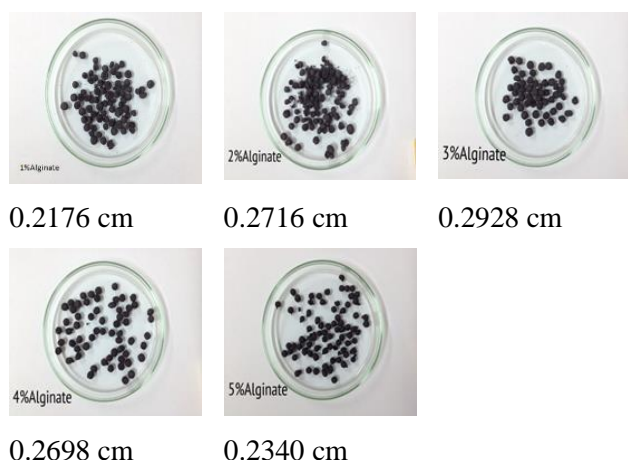


Figure 3 Effect of the amount of alginate on the beads characteristics. (2 grams AC and 10% 100mL CaCl_2)

The results showed that the amount of AC and sodium alginate influenced the difficulty of forming and strength of ACbeads. The optimum condition is 2 grams 300 μm activated carbon, 20mL of 4% sodium alginate solution, and 100mL of 10% calcium chloride solution.

Factors affecting the color removal with ACbeads

Studied on factors affecting the color removal with AC beads including ACbeads dosage, pH, contact time and colour shade. The average dye concentration after treatment was measured and analyzed the variance

at significance level 0.05. The results were shown in Figure 4-7.

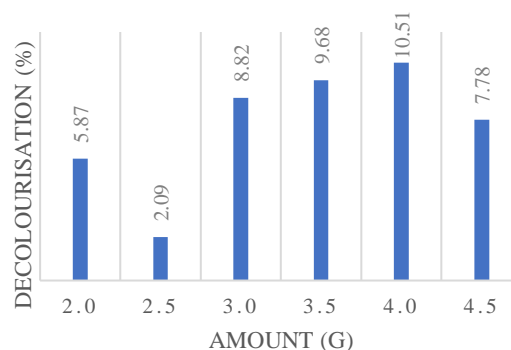


Figure 4 Removal efficiency of blue reactive dyes at various ACbeads dosage.

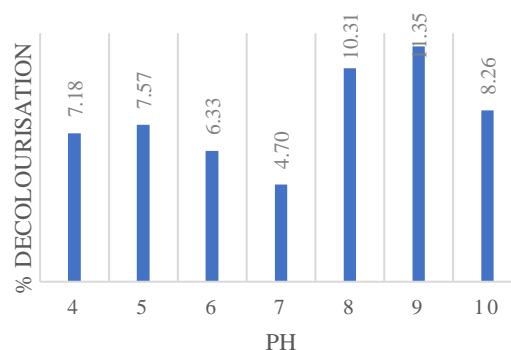


Figure 5 Removal efficiency of blue reactive dyes at various pH values.

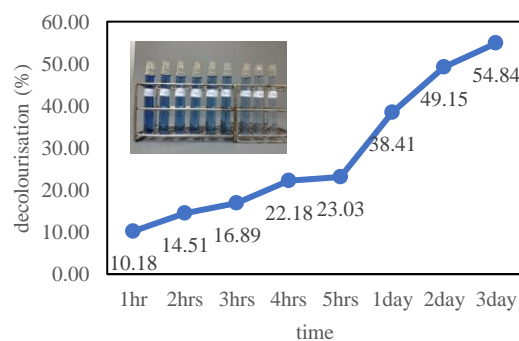


Figure 6 Removal efficiency of blue reactive dyes at various contact time.

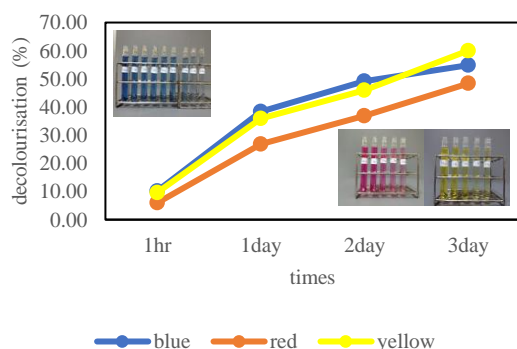


Figure 7 Removal efficiency of blue reactive dyes at various colour shade.

The results showed that the ACbeads dosage, pH, contact time and colour shade had a significant effected on the removal efficiency of reactive dyes with AC beads.

Adsorption Isotherms

Adsorption isotherm were determined using Freundlich and model Langmuir model. The result shown in Figure 8-9 and Table 1

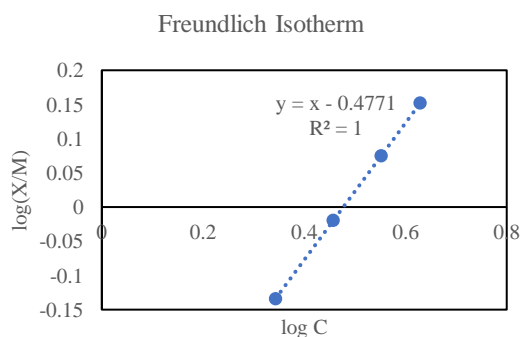


Figure 8 adsorption of blue reactive dye at different time (Freundlich isotherm)

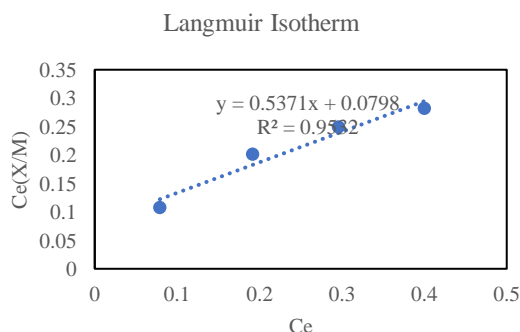


Figure 9 adsorption of blue reactive dye at different time (Langmuir isotherm)

Table1 Parameter of kinetic model for ACbeads.

Freundlich	$Y = X - 0.4771$	$1/n$ 1	R^2 1.0000	$K_f(\text{mg/g})$ -0.3189
Langmuir	$Y = 0.5371X + 0.0798$	$X_m(\text{mg/g})$ 0.5371	R^2 0.9532	$K_L(\text{mg/g})$ 0.1486

As shown in Figure 8-9 and Table1, the correlation coefficient (R^2) of the Freundlich adsorption isotherm model was 1.0000, higher than that of Langmuir adsorption isotherm model, which indicated that the adsorption process was more suitable with the Freundlich adsorption isotherm. The value of the K_f was 0.3189 mg/g of ACbead, and The value of the n was 1, which indicated that the adsorption of ACbeads was mainly a chemical process.

CONCLUSION

This study reported on the possibility of using the ACbeads as adsorbent for the removal of reactive dyes from aqueous solution. Batch adsorption experiments were investigated by various parameters such as ACbeads dosage, pH, contact time and colour shade. The results showed that the adsorption capacity increased with the increased of ACbeads dosage, pH, and contact time. The adsorption data fitted well the Freundlich isotherm.

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Development of Spectrophotometric Method for Determination of Amlodipine by Picric Acid

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ABSTRACT

Development of UV-visible spectrophotometric technique for determining amlodipine using picric acid was proposed. This method is based on the formation of yellow complex which is obtained by the reaction between the primary amine group of amlodipine and picric acid and also absorbs the UV-visible light at 380 nm. Various parameters affecting on the reaction were carefully determined and optimized. The results suggest that the appropriate concentration of picric acid is $500 \mu\text{g mL}^{-1}$. The suitable solvents used for dissolving amlodipine and picric acid are acetonitrile and dichloromethane, respectively. Moreover, the formation of amlodipine-picric complex is independent on the reaction time. The developed method shows linearity concentration of amlodipine in the range of 100 to $400 \mu\text{g mL}^{-1}$. The percentage of repeatability and reproducibility are 0.38 and 3.36, respectively. In addition, the lower detection limit of amlodipine is $0.03 \mu\text{g mL}^{-1}$. This proposed method can be applied to determination of amlodipine in commercial tablets with percentage recovery of 95 – 100.

Keywords: Amlodipine; Picric Acid; UV-visible Spectrophotometry

1. INTRODUCTION

Amlodipine or commercially named Norvasc, a widely used antihypertensive drug, is classified in the medicinal group namely Calcium Channel Blocker which can treat chest pain caused by decreased blood supply to the heart known as Angina pectoris [1]. Chemical name of amlodipine is 2-[(2-aminoethoxy)methyl]-4-(2-chlorophenyl)-1,4-dihydro-6-methyl-3,5-pyridine dicarboxylic acid, and 3-ethyl-5-methyl ester. The chemical structure is shown in Figure 1. Reactive mechanism of the drug is that the structure of amlodipine is converted at liver and released through urinary system. After taking the drug, amlodipine can retain in the blood for 30-50 hours, thus it can react with other drug and have side effects. Hence, the dosage

used for adults is controlled to 5 – 10 mg per day and that for children depends on the discretion of doctor.

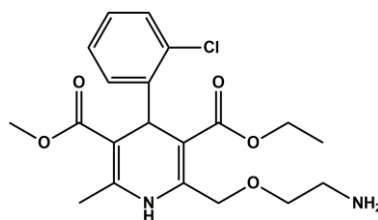


Figure 1 Chemical structure of amlodipine.

Currently, many spectrophotometric method such as HPLC with fluorescence detector [2], UV detection [3-5], voltammetry [6] and LC-MS [7] have been reported for amlodipine analysis but there is not standard method. Additionally, as

known that these instrumentation have requirement of high performance tools, high price, long time of sample preparation and analytical process as well as professional analysts, resulting in high cost. Thus, this present work has focused on method development for analysis of amlodipine using more rapid, simple and high sensitive UV-visible spectrophotometry. It is based on the formation of amlodipine based new complex which exhibits high intensity of absorption band.

There are many reports about the methodology of drug quantitative analysis using picric acid (Figure 2). Sher and coworker has developed the colorimetric visible spectrophotometric technique to determine amount of tranexamic acid and pregabalin by the reaction with picric acid 2,4-dinitrophenol, respectively. The yellow products show maximum absorption at 425 and 418 nm, respectively [8]. In addition, picric acid has been used as a reagent for analysis of gabapentin in a pure drug and capsules [9]. These reports indicate that picric acid is one of potential reagents used for analyzing various types of drug by spectrophotometry but there is no report for amlodipine.

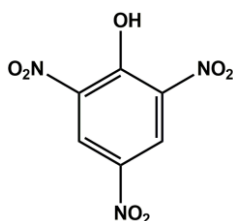


Figure 2 Chemical structure of picric acid.

Therefore, this present work has attempted to develop spectroscopic method to be simple, rapid and high sensitive to quantitate amlodipine based on formation of amlodipine complex with picric acid. Many parameters resulting to the reaction such as type of solvents, concentration of

picric acid and suitable wavelength have been investigated. Finally, this improved method has been applied to analysis of amlodipine in commercial tablet drugs.

2. MATERIALS AND METHODS

2.1 Instrumentation

Detection of the UV-visible signals for all studied parameters were performed on a double beam JASCO V-650 UV-vis spectrophotometer with a high sensitive photomultiplier tube detector.

2.2 Chemicals reagents

All reagents were obtained from commercial sources. Amlodipine was purchased from Pharma. Picric Acid and solvents were obtained from Ajax Chemicals. D-glucose and vitamin C were purchased from APS Chemicals. Sucrose was obtained from Promaster. Starch and sodium chloride were purchased from Ajax Chemicals. The chemical reagents were analytical grade and used without further purification.

2.3 Standard solutions

2.3.1 Stock solution of amlodipine

Amlodipine (0.1000 g) was dissolved in methanol (1 mL), then adjusted the total volume to 100 mL by acetonitrile.

2.3.2 Solution of picric acid

Picric acid (0.0625 g) was dissolved by solvent (dichloromethane, chloroform, acetonitrile, acetone or methanol) and adjusted the total volume to 25 mL in volumetric flask.

2.3.3 Solutions of interference

The solutions of interference were prepared by dissolving starch, D-glucose,

sucrose, vitamin C or sodium chloride (0.0250 g) in acetonitrile. The total volume was adjusted to 25 mL by adding the same solvent into the volumetric flask.

All standard solutions were utilized to prepare sample solutions for studying the optimal conditions of amlodipine analysis.

2.4 Procedure

2.4.1 Method optimization

The suitable wavelength was investigated as described. Picric acid (2.00 mL) was added into the 10 mL volumetric flasks containing amlodipine solution (0.50–2.00 mL). The mixtures were diluted by acetonitrile to the total volume of 10 mL. Absorption band of each sample mixture was recorded on UV-visible spectrophotometer from 375 to 475 nm with acetonitrile used as a blank.

In addition, the effect of picric acid concentration was also determined by adding picric acid (2.0 mL) into 10 mL volumetric flasks containing amlodipine (0.50, 1.00, 1.50 and 2.00 mL). The total volume of mixture solutions were adjusted by acetonitrile to 10 mL and measured the absorbance at 380 nm. The experiments were repeated by changing the volume of picric acid solution to 0.8, 1.2, 1.6 and 2.4 mL.

Effect of solvents was further studied. Amlodipine or picric acid solutions (0.50, 1.00, 1.50 and 2.00 mL) were added into 10 mL volumetric flasks. The total volume was adjusted by addition of dichloromethane, acetone, acetonitrile, chloroform or methanol and measured the absorbance at 380 nm.

2.4.2 Determination of amlodipine in commercial drug samples

The calibration curve was initially constructed from the standard solution of amlodipine. Picric acid (2.00 mL) was added into each 10 mL volumetric flask

containing standard amlodipine solution of 1.00, 2.00, 3.00 and 4.00 mL. The mixtures were diluted by adding acetonitrile to adjust the total volume to 10 mL. The absorbance was measured at 380 nm.

Twenty amlodipine tablets were finely powdered and weighed. An accurately weighed quantity of the mixed power containing an equivalent to 100 mg of amlodipine was dissolved in methanol (1 mL). The final volume was adjusted by adding acetonitrile to 100 mL. Drug solution (3.00 mL) was then added into 10 mL volumetric flask containing picric acid (2.00 mL) and diluted by acetonitrile to obtain the total volume of 10 mL. The absorption bands of all samples were recorded at 380 nm.

3. RESULTS AND DISCUSSION

3.1 Method optimization

For method optimization, a set of four standard amlodipine solutions was measured and the slope of standard curve was determined at different studied parameters.

3.1.1 The appropriate wavelength

Amlodipine analysis is based on the complexation with picric acid. Fitting wavelength is firstly required to reduce the effect of interference and obtain high absorption intensity of the complex. When the solution of picric acid was mixed with the solution of amlodipine in acetonitrile, a yellow product was formed. Absorption spectra of product were scanned from 375 to 475 nm. Upon increasing amlodipine concentration from 50 to 200 $\mu\text{g mL}^{-1}$, an enhancement of absorption intensity was observed with the maximum absorption at 380 nm (Figure 3). It corresponds to charge transfer electron transitions (CT) which have absorption in near visible region [10].

The possible reaction mechanism of picric acid and amlodipine is shown in Figure 4. It is based on the proton transfer from the hydroxyl group of Lewis acid picric acid to the primary amino group of

the Lewis base, amlodipine, resulting in the intensely yellow colored complexes which much more deeply colored than free picric acid when solvated by suitable organic solvents [11].

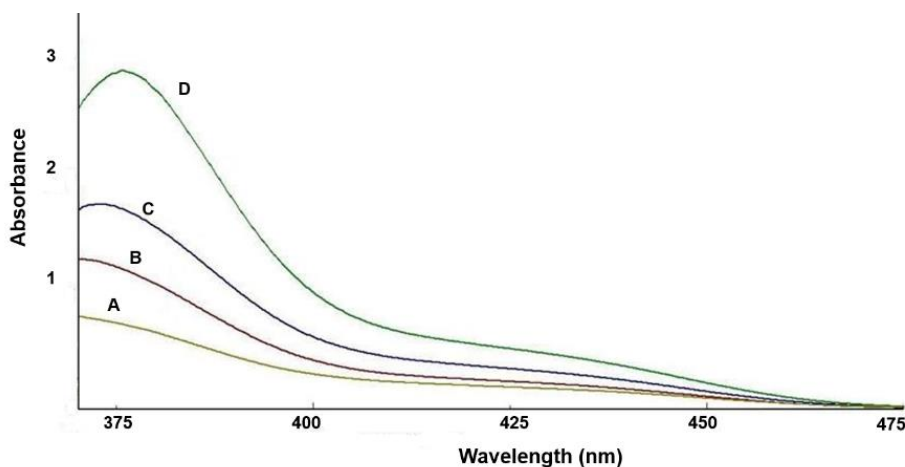


Figure 3 Absorption spectra of yellow product from reaction of amlodipine (50 (A), 100 (B), 150 (C) and 200 $\mu\text{g mL}^{-1}$ (D) and picric acid (500 $\mu\text{g mL}^{-1}$).

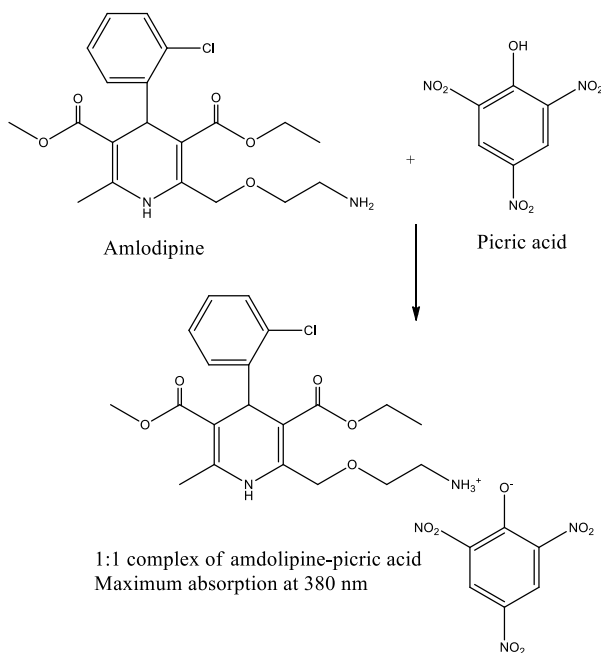


Figure 4 The possible reaction mechanism of amlodipine and picric acid.

Additionally, there is further decision from sensitivity and linear regressive values (R^2). Figure 5 shows the highest sensitivity at 380 nm, confirming that the wavelength of 380 nm is suitable for further studies.

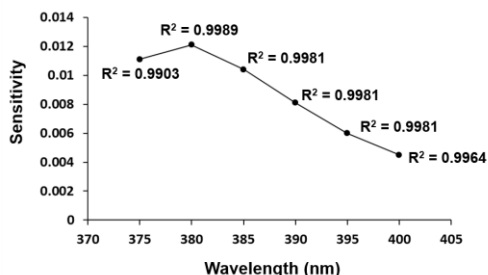


Figure 5 Effect of varying wavelengths on sensitivity for amlodipine determination.

3.1.2 Effect of picric acid concentration

Effect of various concentrations of picric acid were examined to obtain the suitable concentration for amlodipine analysis.

When the standard solutions of amlodipine were mixed by different concentration of picric acid (200, 300, 400, 500 and 600 $\mu\text{g mL}^{-1}$) and measured absorbance at 380 nm, the amount of picric acid affected on absorption of the complexes. The data was analyzed by linear relation of absorbance and concentration of amlodipine. The correlation of slope reflecting to sensitivity and concentrations of picric acid were plotted and inserted with linear regressive values (R^2) (Figure 6). It was observed increasing in tendency of sensitivity from 200 to 400 $\mu\text{g mL}^{-1}$ and decreasing to 600 $\mu\text{g mL}^{-1}$. This evidence indicates effect of picric acid concentration in which at too low concentration, the absorptivity of amlodipine-picric acid complex is low, but at too high concentrations, detection of the complexes would be interfered and lose sensitivity. Moreover, the sensitivity and R^2 values of 400 $\mu\text{g mL}^{-1}$ and 500 $\mu\text{g mL}^{-1}$

were further compared. At 400 $\mu\text{g mL}^{-1}$, it appears higher sensitivity but lower R^2 value than those of 500 $\mu\text{g mL}^{-1}$. Hence, picric acid concentration of 500 $\mu\text{g mL}^{-1}$ would be appropriate concentration to apply for the next experiment.

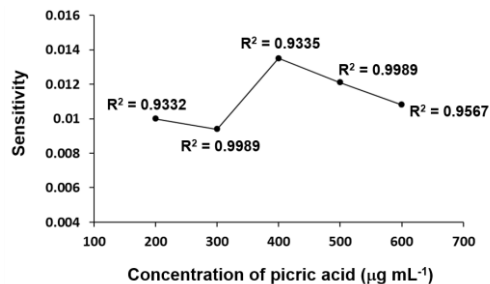


Figure 6 Effect of varying picric acid concentrations on sensitivity for amlodipine determination.

3.1.3 Effect of solvent

Several organic solvents including chloroform, acetonitrile, dichloromethane, acetone and methanol were investigated in order to choose an appropriate solvent for preparation of amlodipine and picric acid solutions, resulting to a good absorption signal of the complexes. For picric acid, it was found that dichloromethane and chloroform provided the slightly different sensitivity. Consideration from R^2 values, it revealed that dichloromethane (0.9989) was more suitable than chloroform (0.9970) to prepare picric acid solutions. In the case of amlodipine, dichloromethane presented the greatest sensitivity of 0.0137 but low R^2 value of 0.9606 which was too low for quantitative analysis. While acetonitrile gave lower sensitivity than dichloromethane (0.0103), its R^2 value was better (0.9818). As a result, acetonitrile was selected to use as a solvents for amlodipine.

3.1.3 Stability of amlodipine-picric acid complexes

The stability of amlodipine-picric acid complexes was examined by

quantifying absorption intensity upon time increase from 1 to 24 min after the reaction taken place. Figure 7 reveals that the absorbance of yellow complexes are most likely similar while time changes, meaning that the time does not affect on the stability of amlodipine-picric acid complex under this experimental conditions. However, in order to control kinetic effect, the absorbance of all samples were detected after reached the reaction for 1 min.

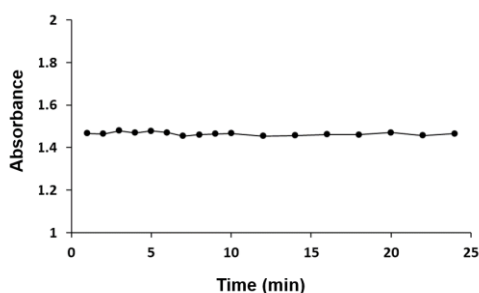


Figure 7 Effect of time on the stability of amlodipine-picric acid complex.

As results, it can be concluded the optimal condition for determination of amlodipine in Table 1.

Table 1 Summarization of the suitable conditions for the analysis of amlodipine by picric acid.

Parameters	Results
λ_{\max}	380 nm
Picric acid Concentration	500 ppm
Solvent for picric acid	Dichloromethane
Solvent for amlodipine	Acetonitrile
Reaction time	1 min

3.2 Method validation

3.2.1 Linear range

According to the optimization of various parameters including wavelength, solvents, time and concentration of picric acid, the linear range of standard solution

of amlodipine was further investigated with triplicate measurements. Calibration curve can be plotted by linear correlation of absorbance and the concentration of amlodipine (Figure 8). The results shows that the concentration of amlodipine which corresponds to Beer's law and in linear range from 100 to 400 $\mu\text{g mL}^{-1}$ can be used for quantitative analysis of amlodipine.

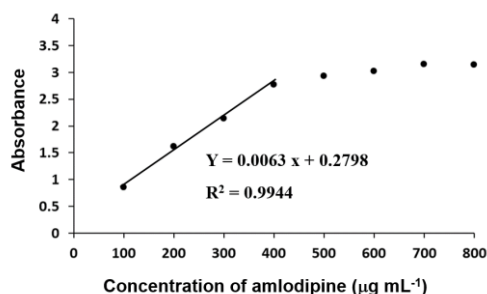


Figure 8 Linear range and calibration curve for amlodipine analysis.

3.2.2 Spectrophotometric parameters

After obtained the calibration curve, the spectrophotometric parameters were also studied and summarized in Table 2.

Reproducibility and repeatability shown by average absorbance value with standard deviation (SD) and percentage of relative standard deviation (%RSD) indicate that the improved analytical method has high precision with LOD of 0.03 $\mu\text{g mL}^{-1}$ and can repeat sample analysis obtaining good results and low deviation.

3.2.3 Effect of interferences

Effect of many interferences was investigated by measuring absorption intensity of the complex (100 $\mu\text{g mL}^{-1}$) in the presence of selected interferences including starch, glucose, sucrose, vitamin C and sodium chloride (50-300 $\mu\text{g mL}^{-1}$). It is found that at lower concentration than 200 ppm gives percentage of deviation less than 5%, meaning that the interferences do

not affect to the analyze. In a contrast, at higher concentration than 300 ppm shows more than 5% deviation caused by the interferences.

Table 2 Parameters of spectrophotometric analysis

Parameters	Results
Beer's law limit	100-400 ppm
Linear equation	$y = 0.0063x + 0.2798$
R^2	0.9944
Reproducibility	1.4498 ± 0.0488
($\bar{X} \pm SD$)	%RSD 3.36
Repeatability	1.5141 ± 0.0057
($\bar{X} \pm SD$)	%RSD 0.3783
Limit of detection (LOD)	0.03 ppm

3.4 Determination of amlodipine in drug samples

The improved method was applied to quantitate amlodipine in drug samples A, B, and C by using the calibration curve constructed from the standard solutions of amlodipine as shown in Figure 7. As a result, amlodipine was found in drug samples A, B and C of 8.63, 4.45 and 8.73 mg/table, respectively. When compared with the labeled amounts of 10, 5 and 10 mg/table, respectively, by using T-test and F-test statistics, it shows 95% confidence level which can be acceptable and percent recovery of 95.1-99.9% indicates the efficiency of the developed method of amlodipine analysis.

4. CONCLUSION

The UV-visible spectrophotometric method has been developed for amlodipine analysis in drug samples by formation of yellow amlodipine-picric acid complex. According to the results of method optimization and method validation, it reveals that this method shows high

sensitivity, good accuracy and precision and high percent recovery. Furthermore, it also is simple, rapid and efficient for quantitative determination and would be applied for analysis of drugs in the pharmaceutical laboratories.

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Antioxidant activity and secondary metabolites of *Abutilon indicum* (Linn.) Sweet from the central region of Thailand

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ABSTRACT

The antioxidant activity is considered to be an important property of medicinal plants, and much of this is associated with secondary metabolites, such as polyphenols and alkaloids. This paper describes determinations of the antioxidant, polyphenol and alkaloid contents of leaves of the medicinal plant *Abutilon indicum* (Linn.) Sweet from Ratchaburi Province in central Thailand. Fresh leaves were extracted by maceration and sonication using 70%, and 95% aqueous ethanol. Antioxidant activities, total phenolics and alkaloids were then determined in the crude extracts by the DPPH, Folin-Ciocalteu and Bromocresol Green methods, respectively. 70% aqueous ethanol extracts obtained by sonication showed the strongest antioxidant activities, and the highest total contents of phenolic compounds, whereas the alkaloid content was highest in the 95% ethanol extract obtained by sonication. The results from this study demonstrate that the sonication method is the most suitable for extraction of secondary metabolites from *Abutilon indicum* (Linn.) Sweet leaves, but different solvent systems favour the extraction of different components.

Key Words: Antioxidant, total phenolic compounds, sonication, alkaloid, *Abutilon indicum* (Linn.)Sweet

1. INTRODUCTION

Abutilon indicum (Linn.) Sweet is a shrub in the *Mavaceae* family and grows abundantly in Asia. It has been used in various traditional medicines and has been reported to possess chemical components that are associated with a variety of beneficial properties, such as for example, anti-inflammatory [1], and anti-arthritis [2] activities. Recently, our research has found that 70% aqueous ethanol extracts obtained by sonication of *A. indicum* leaves have good antiviral activity [3]. In the present study, we have investigated the antioxidant activity of 70% and 95% aqueous ethanol extracts of *A. indicum* leaves, along with their total contents of phenolic compounds and alkaloids.

2. MATERIALS AND METHODS

1. Source of materials

Abutilon indicum (Linn.) Sweet leaves were collected in Ratchaburi Province, central Thailand. Fresh leaves were washed and dried in air at room temperature, then ground and extracted using both maceration and sonication.

2. Extraction by maceration

Maceration was carried out using 50 grams of ground leaves soaked in 300 ml of 70% or 95% aqueous ethanol for 72 hours at room temperature. The extracts were collected and filtered through muslin cloth following by Whatman No. 1 filter paper.

3. Sonication extraction

50 grams of ground leaves were sonicated using the same solvents and plant: solvent ratios as in the maceration method. Mixtures were placed in an ultrasonic bath at room temperature for 30 min, and the extracts collected and filtered through muslin cloth followed by Whatman No. 1 filter paper.

4. Antioxidant activity

Antioxidant ability was determined using DPPH assay, with ascorbic acid was used as standard.

5. Total phenolic content

Total phenolics were determined using the Folin-Ciocalteu reagent.

6. Alkaloid determination

Alkaloids were estimated spectrophotometrically as products of the reaction with Bromocresol Green (BCG).

3. RESULTS AND DISCUSSION

1. Antioxidant activity

The antioxidant activities expressed as IC_{50} values of the 70% and 95% aqueous ethanol extracts obtained by the sonication and maceration methods are shown in Table 1. The 70% aqueous ethanol extract obtained by sonication had the lowest IC_{50} value (0.221 mg/ml), and thus the strongest antioxidant activity.

Table 1 IC_{50} values for the crude extracts of *A. indicum* (Linn.) Sweet

Solvent	IC_{50} (mg/ml)	
	Sonication	Maceration
70% aq. ethanol	0.221	0.320
95% aq. ethanol	0.319	0.450

2. Total phenolic content

The total phenolic contents of the 70% and 95% aqueous ethanol extracts obtained by the sonication and maceration methods are shown in Table 2. The 70% aqueous ethanol extract obtained by sonication had the highest content of phenolic compounds.

Table 2 Total phenolic contents of crude extracts of *A. indicum* (Linn.) Sweet expressed as mg/g gallic acid)

Solvent	mgAE/g of extract	
	Sonication	Maceration
70% aq. ethanol	202.10	135.20
95% aq. ethanol	198.40	120.85

3. Estimation of alkaloid contents

The total alkaloid contents of the 70% and 95% aqueous ethanol extracts obtained by the sonication and maceration methods are shown in Table 3 as the products of their reaction with BCG. In these determinations, the highest alkaloid contents were obtained with the 95% aq. ethanol extract using the sonication method.

Table 3 Alkaloids contents of crude extracts of *A. indicum* (Linn.) Sweet

Solvent	mgAE/g of extract	
	Sonication	Maceration
70% aq. ethanol	7.53	5.740
95% aq. ethanol	10.19	8.51

Various techniques and solvent systems have been used for extracting important components from plants. Although maceration is often used in classical methods, sonication is more convenient to use.

4. CONCLUSIONS

The results from this project have demonstrated that sonication is more efficient than maceration for the extraction of antioxidants and secondary metabolites from leaves of *A. indicum* (Linn.) Sweet. The highest antioxidant activity and phenolic contents were obtained with 70% aqueous ethanol extracts, whereas the highest alkaloid contents were obtained with 95% aqueous ethanol extracts.

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Project professional standards and qualifications. Professional business cleaning: Domestic Housekeepers

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ABSTRACT

This research aims is intended to develop professional standards and professional qualifications in cleaning services business to be used in the certification of professional qualifications for the Thai labor in countries, significant force in driving the national economy. The process Certificate of standards, professional competencies. Centric collaboration the development of professional qualifications in the national and international level. Thailand Professional Qualification Institute (Public Organization): TPQI has cooperation with Rajamangala University of Technology Krungthep research project the preparation of occupation standards and professional qualifications. Project professional standards and qualifications. Professional business cleaning: Domestic Housekeepers. We have made professional standards and professional qualifications to link with professional qualification framework (TPQF). Analytical study about Domestic Housekeepers in Philippines. Draft document Professional business cleaning: Domestic Housekeepers present to 10 committees certification standard, 50 accessories and solve a resolution (of a meeting). Make research' tools assess capacity and work 53 peoples.

The research found that Profession standards and professional qualifications are divided into the following five qualified professional qualifications. Professional business cleaning : Domestic housekeeper Class 1 , Class 2 , Class 3 , Class 4 and Class 5 . The experimental sample, a housekeeper housework daily routine company, housekeeper apartment/condominium. Founding that: Professional qualifications of the first class 13 persons, the second class 10 persons, the third class 10 persons and the forth class 10 persons passed the assessment. The Fifth class 10 persons were not passed the assessment.

Keywords: professional standards; professional qualifications; business cleaning; domestic housekeepers; competencies

Introduction

Housekeeper occupation is important in the current life, whether residential type housing, offices, accommodation services and other business to do the area cleaning and arrangement, preparing the food as well as take care the members of the various ages in the present family. At present, the housekeeper business is not a business to be overlooked. The Kasikorn Research Center Company had predicted in 2007, the number of people working in the home service was estimated to be 400,000 persons and

generated about 27,000 million baht in salary, based on the average salary received from interviews with home service workers. The rate of pay will vary depending on the work experience and employer satisfaction. Domestic servants are divided into 3 categories as follows:

1) Thais who work in home-based occupations in Thailand.

2) Foreign workers who come to work as domestic servants are divided into 2 groups, licensed by the Ministry of Labor and the smugglers.

3) Thais who work as domestic workers in foreign countries

At present, the housekeeper provision agency of both domestically and internationally have no government agency assignment. In order to support these businesses to grow up, there should be establish a government responsible agency to manage the foreign countries housekeeper center standard, employee standard and impose punishment on criminal cases and civil cases of employees. Therefore, regulation should be regulated in accordance with act of The National Skill Standards Council in National Skill Standards of maid assistance occupations which refers to the national skill standardization of maid assistant 1st level consists of criteria for measuring academic knowledge, ability, etc. (Government Gazette: Volume 127, Special Chapter 100, page 40)

The establishment of professional qualification standards is a Thailand national policy, which is the duty of the Thailand Professional Qualification Institute (Public Organization), responsible to establish the occupational qualification standards, certificate employees qualification skill in according with occupational standards, evaluate the performance of employees according to each occupational standards and comply the national occupational qualifications of Thailand with the AEC qualification standard for international working in 2015. Created an occupational qualification network, development and dissemination the occupational qualification standards of housekeeper to be recognized and accepted in all sectors. The Rajamangala University of Technology Krungthep has cooperated with Thailand Professional Qualification Institute (Public Organization) to established a professional occupational qualifications standard in housekeeper, otherwise, establish professional qualifications framework and criteria for determine the personal qualifications in order to improve cleaning services business and housekeeper occupational business to meet manpower efficiency standard for compete in the ASEAN and international economic community.

Research Objectives

To establish the occupational qualifications standards of cleaning service business in housekeeper

Method

This research is divided into two parts: Part 1: Establishing professional occupation qualifications standards of cleaning services business in housekeeper by doing a research and part 2: quality assurance by performance appraisal and housekeeping practice; the data from the research Part 1 is used to determine the evaluation criteria. Detail of both parts are as follow.

Part 1 Establishing professional occupational qualifications standards of cleaning service business in housekeeper. The procedure are as follow.

1. Promote the implemented professional occupation qualification standards of housekeeper to relevant agencies, entrepreneurs and stakeholders to know at least 5 times (5 types of media)

2. Coordinated and invited relevant agencies, stakeholders and concerns to attended the meeting on the professional occupation qualification standards in housekeeper. Starting from, divided housekeepers (occupation owners) in the meeting to be 4-5 groups, informed the objectives of this project to all participants, discussed about actual activities of each housekeeper, attitude toward housekeepers and then gathering and analyzing to corrected all information on housekeepers. The meeting was conducted twice.

3. Studied, analyzed information and details related to housekeeper groups in the Philippines. Approach their objective, procedures and results of data analysis related to housewife group in foreign countries.

4. Draft Functional Map, Key Purpose, Key Role and Key Function to set the professional occupation qualification standards in housekeeper and set the qualification level regarding to the professional qualification framework TPQF.

5. Organize a workshop to stipulate unit of competency, an Element of Competence, a Performance Criteria, a Range Statement, an Evidence and Assessment Guidance.

6. Organized Public hearing and analyzing by invited the participants from all concern sectors at least 50 attendees and invited Professional Accreditation Qualification Board to attend the meeting. Finally, present the results of the professional occupation qualification standardization to the Professional Qualifications Accreditation Committee of 10 persons.

Part 2: Quality Assurance, Performance Appraisal and Housekeeper Practices.

The procedure are as follow.

1. Create performance appraisal form and performance appraisals for housewives in practices by using professional occupational qualification standards of cleaning services business on housekeeper to be using as the evaluation criteria.

2. Examined the quality of the testing tool in terms of content validity by submitted a list of experts who will examine the performance appraisal tools and the performance appraisal form.

3. Evaluated the quality of the instruments and the internal consistency of performance appraisal system in practice by testing with housekeepers 10 persons covering 5 levels.

4. Analyzed and summarized the results of the performance appraisal assessment process. Present the tested results to the Professional Qualifications Accreditation Committee for approval.

5. Concluded results of the standardization of professional qualification standards and accreditation level. Promote process and result this project to public, relevant agencies, stakeholders and concerns at least 5 times.

6. Present the operation manual of occupation qualification standards in housekeeper to the committee for approval.

7. Set the meeting together to prepare assessment manuals and evaluation tools and make a completed report.

Research result

The research results of professional occupation qualification standards of cleaning services business in housekeeper is divided into 5 levels, 24 units as follows:

Level 1 Housekeeper has skilled in assigned routine works such as cleaning house and appliances, on both inside and outside of the house, caring for clothing and apparel by laundry, ironing to be ready for use, prepare foods and service to family, caring all person in home and can solve the basic problems but base on closely supervised by the employer. It consists of performance competency 7 units.

1011 Selects, maintains and store the cleaning solution and tools for cleaning inside house.

1012 Clean all area inside the house.

1013 Clean bathroom ware and arrange its accessories.

1021 Selects, maintains and store the cleaning solution and tools for cleaning outside house.

1022 Clean the floor and walls outside the house.

1023 Maintenance and care outside the house.

3041 Work as professional in practices.

Level 2 Housekeeper has skilled in works such as cleaning the interior and exterior with appliances of the house, caring for clothing and apparel by laundry, ironing to be ready for use, prepare food with prepare food ingredients for cooking and service to family, caring all person in house and can solve the basic problems for example has knowledge about safety of cleaning chemicals product, can applied knowledge and tool under as assigned and supervised by the employer. It consists of performance competency 4 units.

1014 Prepare all room to be ready for use.

2011 Washing the clothes by hand.

2012 Washing the clothes by washing machine.

2032 Caring for clothing and storage.

Level 3 Housekeeper has good experience skills in works such as cleaning the interior and exterior with appliances of the house includes care lawn and garden, clean the house fence, select suitable cleaning products apply for sanitary ware, floor of bathroom and another room floor. Prepare bedroom, living room, and kitchen for all family members, caring and repairing the clothes and apparels. Able to apply technique, create some idea to improve work process in practice, can use instruction manual and

concerns by under supervise by employer. It consists of performance competency 8 units.

- 1031 cleaning of furniture.
- 2021 Ironing with normal electric iron.
- 2022 Ironing with steam iron.
- 2031 Repairing the clothes.
- 3021 Arrange the food table.
- 3022 Serve the food.
- 3031 Primary care children.
- 3032 Care for the elderly in the home.

Level 4 Housekeeper has technical skills applied in work, skills can create new idea to improve work practice. such as cleaning the interior and exterior with appliances of the house, maintain lawn, arrange the garden, clean the house fence road and drainage system, select suitable cleaning products apply for sanitary ware, floor of bathroom and another room floor. Service and comfortable caring to all family members, caring and repairing the clothes and apparels. Able to make decision in assigned work based on technical information and fact. It consists of performance competency 6 units.

- 1032 Cleaning Appliances
- 3011 defines food items
- 3012 Buy raw materials
- 3013 Choose the tools and equipment for cooking.
- 3014 Could cook
- 3041 Have good control work and coaching subordinate.

Level 5 Housekeeper has a fourth-level housekeeper qualification and passed the qualification evaluation on level 5 of the occupational qualification standards in housekeeper, consists of performance competency 1 unit.

Workshop evaluation and performance appraisal model for housekeeper with housekeeper samples 10 persons (5 levels) found that the qualifications. Maid Job levels 1, 2, 3 and 4 were passed all assessments but no person pass for the 5th level.

Discussions

Professional occupational qualification standards of cleaning services business in housekeeper provides comprehensive detailed and cover information on housekeeper occupations. Both the professional qualification level determined by the qualification level conformed to occupation standard. The framework for each level of qualifications occupation standard describes the rules, knowledge, skills, desirable qualities, responsibility, productivity, innovation and the difficulty of the work. To meet the needs of both business and industry. It is also linking and equalize to qualification education system in country and international education qualifications.

Performance appraisals and workshop appraisals of housekeepers have a difficult level depend on occupational qualification levels. The first level is the ability or basic qualification that every housekeeper should practice. The higher level indicate more specific the ability. The skill must be qualified or experienced in housekeeper to meet the defined criteria. Therefore, housekeeper should be encouraged to have their own responsible agency, has an exchange of ideas for develop of their careers, encourage the housekeeper group understand the necessary join evaluating of occupational qualification as urgent issue. Considering to feasibility study, information, knowledge sharing and training can improve ability and qualification to be achieved professional occupation qualifications necessary to develop Thai labor potential compete in the ASEAN and international economic community.

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The Model of Language Competency Development of the Bangkok-Private – Hospital Nurses in the ASEAN Economic Community

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ABSTRACT

The purposes of the research were to determine the Model of Language Competency for developing the four language skills of the Bangkok- Private - Hospital Nurses in order to communicate with foreign customers, to study the possibility of the model ,and to evaluate the appropriateness itself. Data were collected via the 20-item quantitative survey of 125 nurses in a private hospital in Bangkok where many foreign patients use medical services. The findings showed that the nurses in the private hospital in Bangkok need to improve listening skill, listening for foreign patients' profiles and medical histories and listening for foreign patients' signs and symptoms are the most requirements to be improved. The results brought to create 'The Model of Language Competency Development of Bangkok- Private – Hospital Nurses in the ASEAN Economic Community'.

KEYWORDS: Model, Language Competency, English, Bangkok- Private – Hospital, Nurse, ASEAN Economic Community

INTRODUCTION

According to the expansion of the economy in Thailand, the important factor is an income from the hospitality industry, which is private hospitals. And a number of them are increasing. Thailand's industry receives the income from the private hospitals around 150,000 million a year. The private hospitals serve the patients about 55 million times a year and the patients come from 200 countries around the world (The Committee of Australian Private Hospitals Association, 2012). Especially, in Bangkok, there are patients around 2,072,000 in private hospitals (Australian Private Hospitals Association, 2012). According to the survey of the National Statistical Office (2012), the private hospitals and clinics were established from the following Sanatorium Act B.E.2541, there are 321 private hospitals and most of them have more than 500 beds. A number of foreign patients are around 3 million from all 43.6 million. Besides, most of them access the medical services from the private hospitals that consisted of 100 beds up as well as both are 95.4% and 4.6% of the hospital patients of the outpatients.

The growth of private hospitals in Thailand is based on these factors.

Firstly, according to the committee of Australian Private Hospitals Association (2012) stated that tourists are motivated by cheap airline tickets and the Tourism Authority of Thailand promotes Thailand to become the Tourism Hub (Tourism Authority of Thailand, 2015), therefore, many foreigners come to Thailand for travelling, while travelling, they might be sick or have unavoidable accidents. Therefore, they need to go to the private hospitals in Bangkok.

Secondly, since the past ten years, the standard and reliable private hospitals in Thailand have been the one of the world's popular medical tourism so the foreigners travel to Thailand for medical services. Therefore, the private hospitals play the important roles in developing the country, especially, without the supporting from the government taxation. Besides, the private hospitals standardized from HA (Hospital Accredited) and JCI Accredited Organizations while none of the governmental hospital gets JCI (The committee of Australian Private Hospitals Association, 2012). Consequently, private hospitals have been credible for foreign patients.

Thirdly, because the living costs in Thailand are lower than the neighbor countries, that is to say, the retired

people in developed countries tend to move to Thailand for benefit of life then the medical services in private hospitals in Bangkok are unavoidable for them. Consequently, the private hospitals in Bangkok are expensed (The committee of Australian Private Hospitals Association, 2012).

Fourthly, the establishment of the ASEAN Economic Community, as a result, it affects the growth of emigration of neighboring labors. They immigrate to Thailand for work. Because of this a number of labors in the next 2-3 years will be about 5 million from 2 million at the present time (The committee of Australian Private Hospitals Association, 2012). Moreover, the ASEAN rule number 34 stated that "The working language of ASEAN shall be English" (Nopporn, 2015). It is obvious that English is more important as a tool for communication among ASEAN people who are non - native English speakers. Thus, in case of medical services, the immigrants need to go to private hospitals.

Fifthly, the government announced the policy - Thailand will become the Medical Hub, therefore, the private hospitals in Bangkok are the most appropriate for becoming the representatives because they are well prepared and have been improved their images in order to be the international hospitals. Furthermore, Thai medical profession - doctors and registered nurses are famous and acceptable, and the cost of medical service in Thailand is cheaper than some neighbor country's medical cost. Beside, among the ASEAN countries, there are only five countries, Thailand, Singapore, Indonesia, Philippine and Malaysia have got JCI. In fact the hospitals in Thailand have got JCI most (Sampan, 2012). So, it can be said that the private hospitals in Bangkok are the strength of Thailand.

Finally, the geography of Thailand is the center of the provincial part which is between the peninsula and islands, also Thailand is the passageway to reach to China and India (Sampan, 2012).

As a conclusion, all above factors are mentioned earlier are the strength of Thailand, on the contrary, the medical profession, nurses - people who communicate firstly and directly with the foreign patients. They are not well enough in English communication. If they are parallel to the nurses in rival countries: Singapore, India, and Malaysia which are competitors of Thailand. Their English hospital staffs are better than the Thais (Kasikorn Thai Research, 2010). It may some people in ASEAN are good at English because they use English as a second

language and an official language. ESL - English as a Second Language is taught so their people can use English very well. On the other hand, Most Thais learn English as EFL - English as Foreign Language (Montree et al., 2012) and a few Thais can communicate in English efficiently (Patchanee et al., 2012). Therefore, we have already realized that we are weak in English so maybe this is the problem of Thais in communicating with ASEAN people or other foreigners who use English for communication because the misunderstanding can be occurred and it can blow Thailand's best opportunity. It is cleared that the staff are very important for moving forward the private hospital industry in Thailand and the nurses are the most insignificant because they are people who contact customers directly and nursing is a profession that can work freely in the region. So improving English for nursing in Thailand is immediately needed to be done.

From above statement of the problem, the researcher conducts the research for determining 'The Model of Language Competency Development of Bangkok - Private - Hospital Nurses in the ASEAN Economic Community

REVIEW OF RELATED LITERATURE

English for International Communication

Nowadays, English is the most powerful tool for communication. Most people around the world, approximately more than 350 million are English native speakers and more than 400 million of speakers use English as a second or foreign language (Kitao, 1996). M. Caine, 2008 (cited in Kachru, 1986,1996) stated that English are divided into 3 circles, the Inner Circle, the Outer Circle and the Expanding Circle.

Thailand is in the Expanding Circle, Thai people learn English as a Foreign Language. In case of Thailand, English is being used for international communication, for example, English in work place, the office workers interact with the foreign boss and the customers, the sellers speak English to the tourists, the waiters in the reaturant take care of their cutomers, nurses in private hospitals take care of their paitents and etc. It can be concluded that, English is being used for international Communication, especially in Thiland.

English for Specific Purposes (ESP)

According to Robinson (1991), English is the key to access the knowledge and to enter to the international technology and commerce so not only

learning English as General English but also English for Specific Purposes (ESP) is very important. The need of learning ESP is increasing sharply and it can be said that EPS plays an important role for international Business. ESP can be divided into 2 groups according to the requirements of learners - first, English for Academic Purposes, for academic study and second, English for Occupational Purposes, English for vocational Purpose, Vocational English as a Second Language for working and training.

ESP focuses on the English language that be used in the real situation in the workplace, for example, tourism, science and technology, engineering and medicine, etc. ESP emphasizes on four features, which are language skill, structure, functions and vocabulary that it can be argued that "ESP is an approach to language learning which based on learner's need" (Hutchinson and Water, 1994). In addition, the ESP can be grouped into two types which are English for Academic Purposes (EAP) - learning English for academic Purposes and English for Occupational Purposes (EOP) - learning English for Business Purposes, for instance, English for Medical Purposes and so on. Since ESP is the equipment to bridge the gap of the needs of learners in order to work efficiently in their work. The five steps is going to find out the ESP are as follows:

Step 1: Need Analysis - to identify what the learners' needs

Step 2: Course and Syllabus design to collect the data from the need analysis procedure

Step 3: To produce the material according to the requirement

Step 4: To teach and to learn

Step 5: To assess and evaluate ESP

(Rabiathul Adhabiyyah binti Sayed Abudhahir, Mahanum binti Mahdun, Aliyatulmuna Md. Nor, 2014).

In summary, ESP is for people who use English in their real working situations and environments in order to work efficiently.

Needs Analysis

Vičić (cited in Haycraft, 1987) said that need of learners is motivated because it is what they want to learn and their desires. In order to meet the needs of ESP learners, using questionnaire and doing interviews with the participants are the useful methods. According

to Rabiathul Adhabiyyah binti Sayed Abudhahir, Mahanum binti Mahdun, Aliyatulmuna Md. Nor, 2014 (cited in Jordan, 2011), the needs of learners can be analyzed as necessities, wants and lacks. What they should know in order to be able to communicate efficiently in a real situation is a necessity. Wants and lacks are related - that is - the lacks focus on what learners have and have not known, therefore, the wants is needed to be fulfilled the lacks. The method of setting 'what' and 'how' determines needs analysis. This approach considers Objective Needs - collecting by obtaining facts from outside source, in the other hand, Subjective Needs are gathering facts from the cognitive and affective factors of the inside source of a community (Evans cited in Dudley Evans & St. John, 1998).

In accordance with Tariq Mahmood Khan¹, Ghulamullah², M. Naeem Mohsin³, Ashiq Hussain Dogar⁴ and Ahmed Sher Awan¹ (cited in Allwright 1982) mentioned that students' perceptions in their areas were the beginners of the Strategies Analysis. Strategies Analysis was grouped into three sections - those are - Need (most relevant and important skill), Wants (the needs on which learners rate in high priority and need to be learned in limited time.), and Lacks (talking about previous knowledge that they have already known and what they need to know). Thus the purpose of the need analysis is getting to know what area of English that the learners as the English users would like to improve in their real working life.

Bangkok - Private - Hospital

According to the World Health Organization - WHO, gives the meaning of the Hospital that "Hospital is an integral part of a social and medical organization, the function of which is to provide to the population complete health care, both curative and preventive, and whose outpatient services reach out to the family in its home environment, the hospital is also a center for the training of the health workers and Biosocial research." It can be said that the hospital is a part of social and community. The hospital is in charge of keeping people who have good health including the healing, disease preventing and warm servicing as the member of the family. Moreover, hospital is the center of the Public Health Technical Officer and Biochemistry Research. Hospital is the organization which focuses on the healing patient (Janjao, 2010 cited in Viroj, 1997). The hospital is an important and a necessary public health center that aims to response the need of the patient or client (Janjao, 2010 cited in Prapai, 1997). The Sanatorium ACT B.E. (2nd Edition) (1998) pointed

that sanatorium means a place and a vehicle which is recorded for practicing of the art of healing.

There are two reliable ways to clarify the categories hospitals which are the classification (Janjao, 2010 cited in Lapasiri, 2000) based on hospitals' services; namely; Secondary care center, University hospital and Chronic hospital. Moreover, hospitals can be divided into the hospital' owners and controllers, these are Public hospitals and Private hospitals. Public hospital - the government own, controls and serves medical care to people. There are 13 hospitals which be classified as follows:

Firstly, the hospitals are affiliated with Office of the Permanent Secretary for Public Health - Rajavithi Hospital, Priest-Hospital, Lerdsin Hospital and Nopparat.

Secondly, the hospitals are affiliated with the Ministry of Defense - Phramongkutklao Hospital, Bhumibol Adulyadej Hospital and Somdejprapinklao Hospital.

Thirdly, the hospitals are affiliated with the Ministry of Interior - Police General Hospital, Rachatan Hospital,

Fourthly, the hospitals are affiliated with the Ministry of Transportation and Communications - Highways Hospital.

Fifthly, the hospitals are affiliated with Ministry of Education - Siriraj Hospital and Ramathibodi Hospital.

Sixthly, the hospitals are affiliated with State Enterprises - MEA Hospital, Veterans General Hospital and Burachat Chaiyakorn Hospital.

Seventhly, the hospitals are affiliated with independent entity - King Chulalongkorn Memorial Hospital.

Eighthly, Private Hospital was established by the private sector who was a person or a group of person and served the medical care for people and it supported the services that the government had not been able to serve the need of wealthy patients so this group of people tended to go to the private hospital because it was comfortable and faster than others. The private Hospital could be clarified by the characteristic owner, management, ownership, and supported funds.

Finally, Medium Charity Private Hospital - Hospitals do not expect the profit and be exempt for the registered fee. The private hospitals are managed by the

foundation, association, charity, for example; Bangkok Christian Hospital, Saint Louis Hospital, and Mission Hospital Bangkok, etc.

Commercial Private Hospitals serve people for treating in 4 areas, syneresis, health promotion, treating and restoration. They try to benefit from the management which is able to be established variously, namely, the single owner, limited partnership, and the company (Orapen, 1993). In addition, hospitals still are clarified as size by considering the number of beds. There are 5 groups (Janjao, 2010 cited in Annop, 1993).

OBJECTIVES OF THE STUDY

The objectives of the study are:

2.1 To determine the appropriateness of the Model of Language Competency Development of Bangkok- Private - Hospital Nurses

2.2 To study the possibility the appropriateness of the Model of Language Competency Development of Bangkok - Private - Hospital Nurses

2.3 To evaluate the appropriateness of the Model of Language Competency Development of Bangkok- Private - Hospital Nurses

METHODOLOGY

Subjects and subject selection

There was one target population for the study: nurses in the Private Hospital Business which was accessed to medical services by many foreign patients. The target population selected nurses from the Private Hospital Business which was accessed to medical services by many foreign patients and with more than 100 beds up by Stratified Random Sampling.

Instruments

The instruments used in the study were the informal observation and the questionnaire. The questionnaire were divided into 2 parts, part1: Background Information and part 2:English for nursing, which Basic English skills do you need to improve the most.

Procedures

There were three procedures that were used to collect the data to identify needs of English for nursing within the context of the Private Hospital in Bangkok.

Firstly, the preliminary study for constructing a questionnaire. Secondly, do the informal observation. Lastly, do the questionnaire.

Data analysis

The data was obtained from the questionnaire and was calculated into the frequency, the percentage and the open-ended questions were analyzed by content analysis technique.

RESULTS AND DISCUSSION

The results of the general background from part 1 are as follows:

1. Age: the most age range in the study was 20-29 years old at 39%, then the second ranges were 30-39 at 30% and 40-49 at 28% and the least range was more than 50 at 3%.
2. The amount of level of nurses' educational level: it is apparent that the largest area was Bachelor Degree (92%) and the smallest was Master Degree (4.8%) respectively.
3. The experiences of nurses about working in private hospitals: the biggest slice is 40.8%, which means most of nurses in this study have worked in the private hospitals around 0 – 5 years. The smaller slices are the nurses who have worked more than 20 years and 5.1 – 10 years are about 20.8% and 19.20%, respectively, and about 11.20% working for 10.1 – 15 years. The nurses who did not answer the question is 0.8%.
4. Data on the number of nurses on learning English before they graduated: 81.6% of nurses learned English for nursing before they graduated and a few nurses did not learn is 18.4%.
5. A number of nurses who studied English for nursing or related subject after they graduated: there are 54.4% of nurses who studied and the 4.6% did not.
6. Data on nurses' ratings about their language proficiency of at the present: the first 60% 'sufficient' is the largest rating. The second largest rating 'Bad' is 29.6%, while 'Good', 'Very bad' are 5.6 and 4.0. lastly 0.8% is 'very good' of the total of rating.
7. The department that nurses working in: 42.4% is the highest slice which means nurses work in IPD. The second one is OPD 29.6%. The Third one is 'others' 21.6% and the last one is ER, which is only 6.4%.

The results of Nurses' needs for improving English with foreign patients from part 2 are as follows:

Table 1 Listening skill

Listening					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Miss	3	2.4	2.4	2.4
	Essential	47	37.6	37.6	40.0
	High Priority	25	20.0	20.0	60.0
	Medium Priority	38	30.4	30.4	90.4
	Low Priority	10	8.0	8.0	98.4
	Not a Priority	2	1.6	1.6	100.0

From the above table, Most of nurses need to improve their listening skill in essential level are 37.6% which is the highest rate.

Table 2 Speaking skill

Speaking					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Essential	45	36.0	36.0	36.0
	High Priority	30	24.0	24.0	60.0
	Medium Priority	34	27.2	27.2	87.2
	Low Priority	15	12.0	12.0	99.2
	Not a Priority	1	.8	.8	100.0

According to the table, 36.0% from the essential is the highest need.

Table 3 Reading skill

Listening					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Miss	5	4.0	4.0	4.0
	Essential	26	20.8	20.8	24.8
	High Priority	30	24.0	24.0	48.8
	Medium Priority	55	44.0	44.0	92.8

	Low Priority	7	5.6	5.6	98.4
	Not a Priority	2	1.6	1.6	100.0

From the above table, It can be said that nurse need to improve their reading skill in essential level are 20.8%.

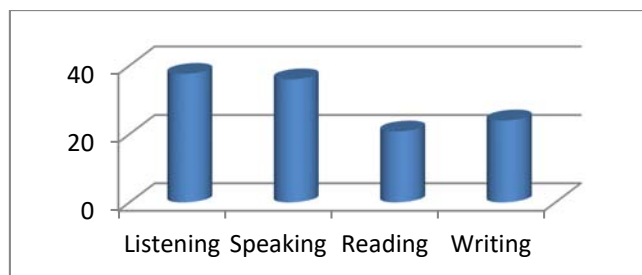
Table 4 Writing skill

Listening					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Miss	3	2.4	2.4	2.4
	Essential	30	24.0	24.0	26.4
	High Priority	28	22.4	22.4	48.8
	Medium Priority	46	36.8	36.8	85.6
	Low Priority	14	11.2	11.2	96.8
	Not a Priority	4	3.2	3.2	100.0

From the above table, It is cleared that 24% of nurses need to improve their writing skill in essential level.

As a results of Nurses' needs for improving English with foreign patients, they were paralled as the graph below:

Figure 1 The Comparison of the Four Skills



The graph shows the comparison of the need of improvement language skills. It can be seen that the amount of listening skill is the highest. Nurses would like to improve themselves in order to interact with the foreign patients similar to speaking skill is the second

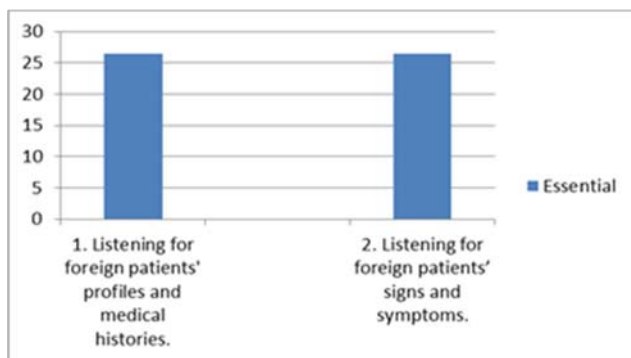
level. Then the writing and reading skills are the third and the last need respectively.

In summary, listening skill is the most priority need of nurses for improving their English proficiency based on English for nursing. However, from the graph, listening and speaking skills are almost equable.

Listening skill consisted of 2 items are as follows:

1. Listening for foreign patient profile and medical histories
2. Listening for Foreign Patients' Signs and Symptoms

Figure 2 The Comparison of Listening for Foreign Patients and Medical Histories and Listening for Foreign Patients' Signs and Symptoms



The graph illustrates the amount of item 1 and item 2 are equable which 26.4% are.

In conclusion, listening for foreign patients' profiles and medical histories and listening for foreign patients' signs and symptoms are the most needs

The results from the open – ended questions

The results were analyzed by content analysis technique. So they can be grouped as follows:

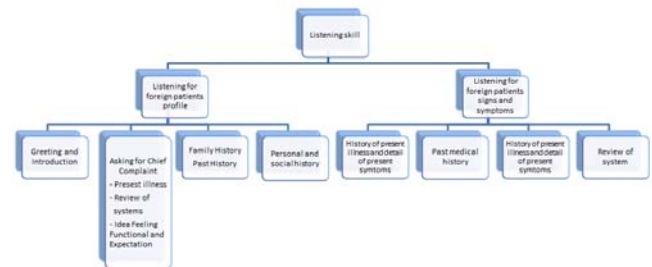
1. Listening skill: nurses need to practice more and more.
2. Speaking skill: nurses need to practice the vocabulary in speaking. Nurses need to practice speaking by making sentences.
3. Reading skill: nurses need to practice more reading and translation and must learn more English and then they can solve the problem by using the IT such as an application on a mobile phone.
4. Writing skill: nurses need to practice the writing skill by focusing on the correctness and they

can solve the problem by using the IT such as an application on a mobile phone.

5. For New graduates or internship students: they cannot spell English words correctly. And they are good at pronouncing words.

6. For experienced nurses: they are too shy to speak in English. They rarely would like to develop themselves. They don't take chances.

Figure 3 The Model of Language Competency Development of Bangkok-Private-Hospital Nurses for the ASEN Economy Community



According to the finding, 'The Model of Language Competency Development of Bangkok-Private-Hospital Nurses for the ASEN Economy Community' was created. After that it was evaluated the appropriateness of the model by the supervisors who were the nurse teacher, nurses, and English Teachers. To sum up, this model is appropriate at 100%

CONCLUSION

Based on the findings of the study, several conclusions were drawn. Overall, the nurses need to improve listening skill as the most priority, followed by speaking, writing and reading.

Listening foreign patients for their profiles and medical histories and listening foreign patients for their signs and symptoms are the highest priority of their needs at 37.6%. However, the need of speaking skill almost equals the listening skill at 36.0%. It can be said that listening and speaking skills are related skills.

On the other hand, the need of writing is more than reading skill. It could be seen that written can be the evidence in the record and other medical profession have to read it for further medical service. So, if the record is not clear, it would influence to the medical care. While the need of reading skill is at least, it could summarize that nurses are prepared to read and they are quite good at reading skill.

According to the data from the open-ended questions, there were many interesting points.

First, listening skill, “nurses need to practice more and more.” it is clear that keep practicing can help the learners improve their English language skill as Larsen-Freeman (2011) mentioned the audio lingual Method is an oral-based approach. Learners need to drill in the use of sentence patterns which including the grammar.

Second, speaking skill, “nurses need to practice the vocabulary and use the vocabulary to make sentences, it showed that nurses had limited vocabulary when they have to speak to the foreign patients. Therefore, they need to learn more vocabulary in order to make sentences.

Third, reading skill, “nurses need to practice reading and translation and must learn more English and they can solve the problem by using the IT such as an application on a mobile phone.” According to these statements, some nurse cannot comprehend the reading well and an application on an electronic device is needed for translation.

Fourth, writing skill, the writing part focuses on the spelling and correctness. An application on an electronic device is used. For new graduates or internship students, “They cannot spell English words correctly” “They are not good at pronouncing words.” It can link to the vocabulary and pronunciation. In the past, most of the learners were taught by spelling the words and remember it without listening to the sounds of words. They call a parrot says. Thus when they grew up and must read the new words that they do not get familiar. We cannot pronounce so they cannot write it correctly.

Fifth, for experienced nurses, “They are too shy to speak, to talk in English.” “They rarely would like to develop themselves.” and “They don’t take chances. These problems are the big issues for many Thais. They are shy to speak, especially for adult learners, they are shy because they are afraid of mistakes. Therefore, the shyness and embarrassment are as big as walls against ESL speakers to improve their English which causes that they do not want to develop and never take a chance for developing their English.

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VR Technology for Foreign Language Education: Investigation of the Effect of Communication Partner's Closeness on English as a Second Language Learning in VR

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ABSTRACT

As the spread of VR technology advances rapidly, there are many possibilities of how to use VR. Among them, we focused on English education using VR. VR is a tool suitable for experiential learning and can be expected to be effective in English education. Although there are already some English teaching applications, it is not clear how the closeness of the communication partner affects English learning in applications and VR characters. Also, it is generally said that it is good to make a native speaker lover in order for the second language learner to learn a foreign language effectively, but it is not easy to actually make such a lover. However, if you use VR, you can build an environment similar to a real lover and you can realize effective English education. We took questionnaires and investigated what elements are required for English education using VR. As a result, it turns out that closeness of the communication partner can be an important factor in English education. We develop English educational application by VR and verify learning effect.

Key words: VR, Education, English, romance

1. INTRODUCTION

In recent years, VR has developed further and it is expected that its development will continue in the future. This time, we thought about VR English education and tried to verify the learning effect by trying the difficult learning method in the real world with VR. There is such a word about learning English. "To learn English it is best to make a foreigner's girl." This is as the word is, which means that it is best to make a foreigner's girl to learn English, but actually it is difficult. However, with VR you can create a fictitious girl in VR and you can verify how much learning effect is. This paper summarizes the experiment method and result.

2. PREVIOUS RESEARCH

As a prior study of VR education, there is a paper "A Case Study -The Impact of VR on Academic Performance". Is this paper effective for education using VR? I am researching. In this paper, it is written about the experiment using the VR and the conventional educational method, and the result that the lesson using the VR improves the student's compre-

-hension degree and knowledge retention ratio and the willingness to learn It has.

3. PURPOSE OF THE STUDY

In this research, we investigate whether the learning effect changes depending on the relationship between the teacher and the person taught. Specifically, investigate whether the learning effect changes depending on the high intimacy of the teacher and the person taught. The definition of intimacy in this research refers to the depth of relationship between people and people. If this is found out, it is expected that higher learning effects can be expected from future VR education, and higher learning effects can be obtained in education other than VR

4. RESEARCH METHOD

About the method of research. We first took a questionnaire and investigated how much VR English learning with the romantic element was in demand. Based on the results of the questionnaire, we asked VR to have a conversation for each of the opposite sex and situation in VR using VR 's app that we plan to

develop independently and then asked us to take a test to see if the learning effect is high to decide. Also, in order to verify the effect of intimacy on the learning effect, investigate the relationship with heterosexualities in three stages of others, friends, and lovers.

5. QUESTIONNAIRE SURVEY

In the questionnaire, we asked 9 questions, 8 of which are 2-choice questions. The other one is a question of a choice of 5 choices. The contents of the question mainly focused on things related to VR, those related to English, those related to romance. Ultimately, we found that the demand for an application that learns English with VR while doing the pseudo-romance which we are about to make is high, and the research value is high. But when you learn English in Question 6, which do you want to

study, either passive learning or active learning? In response to the question, we predicted that active learning was high, but in reality passive learning turned out to be higher. Since I was planning to make VR English learning application that we are about to make for active learning, I would like to take a look at the application development that can passively learn based on this questionnaire result.

6. CONCLUSION

In this research we examined how the intimacy of teaching people and taught people influences learning using VR application. In the questionnaire survey beforehand, we were able to confirm the high demand for research on VR English education and proved the research value of VR English teaching. I would like to contribute to the future development of VR education.

Consideration on Emotional Expression of Input Character Reading Software

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ABSTRACT

A number of methods have been developed for speech synthesis technology so far, but the way to express rich emotions was one of the tasks. In recent years, attention has been paid to the method of expressing emotions, and the technique has been used in various synthesis software. However, I do not hear much about the case of investigating whether the expression of emotion is correctly transmitted to the audience. In this research, we actually use speech synthesis software and examine the impression and evaluation of the subject who heard it.

Key words: Speech Synthesis, Emotional Expression, Phoneme

1. INTRODUCTION

In recent years, the development of software that reads input characters is accelerating. We focused on emotional expression in these software developments. In recent years, the input character reading software can be read aloud with human voice, so it is utilized in various situations. However, in order to get closer to humans, realization of rich emotional expression is one of the tasks.

Therefore, in this research, we examine what emotional expression can be expressed by the reading speed and the pitch of the sound and investigate what kind of impression the person who heard it will receive. Through these investigations, it is possible to lead to improvement of the current situation that emotions are not felt by stick reading for "machine sound" which is present in many familiar environments.

In addition, these researches can be expected to contribute to the creation of rich emotional expressions that can be utilized in media content and interactive system development with human beings and others. From now on, actually using input character reading software, investigate the elements necessary for expressing emotion, and verify whether the emotion is correctly conveyed to humans.

2. PREVIOUS RESEARCH

There are many papers on emotional expression of speech synthesis [1][2][3]. As for the method of expressing emotion, various methods such as constructing emotional speech space are considered, but the impression and evaluation of the person who heard the speech has not been clarified much. Especially, there are rare examples using the latest speech synthesis software.

3. PURPOSE OF THE STUDY AND RESEARCH METHOD

It aims at evaluating software for synthesizing speech close to humans. Have several subjects listen to the synthesized speech and then conduct a questionnaire survey. The contents of the questionnaire survey mainly chiefly listen to different sounds of intonation, which one is most readily emotionally read out, correctly understand the parameter of the emotion value being changed.

4. QUESTIONNAIRE SURVEY

We actually used the speech synthesis software, created some texts, asked several subjects to ask questionnaire survey. First, 12 types were created.

From simple greetings such as "Good morning", I made up three lines of short sentences. The contents of the questionnaire survey are roughly divided into two types. The first is whether the richness of emotions is different depending on the difference in intonation. The second is whether changes will be conveyed to the audience by changing the parameters of emotional expression. A questionnaire survey was conducted on these two points. There are three types of parameters of emotional expression: "joy", "anger" and "sadness", and by changing them, the subjects' responses were obtained.

5. CONCLUSION

In this research, we actually asked the subjects to listen to the emotional expression of the synthesized speech and responded to the questionnaire. Indeed, along with the progress of speech processing technology in recent years, it has become possible to express fairly rich feelings. For example, if you raise the parameter of "sorrow", the speech speed will be

slightly late, the difference will appear in how to read such as slightly lowering the ending. However, according to the results of the questionnaire survey, it was a little difficult to distinguish between "joy", "anger" and "sorrow", and some people were mistakenly transmitted. From this, in the future it is a task to be able to express more sensitive emotions.

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Using GIS to Understand the Past within its Modern Context

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ABSTRACT

Today's modern landscapes may bear little resemblance to the past. A walk along the streets of a modern town or city may reveal little of its past history. Many scholars choose to believe that the modern landscape has totally destroyed any remnants of the past. If one looks carefully though, glimpses from the distant past may be seen amongst the modern buildings and road layouts. Placing the current landscape into a context has various advantages. For example, an understanding of the past landscape can assist in educating a community about their environment and culture. This information can in turn help drive conservation and future planning decisions. Furthermore, this understanding can be used to contextualize historic artefacts and make them more readily understandable. The aim of this project was to discover whether GIS (Geographic Information Systems) software and historic cartographical evidence could be used to relate a suburban landscape to its past land use. Through overlaying various historic maps the author was able to relate the modern landscape to the past.

Keywords: GIS, landscape, Patcham

INTRODUCTION

Many modern city landscapes may appear uninspiring or quite often bland. They are quite often difficult to interpret and understand in the current context. For example, many of Europe's cultural landscapes have changed beyond recognition since the early 19th century and particularly during the 20th century (1). Many scholars though have a tendency to ignore the influence of past land use on the modern urban environment. The modern street plan is often seen as having totally destroyed any traces of history and the past activities associated with it (12). A city though is not a static monument or group of buildings. Cities are subject to dynamic forces in the economic, social and cultural spheres. Within the landscape, continuity may still be recognized amongst the often dramatic changes. Amongst the modern street layouts and buildings, continuity from an earlier period may be identified by the alignment of the road layouts and the names of the streets. If one looks closer, a seemingly innocuous bump within the landscape may be evidence of an activity that has taken place in the long distant past.

Patcham village (grid reference TQ 29992 09106) which is mentioned in the Domesday Book, is a suburb of the city of Brighton and Hove, Sussex, England. Human activity dating as far back as the Bronze Age has been discovered in the surrounding area. In the 19th century, Patcham nestled on the edge of the South Downs within an area used to graze sheep and grow cereal crops. In 1928 the parish of Patcham was incorporated into the Borough of Brighton. A period of rapid change followed with the loss of rural farmland to large scale housing development (3, 6, 8, 9, 13). The area now looks much like any other suburban landscape and in many respects; unremarkable and uninspiring (see figures 1 and 2).

The aim of this project was to discover whether the modern developed area around Patcham Village could be related to the late 18th century and 19th century rural landscapes. The area studied encompasses the Brighton and Hove suburb of Patcham and associated areas of the suburbs of Hollingbury, Westdene and Withdean. The study area is a typical suburban landscape and one of urban expansion that could be recognized throughout the United Kingdom. The question was predominantly answered with the aid of GIS (Geographic Information Systems) software and

historic mapping. This study relates the early 21st century built environment directly to estate and field boundaries recorded in cartographic evidence from the late 18th century onwards. Although no recorded evidence exists, it can be presumed these boundaries pre-date this period. The data on the

specified area could be used for both educational, cultural and tourism purposes. Contextual data in the form of landscape reconstruction and a relation to its modern counterpart can aid the understanding of a community's environment and help drive conservation and future planning decisions.



Figure 1. The droveway in Patcham as it would have looked in the early 19th century (11).



Figure 2. The droveway in Patcham in 2012 (11).

METHOD AND ANALYSIS

In order to answer the question a number of various historic maps and secondary source evidence was consulted. Many early maps were found to lack detail and overall accuracy (14). It was therefore decided to use a 1783 map produced by Yeakell and Gardner (2 inch to 1 mile, 1:31680), an 1842 Tithe map and the 1813 (1 inch to 1 mile, 1:63360, first edition) and 1879 (1:2500, county series) Ordnance Survey maps for this study (5, 6, 15, 16). The maps used in this project were visually analyzed against modern Ordnance Survey mapping. Known features were aligned with those on the historical mapping. Furthermore, these maps were also checked for accuracy within Map Analyst software and were deemed accurate enough to be used for this project. Map Analyst works by comparing known features on modern map data to the same features on historic mapping.

The 1783, 1813 and 1879 maps were originally surveyed by the use of triangulation; no records though were available regarding the overall accuracy of these surveys (2, 10). Errors that occurred when these maps were created would be multiplied when scaled up. Vegetation due to its nature can only be measured approximately; it is also possible that the position of tracks and field boundaries would have naturally changed through time (4). When attempting to examine smaller details, the historic mapping used for this project was discovered to suffer from a lack of good resolution. Vector layers were therefore only created of clearly identified features. All maps were georeferenced to vector data (shapefiles) of

the area downloaded from EDINA Digimap (5). None of the above mentioned issues were deemed to have an adverse effect on the overall accuracy of this project. The use of the rubber banding tool (control points) was avoided when geo-referencing the historic mapping. The use of this tool may have created evidence where previously none existed.

The 1783 Yeakell and Gardner map was used as a base to create vector layers of field boundaries, tracks, buildings and trees; these layers were adjusted (edited) by using evidence from the 1813 Ordnance Survey map and 1842 Tithe map. As these maps suffered some accuracy issues, known points on the late 18th century and early to mid-19th century mapping were also checked against the more accurate late 19th century (1879) Ordnance Survey map. Although not perfect the vector layers produced using this method proved to be of greater accuracy. In addition, a near perfect match was achieved when the 1879 ordnance survey map was georeferenced to modern vector data. Vector layers of field boundaries, tracks, rail track, buildings, furze and trees were then created. The results were then compared against the late 18th century and early to mid-19th century layers. Through analyzing these layers a clear continuation could be seen from the late 18th century to the late 19th century (5). On overlaying the data obtained from the 18th and 19th century layers onto the modern street plan a direct relationship could be seen. By means of measurement (Map Analyst) it was found that approximately 75% of the historic tracks and boundaries lined up with the modern roads in the study area (see figure 3).



Figure 3. An overlay of the data obtained from 18th and 19th century mapping onto the 21st century layout

Topographical and 3D (three dimensional) imagery was used to gain a greater understanding of the historic rural landscape and its layout during the studied period (5). A 3D TIN (Triangulated Irregular Network) layer was created from data obtained from a dxf (Drawing Exchange Format) file. A flow pattern layer (created in Landserf GIS) was then draped over it. This combination was found to give a clear view of the locations topography. Through, overlaying the 18th and 19th century data onto these 3D layers it could be seen that the layout and development of the fields and tracks had been directly influenced by the areas topography. It would seem that crops were grown on the flatter areas and sheep would graze on the steeper slopes. Tracks appear to follow valleys and ridges.

DISCUSSION AND CONCLUSION

Using the gathered data, the study area was visited with the aim of finding further evidence of historic field boundaries. Although the area has been highly developed, some possible evidence was discovered. The best example was at Patcham High School where a clear ridge ran along the length of the playing field. This ridge aligned perfectly with the field boundaries shown on the historic mapping. Without further investigation though, it is difficult to establish whether this feature is modern or much older.

A further desktop study found that small parcels of land were sold for development in the studied area throughout the early 20th century (9). This was the result of a specific set of circumstances brought on by the agricultural decline of the late 19th century. Imports from British colonies, resulted in many farms going bankrupt. Small plots of land were then sold off cheaply. Buying a small plot of land to build a small dwelling became popular. These self-built homes were often temporary in nature and lacked basic services such as water and sanitation. Plotlands as they became to be known were initially tolerated by local councils. These were eventually replaced with new towns and suburbs through compulsory purchase orders. This scenario can be used to explain why the studied area is now littered with various housing styles and small self-contained areas of housing with a number of roads ending in cul de sacs. It also appears that the selling of contained plots of land has helped ensure that the field boundaries and tracks can be recognized within the modern street layout (7, 11).

Through the use of GIS and historic mapping a clear link can be seen between the

present road layout and the 18th and 19th century rural landscape. In addition, this landscape has been influenced by the topography of the landscape. Later subdivision of larger fields and the selling of small land plots for development ensured that the past has influenced the modern landscape. The study has proven a clear link to the modern landscape as far back as the late 18th century. The study has shown that GIS software can be successfully used to geo-reference historical maps. A series of historical maps can be aligned to show land use change over time. This change can then be represented visually. Similar studies could be used to assist in teaching communities about their local history and culture. A visual link to the past can help to take history out of the text book and place it in a real life geographical location. Furthermore, such evidence could be used to provide an explanation of an urban layout where little or no historical data exists.

LIMITATIONS

The scope of this study is limited to a specified geographical context. The design of the study may therefore not be applicable to all geographical contexts.

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User Acceptance of the Line Application in an Educational Context

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ABSTRACT

The use of various forms of social media within education is both an area of increasing interest and one that lacks research. Social networking applications when used in conjunction with mobile devices may be able to increase learner achievement, engagement, motivation, satisfaction and self-efficacy levels and also improve attitude levels in educational contexts. Emerging technology such as the Line application may have various benefits when used in teaching and learning. The Line application has already attracted a great number of users, particularly within Asia. The following study examined whether the Line application would have benefits for learners when used as a learning management system. This project aimed to devise a relatively simple, free and convenient method to improve student learning. The author found that used in the appropriate manner the Line application can have various benefits. Students were found to be accepting of the Line technology and the study produced encouraging results.

Keywords: Line application, English, language, education

INTRODUCTION

The Line application was launched in Japan in 2011. Within eighteen months the application had reached 100 million users and within two years this figure had reached 200 million. By October 2014 the application had attracted 560 million users worldwide and by February 2015, this figure had reached 600 million. Today the application is owned and operated by the Line Corporation, a branch of South Korea-based Naver (1, 6). The Line application is primarily used for instant communications across various devices such as smartphones, tablet computers and personal computers. It is possible for Line users to exchange text messages, images, video and audio and various forms of documents and presentations. In addition, it is possible to conduct free VoIP (Voice over Internet Protocol) conversations and video conferences. The application also allows users to add members to groups. Originally the application was developed as a mobile application for Android and iOS smartphones. The service has since been expanded so that it is possible to run the application across multiple platforms. Although, the desktop application is only available for

computers running the Microsoft Windows and MacOS platforms it is also possible to run a browser based version in Linux (6).

In recent years, social media applications have attracted the attention of educators and researchers in education. In various studies social media applications have been found to have various positive benefits amongst students. In addition, many students now have devices that can connect to the World Wide Web to access social networking sites and applications. The use of mobile devices and social networking applications may provide solutions for some of the issues that currently exist in education. For example, the English language is now seen as the world's second language. In Thailand the language is now widely used in sectors such as business, engineering, science and tourism to name but a few. There is therefore a constant need to improve the nation's English skills. This may require time spent learning both inside and outside of the classroom. In developing countries, the use of the Line application may provide a simple and free alternative to learning management systems such as Moodle and Edmodo. Resources such as videos and reading content can be uploaded to the application to assist the students' learning. In

addition, course information can be quickly shared by the instructor with their students. The use of learning management systems in educational contexts is also known to positively affect learning outcomes (3, 7).

McCarty, Sato, and Obari, (2016) studied the use of Line application as part of a wider project. The study examined students' online interaction in English using smartphones and the Line app. Learners wrote messages in English and posted them in a closed group. After one-month of interactions the students showed improvement in their English language competence in both receptive and productive skills. The results of the questionnaire also showed that students actively participated in the study and displayed positive attitudes towards the use of the Line application when learning English (5).

Van De Bogart and Wichadee (2015) studied students' perceptions of the Line application within a Thai university context. Undergraduate students were examined in relation to their acceptance of Line in terms of using it to submit homework, follow up course information queries and download materials. The results showed that perceived usefulness and perceived ease of use had a positive relationship with attitude towards usage. Furthermore, perceived ease of use was positively related to perceived usefulness. The study though found some compatibility issues with video clips and internet connections (9).

METHOD

The participants of the study were 57, 2nd year English major students studying at a Thai university in Bangkok, Thailand. The students were of mixed gender and of Thai nationality. The participants used in the study were chosen for convenience. During semester 1 of the 2016 academic year, the students were added to a Line application group. The students were informed that their participation was voluntary and non-participation would not affect their final course grade. Over a ten week period, posts relating to course information and useful resources were made approximately twice a week by the lecturer. During the course students were permitted to use mobile devices such as smart phones and tablet computers in the classroom in conjunction with the Line application. The devices were also used outside of the classroom in order to view uploaded course materials within the application.

The research used a mixed methods approach that incorporated a post treatment questionnaire survey, focus group interviews and observation. The study used a 5 point Likert scale questionnaire to measure the studied constructs. A response of 5 (strongly agree) was seen as positive whereas a response of 1 (strongly disagree) was seen as negative. The study was conducted using an adapted questionnaire that had been successfully used in previous studies (9, 10). The questionnaire was tested for reliability prior to the study using Cronbach's Alpha and was found to be reliable. The results were as follows: perceived usefulness=.83, perceived ease of use=.62, compatibility=.71 and attitudes=.75. In regards to the Cronbach's Alpha, an alpha value greater than 0.60 is seen as reliable (2). The questionnaire was therefore deemed reliable for data collection purposes. The data was analyzed using descriptive statistics (mean and standard deviation), t-tests and Pearson correlation.

The following hypotheses were established after a review of the literature:

Ha1 Perceived usefulness of the Line application in an educational context is shown to be above a neutral level of 3.4.

Ha2 Perceived ease of use of the Line application in an educational context is shown to be above a neutral level of 3.4.

Ha3 Level of compatibility of the Line application in an educational context is shown to be above a neutral level of 3.4.

Ha4 Students' attitudes towards the Line application in an educational context are shown to be above a neutral level of 3.4.

Ha5 Perceived ease of use is positively related to perceived usefulness.

Ha6 Perceived ease of use is positively related to attitude towards usage.

Ha7 Perceived usefulness is positively related to attitude towards usage.

RESULTS AND DISCUSSION

The Line application was positively received by the 57 participants. Through observation, it could be seen that the students actively engaged with the media. The results from the focus group interviews suggested that the use of the Line application was generally a good idea when controlled and applied correctly. Students commented that some previous experiences of learning with mobile technology and social media

had not been totally successful. The use of materials that had not been designed for smaller screens was a common complaint from the students. Materials with a large amount of text were found to be difficult to read on devices with small screens. Overall, the students agreed that the use of Line application should be used to benefit them and not as a tool to increase their workload. Some students commented that there were issues related to viewing video media on their mobile devices. A lack of sound was a common complaint. This issue possibly relates to the format used when

compressing the original video. Further, investigation is therefore required. The Line application was found to be a quick and convenient platform for sharing information both inside and outside of the classroom environment.

The study focused on the constructs of perceived usefulness, perceived ease of use, attitude and compatibility in relation to the Line application. The following table displays the descriptive statistics obtained from the questionnaire data (see Table 1).

Table 1. Data on the use of the Line application in an educational context.

Construct	X	SD
Perceived usefulness	4.03	.84
Perceived ease of use	4.00	.65
Attitude towards use	3.97	.79
Compatibility	3.80	.74

The data was further analyzed to establish statistical significance above a neutral value of 3.4 (4). T-tests showed the data to be statistically significant for perceived usefulness ($t=5.65$, $df=56$, $<.05$), perceived ease of use ($t=6.92$, $df=56$, $<.05$), attitude towards use ($t=5.50$, $df=56$, $<.05$) and compatibility ($t=4.08$, $df=56$, $<.05$).

The results of the correlation analysis were shown to be statistically significant at $r=.77$, which indicates a strong positive correlation for perceived usefulness and attitudes towards Line application. The results of the correlation analysis for attitude towards use and ease of use was statistically significant at $r=.55$, which indicates a moderate positive correlation. The relationship between perceived ease of use and perceived usefulness was statistically significant at $r=.58$, which indicates a moderate positive correlation. The data shows that all the variables were positively related. The strength of the correlation is based on Salkind (2000) (8).

It can be suggested that the hypotheses tested within this study are supported by the findings. The two previous studies by McCarty et al. (2016) and Van De Bogart and Wichadee (2015), using the Line application in educational contexts have both produced positive results. The Line application may therefore have possible positive benefits when used for educational and instructional purposes (5, 9). The issue related to video compatibility may have negatively affected

the results. With proper testing of the media and materials prior to uploading the overall user experience could be improved.

CONCLUSION

Overall the participants in this study displayed positive responses to the use of the Line application as a learning management system and learning tool. The platform is relatively easy to use and more importantly free to the end user. The platform is popular and therefore likely to already be a part of the students' every day activity. Information and resources can be quickly shared between the course lecturer and students. Further studies though are required to examine the materials and resources that are best suited to a platform such as the Line application.

FUTURE RESEARCH

This study has opened up questions in various areas for future research. Focusing solely on major students in one particular subject limits the value of the data in this study. The present study was conducted over a relatively short period; a longer study may provide differing outcomes and results. Varying the length of the study may provide information on whether there is an optimum length of time for using social networking applications in an educational context. A study on the optimum Line group usage levels per week may prove beneficial.

LIMITATIONS

The students participating in this research can only reflect the characteristics in a Thai context. The research findings are therefore not completely representative and cannot be generalized to other cultures and nationalities.

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Exploring Students' Intention to Use Mobile Devices for Educational Purposes within a Higher Education Context

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ABSTRACT

The advent of the Internet and mobile technology has permanently changed the manner in which people communicate and interact. In relation to education, a volume of research has been conducted regarding the impacts of mobile technology in teaching and learning. However, there is a lack of previous research that focuses on the use and management of mobile technology at the higher education level. It is important though that educators have a strong understanding of any issues before applying mobile technology in their teaching. This study examines user acceptability in integrating mobile technology into a course at the higher education level in a Thai context. Furthermore, this paper describes how mobile technology can positively impact both teaching and learning within the classroom. The results from the study show that the use of mobile technology within the classroom was beneficial and positively received by the students.

Keywords: mobile technology, education, teaching, learning

INTRODUCTION

Research suggests as technology advances and becomes relatively affordable more and more learning will occur digitally. Technology can motivate and inspire students and prepare them for the challenges of a 21st century workplace. Students can use mobile technology to communicate, collaborate, and support critical thinking and creative problem solving skills. Students though may ultimately suffer if instructors do not have the necessary tools and support to effectively instruct in the digital world. Therefore, instructors need to develop long term strategies in a field that is constantly changing. It is important that today's educators are equipped with the skills and knowledge to cope with these changes. Technology implementation needs careful management to ensure that it is successful. Furthermore, an educational institution that is unable to create and manage a digital culture may struggle in the modern world. It is therefore important that educators constantly collect data related to technology and make decisions based upon the findings (5).

Nowadays, a university degree can be considered an essential qualification in order to gain a well-paid job. In addition, an accredited

degree can afford opportunities to those who would like to live and work abroad. Universities have existed for many centuries and the long term stability of these institutions may be reflected in their value to society in their current form. Technology though has rapidly changed the manner in which tasks are carried out and completed. Additionally, various benefits have been noted in the field of education related to the use of such technology. It is therefore essential that technology is carefully managed so that these benefits are passed on to the students. Unfortunately, there are various barriers to the adoption of technology in higher education. For example, a 2014 United Kingdom (UK) report cited a lack of time as the leading barrier to technology enhanced learning at universities. A lack of academic staff knowledge came in at second place. Financial constraints were cited as the third most common reason as a barrier to the use of technology. Institutional and departmental culture was noted at number four. In addition, it has been suggested that a lack of research on the use, management and benefits of educational technology in higher education institutions also currently exists (9).

As previously mentioned, the lack of a strong body of evidence that technology is

beneficial to students and learning is often cited as a reason for non-adoption. This attitude can therefore make it difficult to justify the expense and disruption to skeptical stakeholders within an institution. In addition, to purchasing the technology an institution may need to spend further funds on upgrades and support. Additional time may also be required for staff training and the implementation of the technology. This time may be seen as unproductive, down time in the eyes of some university governing boards. The universities themselves are driven by financial accountability for public funds so spending vast sums on technology that may or may not improve learning is a risk that many institutions are unwilling to take (6). In relation to the evidence it would therefore be prudent to suggest a form of technology that is readily available and requires little to no further training in order to use it.

Studies suggest that in many countries throughout the world, university students are equipped with mobile devices capable of running learning applications and connecting to the World Wide Web. Many higher educational institutions also have the infrastructure necessary to integrate the use of various forms of technology within their courses. Furthermore, Web based learning resources have neutralized the issue of cross platform compatibility. A 2015 United States (US) report found that many students used mobile technology for non-personal, educational reasons within the classroom. Seventy four percent of smartphone owners and sixty six percent of tablet owners reported using them to aid their learning (1).

As previously mentioned, the lack of strong body of evidence that technology is beneficial to students is cited as a reason for non-adoption. This argument though lacks some credibility. Previous studies have found that various forms of technology such as mobile technology can be successfully integrated into the classroom environment. For example, a US study by Gikas and Grant (2013) focused on the use of mobile devices in the higher education classroom. The students found the mobile technology to be useful for accessing information quickly, learning at their own pace and for collaboration purposes. The use of mobile devices did not prove to be a distraction within the classroom (4).

METHOD

The participants for this study were 57, 2nd year English major students studying at a Thai

university in Bangkok, Thailand. The students were taking an essay writing class as part of a Bachelor's degree program. The students were of mixed gender and of Thai nationality. The participants used in the study were chosen for convenience. The students were informed that their participation was voluntary and non-participation would not affect their final course grade. Over a six week period students were permitted to use mobile devices such as smart phones and tablet computers in the classroom. The devices were used to access information and resources that were necessary to complete writing activities.

The study utilized a mixed methods approach. This approach incorporated a post treatment questionnaire survey, focus group interviews and observation. The study used a 5 point Likert scale questionnaire to measure the tested variables. A response of 5 (strongly agree) was seen as positive whereas a response of 1 (strongly disagree) was seen as negative. The study was conducted using an adapted questionnaire that had been successfully used in previous studies (2, 10). The final questionnaire was checked for reliability using Cronbach's Alpha and was found to be reliable. The results were as follows: perceived usefulness=.65, perceived ease of use=.73, attitudes towards mobile learning=.77 and future behavioral intentions=.74. In regards to the Cronbach's Alpha, an alpha value greater than .60 is seen as reliable (3). The questionnaire was therefore seen as being reliable for data collection purposes. The data was analyzed using a combination of descriptive statistics (mean and standard deviation), t-tests and Pearson correlation.

The following hypotheses were established after a review of the literature:

Ha1 Perceived usefulness of mobile devices in an educational context is shown to be above a neutral level of 3.4.

Ha2 Perceived ease of use of mobile devices in an educational context is shown to be above a neutral level of 3.4.

Ha3 Students' attitudes towards mobile devices in an educational context are shown to be above a neutral level of 3.4.

Ha4 Students' future behavioral intentions towards mobile devices in an educational context are shown to be above a neutral level of 3.4.

Ha5 Perceived ease of use is positively related to perceived usefulness.

Ha6 Perceived ease of use is positively related to attitude towards usage.

Ha7 Perceived usefulness is positively related to attitude towards usage.

Ha8 Perceived usefulness is positively related to future intention of use.

Ha9 Attitude toward usage is positively related to future intention to use.

RESULTS AND DISCUSSION

The use of mobile technology was positively received by the students in this study. The results of the focus group interviews indicated that mobile technology was generally of benefit to the participants when applied correctly. Students suggested that the ability to instantly obtain

information was a great benefit of using mobile devices within the classroom. The size of the screen on a number of devices was a restricting factor. Some students suggested it was difficult to read and follow research papers that used the two column format. Overall though, the students believed that the benefits of using the mobile technology outweighed the drawbacks. Through observation, the students appeared to be using the devices solely for academic purposes and not for personal reasons. The following shows the results of the quantitative data (see Table 1).

Table 1. Data on the use of mobile technology within an educational context.

Construct	X	SD
Perceived usefulness	4.25	.61
Perceived ease of use	4.04	.60
Future behavioral intention	4.14	.74
Attitude towards mobile learning	4.04	.77

The quantitative data was further analyzed to establish statistical significance above a neutral value of 3.4 (6). T-tests showed the data to be statistically significant for perceived usefulness ($t=10.52$, $df=56$, $<.05$), perceived ease of use ($t=8.13$, $df=56$, $<.05$), future behavioral intention ($t=7.53$, $df=56$, $<.05$) and attitude towards use ($t=6.22$, $df=56$, $<.05$). The results of the correlation analysis were also shown to be statistically significant for perceived ease of use and perceived usefulness at $r = .49$, which indicates a moderate positive correlation. The results of the correlation analysis for attitude towards use and perceived ease of use was statistically significant at $r = .64$, which indicates a strong positive correlation. The relationship between perceived usefulness and attitudes towards use was statistically significant at $r = .59$, which indicates a moderate positive correlation. The relationship between perceived usefulness and future intention to use was statistically significant at $r = .52$ which indicates a moderate positive correlation. The relationship between attitude and future intention to use was statistically significant at $r = .65$ which indicates a strong positive correlation. The data shows that all the variables were positively related. The strength of the correlation is based on Salkind (2000) (8). In all cases therefore the hypotheses outlined within this study can be accepted. The findings from the study would also appear to agree with the findings of Gikas and Grant (2013) and Zhu, Hu, and Guo, (2012) in that students are accepting of mobile

devices within educational contexts and the classroom (4, 10).

Governments are aware of the need to educate adults that have been failed by the existing system. Across the world, solutions are being sought to the problem of how to educate a population that does not have the opportunity of a university education. Emerging organizations that use a technology based learning system may pose a threat to the existing university structure. Despite the various issues related to the resistance for change, universities cannot afford to ignore the implications. In addition, in the next 100 years the level of technological change may be enormous. The institutions therefore need to manage rapid evolution whilst keeping pace with new developing technologies.

CONCLUSION

The changing nature of technology and its availability has ensured that there are various, emerging areas and possible educational tools to be examined. Investigating the students' perceptions of technology in an educational context is an area of importance. The students' views and perceptions are of concern when attempting to understand the potential impact of various forms of technology in educational settings. Examining these technologies in various settings and scenarios will therefore be of benefit to both educator and learner.

The future of education involves technology and digital learning. Instructors therefore must be competent in supporting and creating a culture that assists in its adoption. Research and assessment of technology usage in courses and programs should be on-going. The instructor should be adaptive to change and ensure that technology is being used actively to improve learning. Technology must be integrated and managed objectively in order to conform to university and government policies. The instructor should have vision and commitment in relation to educational technology. As this study has demonstrated, students are both willing and able to responsibly utilize mobile technology within the classroom.

FUTURE RESEARCH

A larger scale study could provide more generalizable data on the use of mobile technology within an educational context.

LIMITATIONS

The students participating in this research can only reflect the characteristics in a Thai context and are limited by number. The research findings are therefore not completely representative and cannot be generalized to other cultures and nationalities.

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