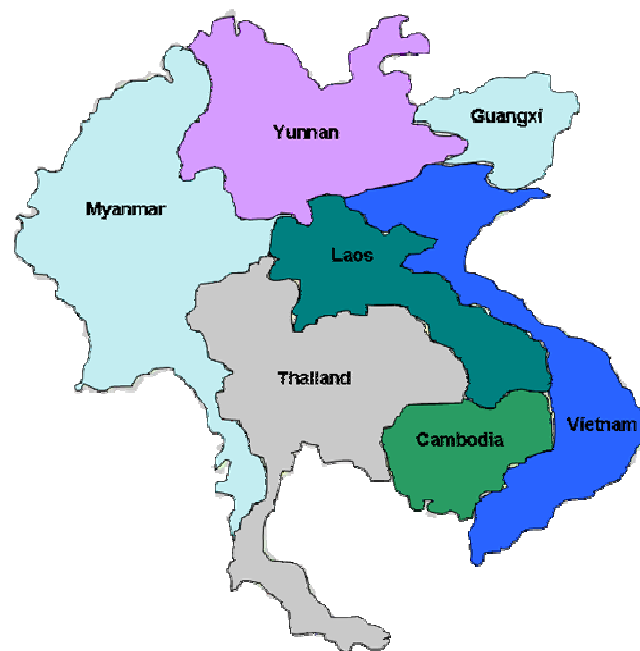


GMSARN

INTERNATIONAL JOURNAL

Vol. 7 No. 3
September 2013



Published by the

**GREATER MEKONG SUBREGION ACADEMIC
AND RESEARCH NETWORK**
c/o Asian Institute of Technology
P.O. Box 4, Klong Luang, Pathumthani 12120, Thailand





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The Greater Mekong Subregion Academic and Research Network (GMSARN) was founded followed an agreement among the founding GMS country institutions signed on 26 January 2001, based on resolutions reached at the Greater Mekong Subregional Development Workshop held in Bangkok, Thailand, on 10 - 11 November 1999. GMSARN was composed of eleven of the region's top-ranking academic and research institutions. GMSARN carries out activities in the following areas: human resources development, joint research, and dissemination of information and intellectual assets generated in the GMS. GMSARN seeks to ensure that the holistic intellectual knowledge and assets generated, developed and maintained are shared by organizations within the region. Primary emphasis is placed on complementary linkages between technological and socio-economic development issues. Currently, GMSARN is sponsored by Royal Thai Government.

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GMSARN International Journal
Volume 7, Number 3, September 2013

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Adsorption of Acid Dye on Activated Carbon Prepared from Water Hyacinth by Sodium Chloride Activation

Panupong Tarapitakcheevin, Panomchai Weerayuttil, and Kulyakorn Khuanmar

Abstract— The adsorption of acid dye (AB80) onto the prepared adsorbents from water hyacinth, Hyacinth Black Carbon (HBC) and Hyacinth Activated Carbon (HAC), were investigated. Batch isotherm studies were carried out under varying experimental conditions of contact time, temperature, and pH. The adsorption efficiency study was also compared to the Commercial Activated Carbon (CAC). The study results indicated that the prepared adsorbents from hyacinth, HBC and HAC, could be substantially used for the adsorption of acid dye (AB80) as compared with the commercial activated carbon, CAC. The HAC also presented the comparable efficiency to CAC. Base on the Langmuir isotherm, the monolayer adsorption capacity was determined to be 5.75, 56.50, and 100.00 mg/g for HBC, HAC, and CAC, respectively. The R_L values showed that all adsorbents were favourable for the adsorption of acid dye (AB80). Base on Freundlich isotherms, the magnitudes of $1/n$ for Freundlich isotherms were revealed to lie between zero to one, indicating that acid dye (AB80) is favorably adsorbed by all three adsorbents. The results of isotherm adsorption study elucidated that HBC was fitted to Langmuir model with high correlation (R^2) of 0.997 while HAC and CAC were well fitted to Freundlich model with favorable correlation (R^2) of 0.990 and 0.991, respectively.

Keywords— Adsorption, acid dye (AB80), water hyacinth, sodium chloride activation, activated carbon.

1. INTRODUCTION

Water hyacinth (*Eichhornia crassipes*) is a free-floating perennial aquatic plant and it was introduced to Thailand in 1901 during the reign of King Rama V from Indonesia as ornamental plant. Nowadays, water hyacinth changed itself form the decorated flower to problematic weed due to its fast spread and congested growth (over 60 kg/m²). The floating mats of water hyacinth obstruct navigation and clog irrigation works. Although water hyacinth is seen as a weed and worthless, there are many researches reported its application for water treatment due to its dominant structure is fibrous tissue which is capable to be an adsorbent for pollutants removal from water [1-5].

Water pollution from textile industry is a challenge problem due to large volume of colored wastewater and its low biodegradability. Effluents discharged from textile industry into receiving water might be toxic to aquatic life, and colored water reduce sunlight transmission through water. Especially when even just 1.0 mg/L of dye concentration in water supply, it could be inappropriate for human consumption [6, 7]. Adsorption is an effective process for removal of contaminants from wastewater. Activated carbon is the most widely used as an adsorbent because of its advantage on high adsorption capacity for both organic and inorganic compounds. The adsorption capacity of activated carbon is usually related to their specific surface area and porosity. In addition, the adsorption property of activated carbon is found to strongly depend on the activation process [8]. Chemical activation has

been recognized for the production of activated carbon with high developed porosity. Furthermore, this procedure leads to high yield by activating at low temperature as well [9]. Activating agents used in the chemical process are normally KOH, NaOH, H₃PO₄, ZnCl₂, Na₃PO₄, NaCl, KMnO₄ for various raw materials to yield for activated carbon [10]. Among of these chemical agents, NaCl shows attractive property because of inexpensive and non toxic.

This study aimed to investigate the possibility of activated carbon prepared from water hyacinth by chemical activation using sodium chloride (NaCl) as an activating agent for removal of color from acid dye in aqueous solution.

2. MATERIALS AND METHODS

2.1 Preparation of adsorbent

Water hyacinth was collected from Sritan Pond at Khon Kaen University, Khon Kaen, Thailand. It was thoroughly washed to remove dirt particles and its spongy inflated petioles (leaf stalks) and separated as a piece to prepare for an adsorbent. Then it was dried in sunlight for a week and dried in an oven at 103 °C for 24 hours. The dried material was burnt without oxygen at 600 °C for 2 hours to obtain Hyacinth Black Carbon (HBC). To prepare hyacinth activated carbon (HAC), HBC was chemically activated using 1:1 of NaCl and HBC by weight and followed by carbonization at 800 °C for 2 hours. Then, HAC was washed with distilled water for several times. Both HBC and HAC were crushed to pass a sieve with apertures of 125 μm and kept in an airtight container for adsorption studies. To compare the adsorption properties between prepared carbons and Commercial Activated Carbon (CAC), the powder activated charcoal Fluka 0512 supplied from Sigma Aldrich was selected to use in this study.

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2.2 Characterization of the activated carbons

Adsorbent was characterized as a specific surface area (S_{BET}) by the conventional adsorption of N_2 at 77 K (Autosorb I MP, Quantachrome). The morphology of the adsorbents, after being coated with gold, was characterized by SEM (LEO SEM 1450VP, U.K.).

2.3 Preparation of dye solution

The adsorption studies were carried out with color of Acid Blue 80. The acid dye (AB80) was used without further purification. Acid Blue dye has an empirical formula of $C_{32}H_{28}N_2Na_2O_8S_2$, molecular weight of 678.68 g/mol, and its chemical structure of the acid dye is shown in Fig.1. The dye solution of 1000 mg/L was prepared from Acid Blue 80 (dye content 40 %) for single solution which was dissolved in heated deionized water and made up to 1000 ml for the concentrated stock solution. The concentration of acid dye was analyzed by Shimadzu-1601 UV-visible using the maximum UV absorption (λ_{max}) of acid dye solution that was fixed for measuring its color concentrations.

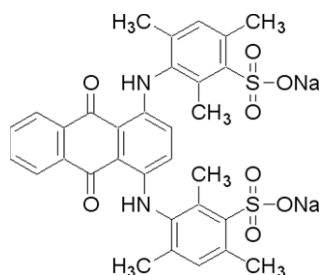


Fig. 1. The chemical structure of Acid Blue 80.

2.4 Effect of contact time

The effect of contact time of three adsorbents (HBC, HAC, and CAC) was investigated at 20 mg/L initial concentration of dye solution. A constant mass 0.1 g of adsorbent materials was mixed with a 50 ml dye solution at neutral pH. The mixture of each batch was constantly agitated as a function of time by orbital shaker at speed of 200 rpm and controlled temperature 25 °C. At various time intervals (5, 10, 15, 20, 30, 40, 50, 60, 90, 120, 180, 240, 300, and 360 minutes), samples were taken and filtered with filter disk 0.45 μ m to remove the adsorbent, then the dye concentrations were measured by UV-Vis Spectrophotometer.

2.5 Effect of temperature and pH

The effects of temperature and pH on the amount of dye solution on three adsorbents (HBC, HAC, and CAC) were examined at 60 mg/L initial concentration of dye solution. A constant mass 0.1 g of adsorbent materials was mixed with a 50 ml dye solution and 200 rpm agitation speed for 6 hours. The effect of temperature study, different adsorption temperatures for each batch of the experiment was controlled from 20-50 °C. The effect of the solution pH on the adsorption of dye solution was examined at the controlled temperature of 25 °C. The solution pH range was adjusted between 2 and 10 by

adjusting the pH of the solution with 0.1 M HCl and 0.1 M NaOH solutions.

2.6 Adsorption isotherms

The adsorption isotherm studies were determined by contacting a constant mass 0.1 g of adsorbent material with a range of different concentrations of dye solutions from 5, 10, 20, 40, 60, 80, 120, 160, and 200 mg/L and the solutions were adjusted to neutral pH. All experiments were conducted in 250 ml of glass bottle with working volume of 50 ml. The mixture of each batch was constantly agitated by orbital shaker at speed of 200 rpm and controlled temperature at 25 °C. After equilibrium time shaking, water samples were filtered with filter disk 0.45 μ m to remove the adsorbent and the water samples were measured concentration by UV-Vis Spectrophotometer. The experimental results were evaluated in terms of fitting with Langmuir and Freundlich model.

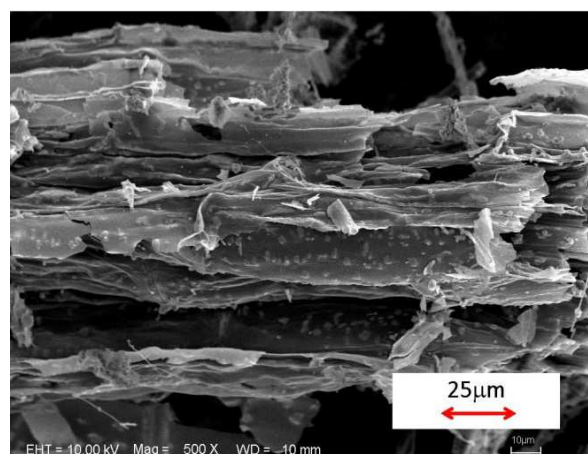
3. RESULTS AND DISCUSSION

3.1 Characterization of adsorbents and adsorbate

The prepared adsorbents as Hyacinth Black Carbon (HBC) and Hyacinth Activated Carbon (HAC), characterized for the specific surface area (S_{BET}) and morphology are shown in Table 1. Specific surface areas (S_{BET}) of prepared adsorbents without and with activation were found to be 158.22m²/g and 745.13m²/g, respectively. Fluka 05120 selected as the representative of Commercial Activated Carbon (CAC), with BET results from other researchers reported that its surface area is in the range of 788-1110 m²/g.

Table 1. Physical properties of adsorbents

Samples	Surface area (m ² /g)	Total pore volume (ml/g)	Mean radius (nm)	References
HBC	158.22	0.098	2.48	This work
HAC	745.13	0.558	2.99	This work
CAC	1110	-	-	[11]
	930	-	-	[12]
	788	0.74	-	[13]



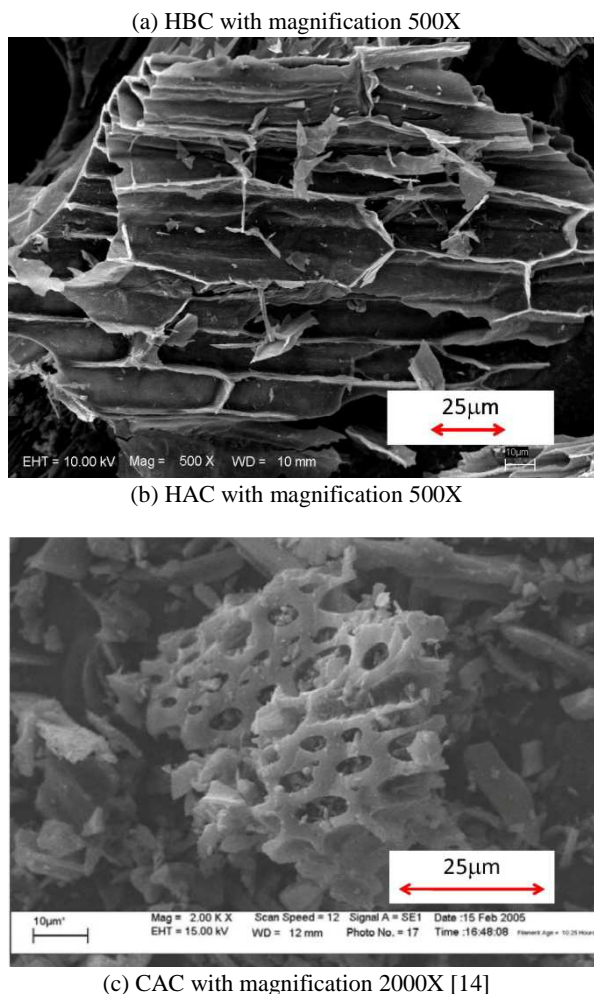


Fig. 2. Scanning electron micrograph (SEM) of (a) HBC, (b) HAC, and (c) CAC

The morphology examinations of adsorbent particles using the scanning electron microscopy (SEM) images are shown in Fig.2 (a)-(c). Fig 2 (a) presents the SEM image for HBC, indicating the surface texture was rough and irregular. The SEM image for HAC shown in Fig 2 (b), reveal the texture having the pores within the adsorbent particles with highly heterogeneous and honeycomb shape gabs with different sizes. The commercial adsorbent texture image shown in Fig 2 (c) indicate that CAC appearing to have numbers of microporous structure which offers more adsorption sites. It also indicated that CAC having a good possibility for dye to be trapped and adsorbed into these pore more than HBC and HAC.

The scanning wavelength was observed to locate the maximum absorbance of acid dye (AB80) by Spectrophotometer. The absorption spectra illustrates in Fig.3. The spectra indicated two peaks of λ_{max} that were 584 and 625 nm, so the higher absorbance was selected. The fixed wavelength at λ_{max} 625 nm was used for measuring concentrations of dye solution for all experiments.

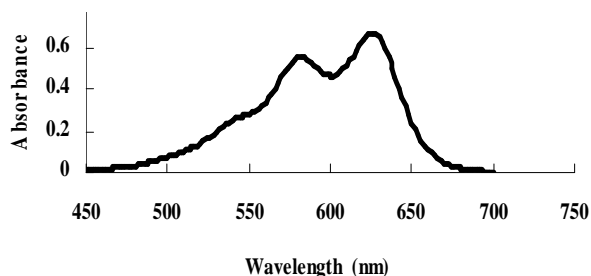


Fig. 3. Absorption spectra for Acid Blue 80 solution.

3.2 Effect of contact time

Various contact time intervals of experiments were performed to optimize the adsorption time at an initial dye concentration of 20 mg/L. The contact time effect of dyes adsorption is presented in Fig.4. The percentage of dye removal by adsorption on HBC, HAC, and CAC were found that HBC shown efficiency of dye removal 28.21 % at the equilibrium of 120 minutes, while HAC and CAC presented favorable removal efficiency of 92.88 % and 97.39 % with the optimum contact time 240 minutes and 40 minutes respectively [15]. Although the HAC and CAC were identified as activated carbon with high surface area, HAC consumed longer time than CAC to achieve the optimum adsorption. This might be due to the surface area and uniformity of pore structure of HAC is less than CAC which is produced for commercial activated carbon.

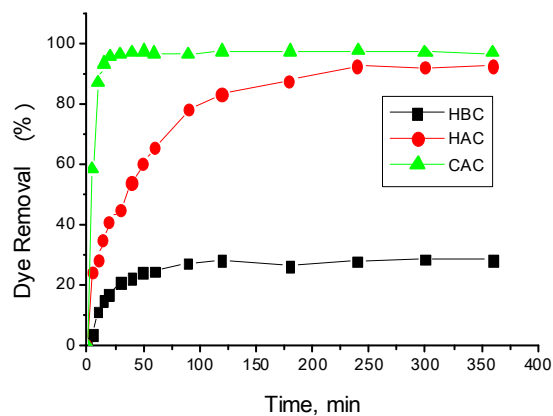


Fig. 4. Effect of contact time of dye removal by HBC, HAC and CAC

3.3 Effect of pH

The pH medium is an important factor in the adsorption process since it controls the magnitude of electrostatic charges. At a high pH solution, the positive charge at the solution interface decrease and the adsorbent surface appears for negative charges. Therefore, the adsorption of cationic dye increases while adsorption of anionic dye decreases. In contrast, at a low pH solution, the positive charges on the solution interface increase and the adsorbent surface appears for positive charges, which results for an increase in anionic dye adsorption and decrease in cationic dye adsorption [7, 16, 17].

According to the general rule, the percentage of anionic dyes adsorption removal will increase at low pH solution, while the percentage of dye removal will decrease at high pH solution. An investigation of the effect of pH adsorption of acid dye was carried out at pH range of 2-10 for 240 minutes. The experimental results illustrated that there was no significant variation in the amount of solute adsorbed on CAC. The adsorption on HAC slightly decreased as increasing pH. Notably, the adsorption on HBC significantly decreased as increasing pH as shown in Fig.5.

The adsorption of both activated carbons, CAC and HAC, seem not to be affected by the charges in the pH of the solution. Similar results were reported for the activated carbon adsorption of tannery dye on which is classified as an acidic dye [18] and Acid Blue (AB25) [16]. An explanation of this behavior might be the presence of both negatively and positively charge function groups in the dye molecules. At low pH solution, more hydrogen ions (H^+) are in the solution making the adsorbent surface more positive, thereby increasing electrostatic attraction between the negative charge SO_3^- anion of the dye and the activated adsorbent. Likewise, at high pH, most favorable adsorption occurred due to interaction of amines groups of Acid Blue (AB80). It is possibly to conclude that both acidic and basic solutions present remarkable adsorption of acid dye on activated carbon which has more active sites (high surface area) due to the presence of both positive and negative groups on Acid Blue (AB80) structure. This substance structure is also known as amphoteric substance [16].

An explanation of HBC adsorption behavior which has lower active sites (low surface area) than others adsorbents, its adsorption followed the general rule. That was a lower adsorption of acid dye at higher pH value while a higher adsorption occurred at lower pH value.

3.4 Effect of Temperature

The effect of temperature on the equilibrium of adsorption of AB80 on HBC, HAC, and CAC was carried out at various temperatures including 20, 30, 40, and 50 °C. The result of this effect is given in Fig. 6. The adsorption of acid dye (AB80) on three adsorbents trended to increase as increasing temperature. Especially, HAC and CAC present a likely increased adsorption capacity at temperature beyond 40 °C.

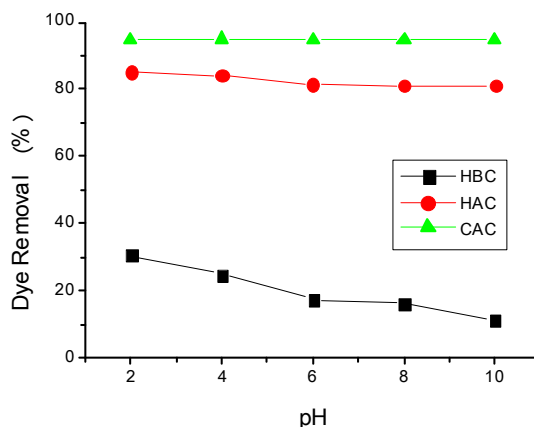


Fig. 5. Effect of pH on acid dye (AB80) adsorption by HBC, HAC, and CAC.

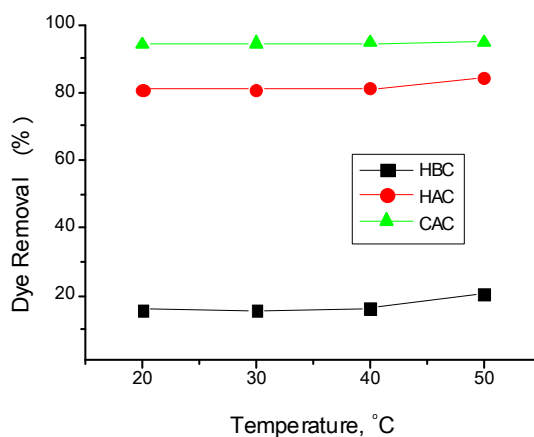
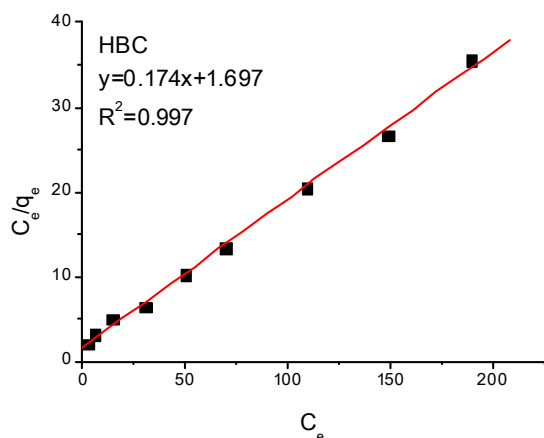


Fig. 6. Effect of temperature on acid dye (AB80) adsorption by HBC, HAC, and CAC

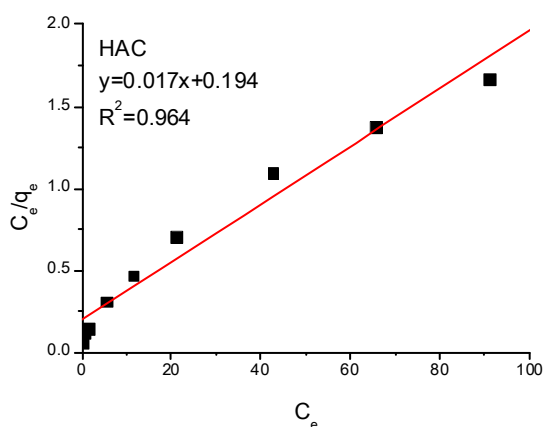
According to the experimental result, the adsorption capacity increased with increasing temperature, so the adsorption was an endothermic process. Because the diffusion process was an endothermic process, the increasing adsorption of dye with temperature might due to the enhance rate of intraparticle of diffusion of the adsorbate. Besides, increasing temperature might also produce a swelling effect within the internal structure of carbons enabling more dye molecules diffuse into carbon [8, 19, 20].

3.5 Adsorption Isotherms

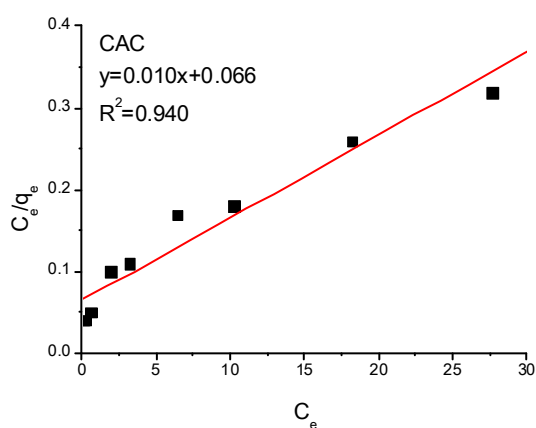
Equilibrium study on adsorption is necessary to establish the most appropriate correlation for the adsorption isotherms. Because the adsorption isotherms not only describe how adsorbates interact with adsorbents but also are basic requirements for design and operation of adsorption systems. The most widely used isotherm equation for the modeling of the adsorption data is Langmuir and Freundlich model [21].



(a) HBC



(b) HAC



(c) CAC

Fig. 7. Langmuir isotherm for acid dye (AB80) adsorption onto (a) HBC, (b) HAC, and (c) CAC.

Table 2. Langmuir Isotherm constants for HBC, HAC, and CAC

Adsorbents	q _m (mg/g)	K _L (L/mg)	R ²	R _L [*]
HBC	5.75	0.10	0.997	0.05-0.67
HAC	56.50	0.09	0.964	0.05-0.69
CAC	100.00	0.15	0.940	0.03-0.57

* R_L indicates the shape of isotherm [22].

- R_L > 1 Unfavorable
- R_L = 1 Linear
- 0 < R_L < 1 Favorable
- R_L = 0 Irreversible

3.5.1 Langmuir Isotherm

Langmuir equation model is valid for monolayer adsorption onto the adsorbent surface that reflects the limiting adsorption capacity. The model equation is given by Eq (1).

$$q_e = \frac{X}{M} = \frac{q_m K_L C_e}{1 + K_L C_e} \tag{1}$$

where q_m and K_L are Langmuir parameters related to maximum adsorption capacity (mg/g) and free energy of adsorption (L/mg), respectively. C_e is the equilibrium concentration in the aqueous solution, X is the amount of adsorbate (mg), M is the mass of adsorbent (g), and q_e is the equilibrium adsorption capacity of the adsorbent (mg/g). The linearized form of Langmuir equation can be written as Eq (2) and (3).

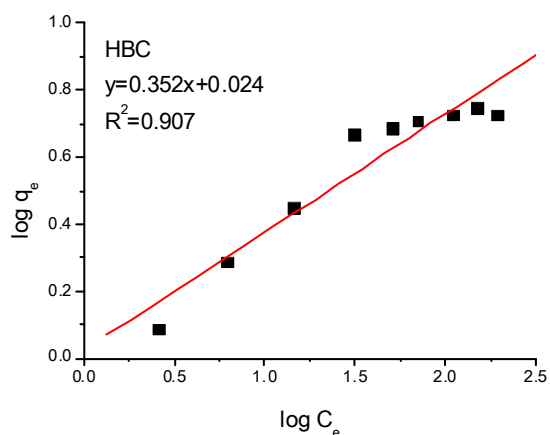
$$\frac{1}{q_e} = \frac{1}{q_m} + \frac{1}{q_m K_L} \cdot \frac{1}{C_e} \tag{2}$$

$$\frac{C_e}{q_e} = \frac{C_e}{q_m} + \frac{1}{q_m K_L} \tag{3}$$

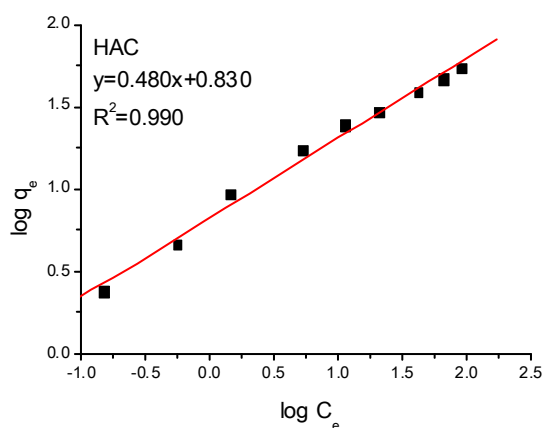
The Langmuir constant q_m and K_L can be calculated by plotting C_e/q_e versus C_e as shown in Fig. 7 (a)-(c). The isotherms of HBC, HAC, and CAC were found to be linear. Table 2 shows Langmuir Isotherm constants for three adsorbents. The maximum sorption capacity of HBC, HAC, and CAC for AB80 was found to be 5.75, 56.50, and 100.00 mg/g, respectively. Nevertheless, the correlation coefficient of HBC was extremely higher than HAC and CAC. This was confirmed that the equilibrium adsorption data of HBC was well fitted to Langmuir model and its behavior also demonstrated that the formation of monolayer coverage of dye molecule on the outer surface of HBC. Furthermore, Langmuir equation can be expressed in term of a dimensionless separation factor (K_L). This factor is defined as Eq. (4) and the calculated values are depicted for the adsorption processes that are favorable or unfavorable for Langmuir model.

$$R_L = \frac{1}{1 + K_L C_0} \tag{4}$$

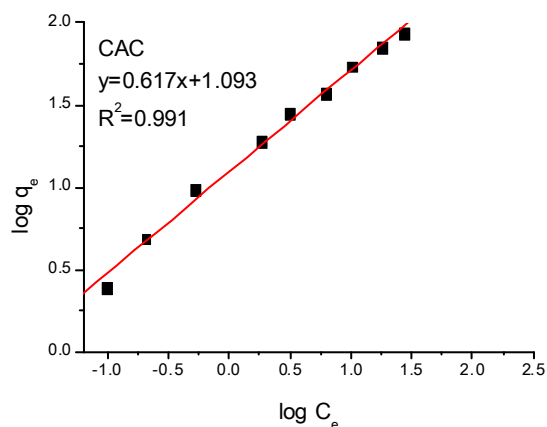
where R_L is a dimensionless separation factor, C_0 is the initial solution concentration and K_L is Langmuir constant (L/mg). Table 2 shows the calculate R_L values of HBC, HAC, and CAC. The values were in the range of 0-1 which confirmed the favorable adsorption of AB80 on the adsorbents.



(a) HBC



(b) HAC



(c) CAC

Fig. 8. Freundlich isotherm for acid dye (AB80) adsorption onto (a) HBC, (b) HAC, and (c) CAC

Table 3. Freundlich Isotherm constants for HBC, HAC, and CAC

Adsorbents	K_F (L/mg)	1/n	R^2
HBC	1.05	0.352	0.907
HAC	6.77	0.480	0.990
CAC	12.39	0.617	0.991

3.5.2 Freundlich Isotherm

The Freundlich model is an empirical equation based on adsorption on the heterogeneous surface and describes reversible adsorption. The adsorption is not restricted to the formation of the monolayer. Likewise, the Freundlich equation predicts that the dye concentration on the adsorbent will increase so long as there is an increased in the dye concentration in the liquid phase [23]. The empirical equation is given as Eq (5).

$$q_e = K_F C_e^{\frac{1}{n}} \tag{5}$$

where K_F and n are the Freundlich constants that indicate adsorption capacity and adsorption intensity, respectively. The linearized form of Freundlich isotherm can be written as Eq (6).

$$\log q_e = \log K_F + \frac{1}{n} \log C_e \tag{6}$$

The value of K_F and $1/n$ can be calculated by plotting $\log q_e$ versus $\log C_e$ as shown in Fig. 8 (a)-(c). The logarithmic plots show the deviation from linearity on the Freundlich linear plot for HBC while HAC and CAC were well fitted to the experimental data. Table 3 shows the Freundlich adsorption isotherm constant and correlation coefficients. The values of K_F indicate the degree of the binding capacity between the adsorbent and dye molecules. Thus, the high degree of K_F implies that the affinity between the adsorbent and dye molecules is also high [24]. From the experimental data, the constant K_F of HBC, HAC, and CAC for AB80 were found to be 1.05, 6.77, and 12.39 L/mg, respectively. Likewise the magnitudes of $1/n$ for Freundlich isotherms were revealed to lie between zero to one, indicating that acid dye (AB80) is favorably adsorbed by all the adsorbents [6].

4. CONCLUSION

The study results elucidated that the prepared adsorbents from hyacinth, HBC and HAC, could be effectively used as an adsorbent for the adsorption of acid dye (AB80). The efficiency of HAC also showed the comparable efficiency to the commercial activated carbon, CAC. The adsorption is an endothermic process due to the adsorption capacity increases with increasing temperature and the adsorption favours acidic pH. The isotherm adsorption study elucidated that HBC was fitted to Langmuir model with high correlation (R^2) of 0.997 while HAC and CAC were well fitted to Freundlich model with favorable correlation (R^2) of 0.990 and

0.991, respectively.

ACKNOWLEDGMENT

This research was financially supported by the National Center of Excellence for Environmental and Hazardous Waste Management and Research Center for Environmental and Hazardous Substance Management.

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Alternative Biomass Residues from Palm Oil Mill for Synthesis Activated Carbon by Zinc Chloride Activation

Wasan Phooratsamee, Kanokorn Hussaro, Sombat Teekasap and Joseph Khedari

Abstract— Palm oil mill annually produce a huge amount of biomass residues as by-products which including palm oil shell. They have experienced problems in waste disposal and have sought ways of addressing these through alternative techniques, including recycling. The aim of this study is a technical and economic feasibility of recycle plant for producing activated carbon from palm oil shell, which is a by-product from palm oil mill. It is so because the palm oil shell carries a large amount of carbon content and cheap which is usable as raw material for producing activated carbon. This paper presents an alternative waste management technology: using palm oil shell as raw material in producing activated carbon by chemical activation with $ZnCl_2$ and economic analysis of recycle plant for the activated carbon production. It was found that it is technical feasibility to activated carbon by using palm oil shell from palm oil mill. The fixed carbon of activated carbon ($ACZnCl_2$) and standard AC were 70.65 (wt%) and 72.41 (wt%), respectively. The BET surface area of $ACZnCl_2$ and commercial AC measured by N_2 adsorption at 77.4 K were found 689 and 711 (m^2/g). The recycle plant has the capacity of 4684.93 tons per day and initial cost of 30,000 million THB. It has indicated that the fifteen years of project life, payback period of the production is approximately 3.47 year.

Keywords— Biomass residues; activated carbon; waste management technology; palm oil shell.

1. INTRODUCTION

There is an increasing pollution growing of air and water resources in Thailand. The need to purify our waters and keep our atmosphere clean requires the development of new methods for the production of highly efficient filter media and effective adsorbents. Active carbon has been considered as one of the most effective adsorbents because of its well-developed porous structures, large active surface area and good mechanical properties. Activated carbon can be prepared from a large number of materials. These materials are usually high in carbon and volatile contents but low in inorganic contents. Some of the most common precursors for activated carbons are coal, coconut shell, lignite and wood [1].

Thailand has been well recognized as one of the top exporters of agricultural biotechnology with traditional energy sources. The amount of waste from agriculture has increased due to rapid industrial development in recent years.

Focus on environmental problems from industrial waste, palm oil shells from factory wastes agriculture in Thailand. Palm oil shells from oil palm occurs carbon primarily in large quantities. The products of palm oil mill are to plant oil palm in Thailand can be produced 1.7×10^6 tons per year [2].

Activated carbon is a microcrystalline, non-graphitic

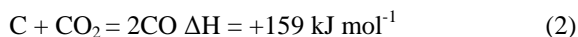
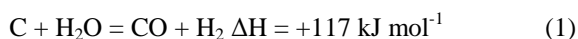
form of carbon with a porous structure that has been processed to develop its internal porosity. This material can be characterized by a large specific surface area of 500-2500 m^2/g , the most important physical property of activated carbon which allows the physical adsorption of gases or vapors and dissolved or dispersed substances from liquids. Activated carbons (AC) are an effective adsorbent for many pollutant compounds (organic, inorganic, and biological) of concern in water and wastewater treatment. Its first use came into prominence through its use as an adsorbent for certain poisonous gases in gas masks during World War I [3].

Activated carbons are commonly prepared using two basic processes: (i) Chemical activation and (ii) Physical or gas activation [4]. Chemical activation is usually limited to woody precursors. This process involves carbonizing the parent material after impregnation with phosphoric acid, zinc chloride, sulphuric acid, potassium sulphide, carbonates of alkali metals, and metal chlorides. The common feature of these compounds is their ability to act as dehydrating agents which chemical activation is 400-800 °C. Case of stimulation by the addition of chemicals into the charcoal or the material before it is used to produce activated carbon. Chemicals used, such as potassium hydroxide (KOH), zinc chloride ($ZnCl_2$), calcium chloride ($CaCl_2$), magnesium chloride ($MgCl_2$), hydrochloric acid (HCl), and phosphoric acid (H_3PO_4). These chemicals to act as a catalyst to the process pyrolytic condensation (pyrolytic condensation), of carbon to carbon loss during the charcoal production process less due to the elimination of water and cellulose products faster has activated carbon more. It also prevents shrinkage of the structure. The carbon structure as it is often activated carbon with a porous medium. In production, it will not exceed temperatures of 900 °C [4]. Physical activation is the development of porosity by gassification with an

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oxidizing gas at 700-1100 °C. Gases are commonly used carbon dioxide, steam and air. They can be used singly or in combination. Several types of oven can be used in the manufacture of activated carbon, i.e. rotary kilns, multiple hearth furnaces and fluidized beds. The type of oven used determines the properties of the activated carbon produced. In general, a decreasing mesoporosity is observed in the order: fluidized bed, multiple hearth furnace and rotary kiln. The reactions of carbon with steam and carbon dioxide are endothermic reactions and the stoichiometric equations are as follows [4]:



Materials used in the production of charcoal are carbon based organic material, meaning that the carbon compounds. Hydrogen is the most important element is the coconut husk, palm oil shell, sawdust, and rice dust [5].

Palm oil shells as part of the palm oil as shown in Fig. 1 are generated after the palm fruit and palm oil production process and disposed of as solid waste. Fig. 2 shows palm oil shells use as fuel in some factories such as the brick factory. As reported that the burned palm oil shell contain free carbon of about 20% by weight.



(a)



(b)

Fig. 1 Oil palm fruit, (a) fresh palm fruit bunch and (b) structure of the palm [6].



Fig. 2 Palm oil shells.

Activated carbon is a charcoal capable of absorbing substances other well because the surface area within the particle height, divided into two categories: type of powder and pellet or flake [5]. The type of powder can be distributed in well water is used in related industries such as solutions or liquid such as clear color and the bleach smell suck the sugar industry. The food industry and production of oil used to absorb contaminants in the wastewater industry and water purification. The pellet or pellets used in the manufacture of a purified gas, such as in air filter lock, poison gas filtered, cigarette butt, etc. There are used activated charcoals in the household. In connection with the products absorb smells like stale in the refrigerator, cabinets, clothing, footwear etc., which will see the demand for charcoal carbon are widely and are more likely to use regularly in the country. It also can be exported to a foreign distributor.

Substantially, activated carbon used in the process of adsorption in order to separate the pollutants released from medium is a liquid or gas in various industries to 400,000 tons / year Therefore, increasing the value of the waste product from palm oil production process by making the adsorbent as activated carbon is the main goal of this research.

2. MATERIALS AND METHODS

Materials: Palm oil shells (Particle size of 2-2.8 mm) were obtained from ASIA GREEN ENERGY PUBLIC COMPANY LIMITED and standard activated carbon (Commercial grade; code No.CGC-11A) was supplied by C. Gigantic Carbon Co.Ltd. Zinc Chloride ($ZnCl_2$) was dissolved in distilled water to prepare a saturated solution.

Methods: Preparation of the activated carbon from palm oil shell was divided into two steps; (i) carbonization and (ii) activation process.

(i) Carbonization process was performed as follows. Palm oil shell (POS) was dried at 110 °C for 24 and sieved in order to between 2-2.8 mm. The sample was set in a reactor which was fixed bed design of stainless steel with 54.1 mm internal diameter and 320 mm length. It was then carried out under constant nitrogen flow ($150 \text{ cm}^3/\text{min}$) at a heating rate 10 °C/min up to 600 °C for 1 h.

(ii) Preparation of activated carbon samples from palm oil shell, using zinc chloride ($ZnCl_2$) under

conditions of activation 1:1 of ZnCl₂: char ratio (w/w) and were kept at 80 °C for 10 h. The temperature of activation was raised at 4 °C /min up to 500 °C, which was maintained for 2 h. Finally, the sample was then washed to remove excess reagent until pH about 6-7 and dried at 110 °C for 3 h.

Sample characterization: An elemental analysis was carried out using a CHNS/O ANALYZER (PE2400 SeriesII). Gaseous products freed by pyrolysis in high-purity oxygen and were chromatographically separated by frontal analysis with quantitatively detected by thermal conductivity detector. Proximate analysis was conducted according to the American Society for Test in and Materials (1997) and the results were expressed in terms of moisture, volatile matter, ash and fixed carbon content. Specific surface area of the sample was determined by nitrogen adsorption-desorption isotherms measured in a Micromeritics ASAP 2020 apparatus. Adsorption of N₂ was performed at 77 K. Before any such analysis, the samples were degassed under N₂ flow at 350 °C for 2 h in a vacuum at 27 Pa. The specific surface area of the prepared activated carbons was estimated by the BET method using N₂ adsorption isotherm data.

3. RESULTS AND DISCUSSION

Characteristics of palm oil shell are presented in Table 1. The proximate analyses of palm oil shell were as follows (dry wt basis%): fixed carbon 9.91, moisture 4.55, ash 1.39, volatile 88.70, C 47.26, H 6.18, and N 0.94.

Table 1: Proximate and ultimate analyses of palm oil shell

Proximate analysis (as received, wt%)	
Moisture	4.55
Volatile matter	88.70
Fixed carbon	9.91
Ash	1.39
Ultimate analysis (dry basis, wt%)	
C	47.26
H	6.18
N	0.94

Characterization of activated carbon samples using ZnCl₂ as chemical agent for activation are presented in Table 2. As can be seen from Table 2, specific surface area of activated carbon (ACZnCl₂) was closely to the standard activated carbon (standard AC, supplied by C. Gigantic Carbon Co.Ltd.

In economic analysis for investment in activated carbon production with capacity of 1.71 million tonnes per year. It is assumed that, the fifteen years of project life, working time at 8 hours a day, 300 days a year, direct labor cost per day is 200 THB/worker, the interest rate of 6.5 %, electricity cost of 2.97 THB/kWh, and maintenance cost per year is 3% of the machines' prices.

The first investment is 30,000 million. Sale price of activated carbon is 170 THB/kg. The approximated first investment and operating cost are shown in Table 3 and 4.

Table 2: Characteristics of activated carbon samples

Items	Types of activated carbon	
	ACZnCl ₂	Standard AC
Proximate analysis (wt%)		
Moisture	1.77	4.03
Volatile matter	24.34	23.18
Fixed carbon	70.65	72.41
Ash	5.01	4.41
Ultimate analysis (wt%)		
C	69.99	72.58
H	2.03	1.97
N	0.78	0.63
Typical properties		
Specific surface area (m ² /g)	689	711
Total pore volume (cc/g)	0.3571	0.3906

Table 3: First investment for activated carbon production

Investment Item	Cost (million THB)
Land and building	1,500
Machines/equipments	
-Reactor, 2 sets	5,000
-Drying machine with belt filter 1 set	1,000
-Furnance, 1 set	8,000
-Continuous ball milling machine, 1 set	4,000
-Packing machine, 1 set	9,500
Total first investment	30,000

Table 4: Operating cost for activated carbon production

Operating cost	(THB)
Labors (12 workers/3shifts)	2160000
Maintenance (5% of machine cost)	15x10 ⁸
Electricity	1,403,040,473
Raw materials	2.3567x10 ¹¹
Water	52,113,600
Total	2.38628x10¹¹

Results from the analysis show that, payback period of production is approximately 3.47 years.

4. CONCLUSION

This paper makes two contributions. First, it provides the alternative waste management technology to utilize palm oil shell from palm oil mill: as raw material in producing activated carbon by chemical activation with $ZnCl_2$ at 500 °C activation temperature for 2 h. Second, it provides the feasibility of activated carbon production in terms of production technology and financial analysis.

Base on the experiment can conclude that it is technical feasibility to activated carbon by using palm oil shell from palm oil mill. The fixed carbon of activated carbon ($ACZnCl_2$) and standard AC were 70.65 (wt%) and 72.41 (wt%), respectively. The BET surface area of $ACZnCl_2$ and commercial AC measured by N_2 adsorption at 77.4 K were found 689 and 711 (m^2/g). It indicated that the activated carbon produced from palm oil shell lies in the range of commercial activated carbons. Accordingly, the activated carbons produced from biomass residues can be used as adsorbents for various environmental application including removing hazardous compounds from industrial production.

In addition, it is feasible to establish the recycle plant with the capacity of 4684.93 tons per day and Initial cost of 30,000 million THB. The indicated that the fifteen years of project life, payback period of the production is approximately 3.47 year. Therefore, it makes the recycle plant feasible to invest.

ACKNOWLEDGMENT

The authors would like to thank the King Mongkut's University of Technology Thonburi and Scientific and Technological Research Equipment Centre Chulalong University for supporting in analysis equipment.

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Product Development and Marketing Strategies for Community Products in the Lower Northeast Area, Thailand

Pensri Jaroenwanit and Suriya Saiyot

Abstract— This paper aims to study new product development and marketing strategies in the context of community products in the lower northeast area, Thailand. Surin province has been chosen as the area of study since this province is well known as a beautiful location for traveling purposes and a great place for souvenir shopping. It has earned a reputation for its fine silk and notable silver beads & ornaments. Both qualitative and quantitative researches are used for this study. The study starts with compiling qualitative data from various sources and then operationalizes quantitative findings via a questionnaire survey. The qualitative endeavors include in-depth interviewing, focus group discussion, and brain storming. Informants of qualitative research included consumers, experienced distributors, the members of an enterprise's target community, designers, expertise practitioners, and government officers. The quantitative research involves a field survey, using the questionnaire as a data collecting tool. Field survey samples consisted of 100 consumers who live in Surin province and are experienced in purchasing or using the same kind of community products as under the study. The data obtained from the survey were analyzed by fundamental descriptive statistical methods. The findings show that several outputs are obtained from the process of new product development, including product idea generation, product idea screening, product concept development, product concept testing, and marketing strategy development. It was also found that the respondents agree with the new product concept. They might buy the product if it is in accordance with the stated concept. Marketing strategy should fit the target customers' demand and reach them efficiently and economically.

Keywords— Community, marketing strategy, northeast Thailand, product development.

1. INTRODUCTION

To be able to survive sustainably and grow in the current competitive market, businesses have to understand the market, especially regarding demand and supply. Businesses must not only be able to produce their products, but also apply marketing strategies in order to achieve acceptance from their target consumers. Additionally, they must develop new products to satisfy their target consumers' changing needs and wants.

Although plenty of marketing research has been conducted to understand and find out about the ultimate outcomes of consumers' choices, studies of marketing strategy and product development deserve more attention.

Although community products in Thailand have historically generated a lot of income for communities and the local people, the businesses surrounding these products still have weaknesses. Most importantly, many businesses lack a plan for marketing direction, resulting in the community products failing to sustain themselves on the market [1]. The most vital problem lies in some non-standardized products and imitated and/or copied products. For example, packaging does not meet the

standard, nor is it adequately outstanding to attract customers' attention [2].

Process-based conceptualizing of product development brings about problems and failure. Hence, the conceptualizing of a product should be developed to emphasize marketing. Such conceptualization begins by looking at market demand and proceeds by producing a product to respond to the demand - a more sure way towards success [3]. A product that meets the market needs and is accepted in the target market must be a quality product [4]. A business organization, therefore, needs to regularly develop new products and follow values that respond to customers' demand, which will result in the business's flexibility towards the market's competitive reaction to its products.

The objective of this paper is to present this new product development and marketing strategy in the context of a community product in Thailand. This study was conducted with an attempt to analyze the opinions of key informants on the development and marketing strategy of a selected product. The study also surveys the satisfaction and opinions of customers towards the targeted product in order to understand their demand and develop the new product concepts accordingly. The findings are presented and discussed. Conclusions were then drawn to prepare for further study in the next steps of new product development and to clarify business implication.

2. LITERATURE REVIEW

To clarify the role of marketing strategy and new product development, this section scrutinizes and discusses

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relevant literature and existing bodies of knowledge. Collectively, this knowledge reflects the importance of the topic of study and elaborates on conceptualization and taxonomy, of each relevant concept.

2.1 New Product Development

The consulting firm Booz, Allen & Hamilton has identified six categories of new products in terms of their newness to the company and the marketplace [5].

1) New-to-the-world products: Products new to the company and the market;

2) New product lines: New products that allow a company to enter an established market for the first time (the product is new to the company, not to the market);

3) Additions to existing product lines: New products that supplement a company's established product lines;

4) Improvements and revisions of existing products: New products that provide improved performance or greater perceived value and replace existing products (improvements in features and benefits of a product);

5) Repositioning: Existing products that are targeted to new markets or market segments (to be called a new product there must be some changes in the existing product to suit the new segments targeted);

6) Cost reductions: New products that provide similar performance at lower cost to the company.

This research study focuses on category 4, improvements and revision of existing products.

Kotler says only 10% of all new products are truly innovative and new to the world. New product development in various categories mentioned above is very important for any organization because existing products are vulnerable to changing consumer needs and tastes, new technologies, shortened product life cycles, and increased domestic and foreign competition. Organizations have to be on the lookout for new products [6].

Eight stages are involved in new product development process. [6].

- 1) Idea generation
- 2) Idea screening
- 3) Concept development and testing
- 4) Marketing strategy development
- 5) Business analysis
- 6) Product development
- 7) Market testing
- 8) Commercialization

This research was conducted by following the new product development process from steps 1 to 4 only.

2.2 Marketing Strategy

The primary focus of marketing is to effectively allocate and coordinate marketing resources and activities to accomplish the firm's objectives within a specific product market. Therefore, the critical issue concerning the scope of a marketing strategy is specifying the target market(s) for a particular product or product line. Next,

firms seek a well-integrated program of marketing tailored to the needs and wants of potential customers in that target market. [7].

Many researchers emphasize the success of introducing new products to the market as they believe this is the way to maintain customer loyalty and to restore product life cycles [8, 9, 10,11].

The importance of focusing on market acceptance was highlighted and it was pointed out that customers are the best product designers, as they can define and solve the problems that develop with their products [8]. Therefore, obtaining local business representatives' and customers' opinions towards the local products is invaluable insight for marketing strategy and product development.

2.3 Context Discussion

The 2001 government policy of One Tambon One Product (OTOP, which is a concept of one product per town, or subdistrict) encouraged cooperation within the community by persuading community members to form into small entrepreneurs to produce OTOP. The Government approach to rural development and attaining self-reliance is based on teaching communities how to successfully develop and market their unique and distinctive products. The OTOP project was undertaken to assist rural villages in promoting tourism and advancing national brands. It emphasised the global market for locally produced products [12].

In the period of more than 10 years since 2001, regional products have generated income for local communities. However, regional producers still have weaknesses in production and marketing as they lack a marketing plan, resulting in local products that are not able to sustain in the current competitive market, much less enjoy long-term growth and profitability into the future. The concept of process-based conceptualization has resulted in significant problems and failures when competing in the current market. Hence, the conceptual process should be altered to emphasize marketing. This process begins by examining the market demand and producing a product to respond to the demand, which is a better way for a business to succeed. A product that meets market needs and is accepted in the target market must be a quality product. Local producers, therefore, need to understand the current market, regularly develop new products, and follow values in line with customers' demands. This will result in competitiveness and the business's flexibility towards the market's competitive reaction to its products.

Surin Province is one of the prominent regional provinces in Thailand, located in the lower Northeastern area. It is famous for many of list OTOP products; for example, fine silk, clothing articles, utensils, decorating items, art and handicraft, silver beads and ornaments, and hand-made souvenirs. Some community products have little by little entered both domestic and foreign markets, for example, woven cloth and cloth products, such as scarves and clothes; wickerwork items from natural fibers; earthenware; imitated flowers; woodenware; sandalwood products; and products from mulberry paper.

In an effort to enhance quality, the OTOP products have been judged on basis of quality, given grades from

A to D by a committee selected for this purpose [13]. Grade A products are the highest quality and considered competitive enough for export. Grade B products have strong potential, should be competitive domestically, and can be developed to international standards. Grade C products should be studied further. Finally, Grade D products generally have very low potential for development [14]. Part of the grade is dependent on the condition that all laws and copyrights are respected in the making of the goods and that the goods are not made of entirely imported materials. Once that is determined, the product is judged by the amount of local materials and knowledge that goes into its production, the quality and development of the product, and any potential effects on the environment. Marketing factors are also considered: the distribution channels available, sales trend comparisons, the sustainability of the market, logistical challenges, and the product design [14]. Most local products produced in Surin Province continue to be graded with D, C or B. Very few products are such high quality that they are accepted as grade A products.

In order to increase marketing opportunity, it is vital to study marketing strategy and product development of community products. This will create potential for community products to compete on regional, national, and international markets in the future.

3. RESEARCH METHODOLOGY

Both qualitative and quantitative researches are used for this study. The research starts by compiling qualitative data from various sources and activities, then operationalizes the qualitative findings quantitatively via a questionnaire survey.

The qualitative endeavors included focus group discussion, in-depth interviewing, and brainstorming.

Focus group discussion was primarily conducted with members of the target community enterprise for an analysis of marketing problems and selection of a suitable product.

Baan Taen Thai Silk Industrial Group which is located at Baan Taen Sub-district, Sikhorphum District, Surin Province was selected as the target community enterprise for this study. Silk products were selected by the members of the target community enterprise as the suitable products to be used in the process of new product development study. The main products of the target community enterprise are made from fine silk, including clothes, women's hand bags and shoulder bags, wallets, glasses and tissue boxes, and silk ornaments. The decided upon product, specifically, was women's shoulder bags. The main problems of the selected product included its lack of development or design of new products; lack of product variety, brand names, or other details; and product advertising.

The in-depth interview was used for exploring the satisfaction and opinions towards the selected product and desired products. Informants were: 1) consumers who had experience in buying the selected product either from the target community enterprise or from other producers, and 2) distributors who had been selling the community product in the study area.

Brainstorming was conducted with designers, academics in the field of marketing, expertise practitioners, experienced distributors, together with government officers in charge of promotional activities of the community products. Brainstorming was utilized to gain ideas and to conceptualize new products. It was followed with screening and evaluating the new product concepts.

The quantitative research involved a field survey using a questionnaire to collect data, fulfilling the steps of product concept testing and developing marketing strategies for the selected and tested product. Field survey samples consisted of 100 consumers who live in Surin Province and have had experience in purchasing or using the same kind of community product as the one selected under this study. The data obtained from the survey is analyzed by fundamental descriptive statistical methods.

4. FINDINGS

4.1 Customers' attitudes and satisfaction towards selected products

It was found from the in-depth interviews with consumers and distributors that they did not like the out-of-date and unattractive products with no standard form. The main weaknesses of the selected product were said to be mildew, easy distortion, out-of-date and unluxurious patterns and forms, unattractive colors and styles, and lack of partition inside. Satisfactory traits included various size options, the availability of suitable styles for teenagers, and its local identity. Suggestions for product improvement were modernizing patterns and forms to suit teenagers and young working women; designing more models; making the product more attractive, luxurious and unique; and adding inside partitions.

4.2 New product ideas to meet demands

The consumers' and distributors' satisfaction and opinions about the selected product were applied in assigning characteristics and major trait formation, including three customer-related "product ideas." The three ideas include:

- 1) Luxury-look, working women's handbags or shoulder bags;
- 2) Decorative silk cloths for house and living room decoration;
- 3) Decorative frame of silk cloths with provincial symbol designs on the silk, along with a story or legend.

4.3 Evaluation and screening of new product ideas

In order to select and obtain the best product idea, the Product-Idea Rating Device, which was modified from Kotler's and Keller's, was used as a tool for product selection, as shown in Table 1[15].

The screening of the brainstormed, new product ideas was carried out by 8 specialists in different fields who considered various factors that make a product successful. The weight of each factor was stipulated, including product characteristics, identity, and

demonstration of local wisdom, target market, size of market that would enable commercial selling, competitive situation, and relation with the group's production resources.

TABLE 1 Product idea rating scale

Order	Factors making a product successful	Score weight (a)	Scores of suitable idea (b)								Product score (a)*(b)		
			.1	.2	.3	.4	.5	.6	.7	.8		.9	1.0
1	Identity of outstanding trait	.30											
2	Product design in line with target customers' demand	.20											
3	Fineness of workmanship	.10											
4	Characterization of local wisdom	.10											
5	Containing patterns that reflect local identity	.10											
6	Related to the group's production resources	.05											
7	Size of markets for commercial production	.10											
8	Competitive situation in terms of price	.05											
Total score													

Meaning of rating scales:

0.10 – 0.30 means the product is not suitable to enter the market.

0.31 – 0.60 means the product is moderately suitable to enter the market.

0.61 – 1.00 means the product is good and suitable to enter the market.

Each idea was scored according to the rating scale, and the idea with the highest total score was selected. Therefore, the first idea was selected due to its highest score. The results of each product idea evaluation are shown in Tables 2,3, and 4.

TABLE 2 The results of the first product idea screening: a luxury-look, working women's handbags or shoulder bags

No	Factor	Scores from individual screener (one by one)								Product Score
		1	2	3	4	5	6	7	8	
1	Identity of outstanding trait	0.170	0.160	0.115	0.109	0.150	0.110	0.105	0.110	
2	Product design in line with target customers' demand	0.010	0.025	0.025	0.020	0.040	0.019	0.023	0.030	
3	Fineness of workmanship	0.215	0.200	0.029	0.015	0.200	0.015	0.023	0.018	
4	Characterization of local wisdom	0.016	0.020	0.012	0.012	0.110	0.190	0.190	0.100	
5	Containing patterns that reflect local identity	0.015	0.015	0.130	0.113	0.100	0.150	0.190	0.150	6.017
6	Related to the group's production resources	0.019	0.015	0.016	0.017	0.128	0.150	0.180	0.150	
7	Size of markets for commercial production	0.109	0.029	0.025	0.026	0.170	0.160	0.320	0.160	
8	Competitive situation in terms of price	0.090	0.050	0.018	0.026	0.190	0.180	0.160	0.180	
Total score		1.191	0.898	0.644	0.338	1.088	0.370	0.974	0.514	
Average agreement score from all screeners		0.752								

TABLE 3 The results of the second product idea screening: decorative silk cloths for house and living room decoration

No	Factor	Scores from individual screener (one by one)								Product Score
		1	2	3	4	5	6	7	8	
1	Identity of outstanding trait	0.028	0.110	0.150	0.109	0.140	0.029	0.190	0.116	
2	Product design in line with target customers' demand	0.028	0.030	0.050	0.020	0.060	0.120	0.160	0.025	
3	Fineness of workmanship	0.026	0.018	0.150	0.020	0.015	0.120	0.130	0.120	
4	Characterization of local wisdom	0.180	0.100	0.119	0.023	0.010	0.030	0.010	0.010	
5	Containing patterns that reflect local identity	0.028	0.029	0.026	0.024	0.023	0.030	0.028	0.025	5.162
6	Related to the group's production resources	0.018	0.015	0.015	0.017	0.023	0.015	0.015	0.120	
7	Size of markets for commercial production	0.023	0.016	0.016	0.160	0.170	0.160	0.160	0.160	
8	Competitive situation in terms of price	0.160	0.180	0.180	0.160	0.180	0.180	0.180	0.180	
Total score		0.491	0.498	0.706	0.533	0.621	0.684	0.873	0.756	
Average agreement score from all screeners		0.645								

TABLE 4 The results of the third product idea screening: the decorative frame of silk cloths with provincial symbol designs on the silk cloth and the story of legend

No	Factor	Scores from individual screener (one by one)								Product Score
		1	2	3	4	5	6	7	8	
1	Identity of outstanding trait	0.110	0.115	0.118	0.119	0.230	0.290	0.230	0.230	
2	Product design in line with target customers' demand	0.023	0.030	0.050	0.020	0.060	0.025	0.019	0.025	
3	Fineness of workmanship	0.021	0.018	0.015	0.020	0.015	0.026	0.015	0.150	
4	Characterization of local wisdom	0.180	0.100	0.018	0.023	0.010	0.030	0.010	0.010	
5	Containing patterns that reflect local identity	0.028	0.150	0.115	0.110	0.010	0.030	0.015	0.150	5.232
6	Related to the group's production resources	0.028	0.119	0.015	0.017	0.023	0.015	0.015	0.190	
7	Size of markets for commercial production	0.023	0.016	0.016	0.160	0.170	0.160	0.160	0.160	
8	Competitive situation in terms of price	0.160	0.180	0.018	0.016	0.018	0.180	0.180	0.180	
Total score		0.573	0.728	0.365	0.485	0.536	0.756	0.694	1.095	
Average agreement score from all screeners		0.654								

4.4 Product concepts development

With the best product idea selected, it was developed as follows:

The bag will be formed as a stylish, modern, and luxurious handbag of a large size for working women. Special, local materials, such as leather and metals, will be used in order to add value to the product, as well as increase the price. The women's bag should have rigid, chic, and unique patterns and forms. Target customers are teenagers and working women aged 15-35 years who like new, attractive, and luxurious products of various kinds, with different and outstanding traits.

The new product concept was transformed into three styles of product image which are Large Luggage, Multi-Purpose Luggage, and Fashion Handbag and then underwent product concept testing by asking target customers' about their opinions and intentions to buy the product if it were sold on the market.

Marketing strategies were also collected. The tools used were a questionnaire and face-to-face interviewing. The field-surveyed population included consumers who used to buy or use the local products of the same type as those produced by the target community enterprise.

4.5 Product Concept Testing

From the results of product concept testing, it was found that the respondents agreed with the new product concept. They might buy the product if were in accordance with the stated concept. The most suitable product concept was a Fashion Handbag that retained the former identity and emphasized utility and uniqueness, designed with more separate partitions inside for holding more items. If this were sold on the market, there would be a chance the respondents would buy it. The results of product concept testing shown as in Tabel 5.

Table 5 Numbers and percentages of people answering the questionnaire who classified the style as conforming to the product concept

Style	Number of people	Percentage
Style 1 Large Luggage Target: Working people and adults Materials: Made of silk, leather handle, zip, magnet buttons, and leather strip Featured: It can pack things for a one week break, added value of leather. It uses similar colors in cutting patterns.	18	18.00
Style 2 Multi-Purpose Luggage Target: Working people and adults Materials: Made of silk, canvas handle, and magnet buttons Featured: It uses similar colors in cutting patterns. It is used for keeping documents, a notebook, and other such items.	27	27.00
Style 3 Fashion Handbag Target: Working people and adults Materials: Made of silk, canvas handle, and zip or magnet buttons Featured: A removable shoulder-strap. It uses similar colors in cutting patterns. Zipper pocket is added for small articles.	55	55.00
Total	100	100.0

The reasons of respondents for choosing each style are as follows:

Reasons for choosing style number 1 were: the luggage is large, so it can contain a lot of items and can be used anytime. The product is suitable for the consumers. The design, colors, and shape of the product is beautiful and long-lasting.

Reasons for choosing style number 2 were: the product is compact and has beautiful color, which is suitable for the consumers. The style of the product is luxurious and can be used for multi-purposes, such as keeping documents.

Reasons for choosing style number 3 were: the design is beautiful and the colors can be used for many occasions. The design of a modern variety, it is different, compact, and it also conserves local wisdom.

4.6 Marketing Strategy Development

Most respondents agreed with the marketing strategies proposed for silk, ladies' handbags. They mentioned that the product should have a variety of styles and a variety in sizes. They also agreed that the product should be designed to maintain the original characteristics. They suggested that the products should be designed by focusing on function, modernity, and uniqueness and constantly updated with a new, modern style. Appropriate packaging for each product was also expressed as essential.

Most of participants suggested that the price of the large luggage should be around 1,500-2,500 Baht. According to some respondents, the multi-purpose luggage and the fashion handbag should be set around 1,000-1,500 Baht.

In terms of product distribution, most of respondents believed that it should be fulfilled in different ways, especially through distributing at souvenir stores and convenient stores. The most suitable and convenient place for product distribution would be the OTOP center.

The most respondents expressed that there should be advertisements or public relations to present the silk handbag product to potential customers. The product information should be presented at an exhibition or trade fair.

5. CONCLUSIONS

It can be concluded from the results of field survey research as following:

1) According to the personal information of the respondents who answered the questionnaire, 100% of the respondents were female, 67% of them married. The highest education level was an undergraduate degree (35% of participants); major occupations included those in the government sector (25%), and the majority income was 5,000-10,000 Baht per month (37%). The average age of the participants was 30-35 years old (35%); 52% were working, living, and studying in the urban area of Surin.

2) Buying Behaviors and the Use of Silk Products from the Past Year, 100% of the respondents used to buy local products (OTOP) and 99% knew of the silk products. The amount of respondents who had bought and used silk products was 92%, and 34% had bought a silk purse before. The most widely expressed problem respondents found in using silk bags was discoloration.

3) The analysis of respondents' opinions about the product concept of silk ladies' hand bags of Baan Taen Thai Silk Industrial Group revealed that 53% of participants know of Baan Taen Thai Silk Industrial Group's silk, ladies' hand bags. 4.35% agreed with the group's new product concept of silk ladies' hand bags. A mixture of local materials are used and the product has a modern form, especially focusing on unique characteristics of modern, working women who enjoy working.

4) Market strategy should include alternative designs, models, and sizes, with an emphasis on usage, modernity, uniqueness, and beauty. Fashioned silk bags

should be from 1,000 –1,500 baht. They should be sold at souvenir shops, modern bag shops, special product shops (as fashion items), and small shops in department stores. Marketing communication should be continuous through a selection of appropriate tools. Access to the target consumers should be emphasized. Advertisements, so that more people know about silk bags, can be done through the Internet, in addition to exhibition, fair, and demonstration events. Entrepreneurs should acquire Internet skills and access to an online society, which will assist communication to reach the target customers quickly and economically. It also creates potential for conducting further study on customers' demands.

6. RECOMMENDATIONS

Recommendations are drawn from this research study as follows:

1) The first step in developing product ideas, which is the analysis of problems with a selection of products, should be carried out cautiously in order to minimize mistakes. All relevant people should be involved, especially customer groups, middleman groups, and enuser groups. As a result, a good product idea can be created, which answers all groups' concerns.

2) The main factor that urges customers to buy products is that the product is new and unique, with attractive colors and designs. The unique selling proposition, including difference, identity, multiplicity, and usefulness for different occasions, should then be used to attract more customers.

3) Some customers complain about problems from using products. Entrepreneurs should regularly inspect the characteristics and uses of their products to be able to solve problems in time. Tags should be provided to show details for correct consumption or use. In the case of specific characteristics that require special care and maintenance, augmented products should be offered. For example, quality guarantee may be offered or a problematic product can be returned. This will build confidence among customers.

4) Product standardization and quality are other marketing strategies which would impress the customers and encourage them to come back again.

5) There should be a variety of distribution methods to suit consumer differences in demography and behavior.

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Status of Transboundary Movements of Hazardous Wastes in Selected GMS Countries

Alice Sharp and Li Liang

Abstract— Hazardous wastes are one of the fast growing solid wastes in the urban environment worldwide. Given the complexity and diversity of collection and management of the hazardous wastes (HW) in the solid waste streams, technologies associating with resource recovery, reuse, and recycling continue to evolve. Review of the literature available from the selected GMS countries shows a lack of clear sustainable HW management systems being implemented in these countries. However, some countries may opt for transporting their hazardous wastes to other countries. This study aims to assess the current status of transboundary movements of hazardous and other wastes in accordance with the Basel Convention in selected GMS countries; i.e., Cambodia, Laos, Thailand, and Vietnam, in order to propose a management mechanism to aid in monitoring transboundary pollution. It was found that the most troublesome of HW in this region was electric and electronic equipment. Therefore, this study focuses on analyzing the issues related to E-waste movement, including the background information on economic status of each country, situation of transboundary movements of hazardous wastes (E-waste), and problems encountered in monitoring transboundary movements of wastes.

Keywords— Basel convention, GMS countries, hazardous wastes, transboundary pollution.

1. INTRODUCTION

Historically, the disposal of wastes was not a major problem; as the population was small and sparsely distributed. Their consumption patterns were simple and mainly generate bio-degradable wastes. However, with rapidly increasing quantity of solid wastes being generated as a result of the increase of populations, the waste management issue becomes serious and urgent. Problems related to solid waste are not only the increasing quantity but also the changing in waste compositions; each of which requires appropriate treatment technology.

Hazardous wastes (HW), much like municipal solid waste, are one of the fast growing solid wastes in the urban environment worldwide. Although each country may have developed various regulations as well as monitoring mechanisms, there is no comprehensive data available to provide an overview of hazardous waste situation both in terms of sources of production and types of HW produced. Quantity of HW produced under the current handling methods were also not clear, especially in developing countries [1]. Given the complexity and diversity of collection and management of the hazardous waste in the solid waste streams, technologies associating with resource recovery, reuse, and recycling continue to evolve. However, some countries may opt for transporting their hazardous wastes to other countries. Annually, there are more than 50,000 tons of HW being imported and exported worldwide with more than 50%

being exported to Southeast Asia [2]. A review of the literature available from the selected GMS countries shows a lack of clear sustainable HW management systems being implemented in these countries.

This study aims to assess the current status of transboundary movements of hazardous and other wastes in accordance with the Basel Convention in selected GMS countries (i.e., Cambodia, Thailand, and Vietnam) in order to propose a management mechanism to aid in monitoring transboundary movement of HW. Other issues analyzed in this study include background information on economic status of each country, issues related to transboundary movements of hazardous wastes especially in the case of E-waste, and problems encountered in monitoring transboundary movements of wastes.

2. DATA COLLECTION AND ANALYSIS

The data collected was divided into two forms; quantitative data (e.g., economic performance data, trade data, and handler survey) and qualitative data (e.g., legislative framework, management mechanisms, and financial motivations).

It should be noted that the data used in this study are based on individual country's reports to various international agencies and such data do not provide information on illegal transboundary movements. Report on those movements was used where appropriate.

Data from some countries may not be available; thus, such countries will be discussed basing only on the documents available.

3. ECONOMIC STATUSES OF STUDIED COUNTRIES

The economic statuses of the countries studied have improved drastically during the last few decades (Table 1). It should be noted that the data on waste generation per capita are the average number of each country. However, there can be a vast difference between waste

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generation per capita in rural and urban areas. Although not shown here, data collected suggest the change in consumption patterns that lead to generation of hazardous wastes. Change in consumption patterns can be observed from the shift in structure of outputs from agriculture-based to industry- and service-based. Countries that have high proportion of industrial outputs have a tendency to produce a large quantity of hazardous wastes; therefore, these countries should also have in place some mechanisms for HW management.

Table 1 Selected basic socioeconomic indicators (2011)

Indicator	Cambodia	Laos	Thailand	Vietnam
Annual Population Growth (%)	1.5	2.0	0.4	1.0
Urban Population (%)	21.0	33.2 (2010)	36.1	31.7
GDP (Billion US\$) *	12.875	8.289	345.649	123.961
GDPcap (US\$)	900	1,320	4,972	1,411
Growth rate of GDP (%)	7.1	8.1 (2010)	0.1	5.9
External trade change (%)	1. 35.8	1. 6.1	1. 11.7	1. 34.2
1. Export	2. 25.9	2. 17.6	2.19.1	2. 25.8
2. Import				
Waste generation per capita (kg/cap/day)	0.52	0.55	0.64	0.61
Human development index *	0.523	0.524	0.682	0.593
Environmental performance index *	55.29	n/a	59.98	50.64

Source: Key Indicator for the Asia and the Pacific 2012

* UNDP Human Development Report 2011 [3]

Table 1 further shows that based on the three socioeconomic indicators in GDP, human development index and environmental performance index, Thailand is ahead of the other three neighboring countries including Vietnam, Cambodia and Laos. Thailand with its higher GDP indicates a possibly higher EEE consumption; thus, may generate more E-waste than other countries. However, due to its higher indices in both human development and environmental performance, Thailand is expected to have established or will establish a better

solid waste management system to achieve its national goals toward regulating the production, sale, and use of EEE and subsequent disposal of E-waste generated. This expectation is based on that a higher environmental performance indicator provides a gauge as to how close a country is to its established national environmental policy goals.

Next to Thailand, Vietnam has the second highest GDP, human development index and environmental performance index as compared to Cambodia and Laos. Therefore, it is expected that Vietnam would be considered an intermediary between Thailand and Cambodia and Laos, to achieve the goal of developing a comprehensive E-waste management system in the country.

4. TRANSBOUNDARY MOVEMENTS OF HAZARDOUS WASTES

HW in the region can be grouped into two main types; E-waste and industrial waste. All countries in this study indicate the significance of E-waste problem; therefore, the following analysis will focus mainly on E-waste and the used electronic and electrical equipment (UEEE).

Table 2. Import control policy on secondhand and other HW

Items considered	Cambodia	Thailand	Vietnam
Significant hazardous wastes	- E-waste	- Industrial hazardous waste - E-waste	- Industrial hazardous waste - E-waste
Secondhand EEE			
Import control	No	Yes	Yes
Controlling method	N/A	Permit needed	Ban
Secondhand commodity being controlled			
Air Conditioner	-	X	X
Cell Phone	-	X	X
Photocopy machine	-	X	X
CRT, LCD TV	-	X	X
PC	Ban	X	X
Printed Circuit Board	-	X	X
Refrigerator	-	X (CFC contained is controlled)	X (includes brand new CFC-R12 is banned)
Restrictions on other HW			
on export to final disposal/recovery	No	Yes	No
on import for final disposal and/or recovery	Yes	Yes	Yes
on transit	No	Yes	Yes

Source: Asian Network for Prevention of Illegal Transboundary Movement of Hazardous Wastes 2012

The import control policies on secondhand HW

adopted in Cambodia, Thailand, and Vietnam are shown in Table 2. As there is no regulation on UEEE in Cambodia, it could be the source of UEEE movement in the region as discussed in the next section regarding the movement of UEEE between Cambodia and Vietnam.

For Thailand, the importation of UEEE for the purpose of retail or reuse, equipment shall be in the original conditions as being manufactured, and in use less than 3 years from the manufacturing date. For recycling, equipment must be economically worth recycling, its importing amount should not exceed the capacity of the recycling facility, and it must be imported from the Basel Convention countries.

The statistics on the import and export of HW for each country are discussed below based on the data available.

Cambodia

Based on the inventory report [4], the trend on imported UEEE in Cambodia has changed. **Figure 1** shows that among the six types of UEEE imported, importation of TV sets has gradually reduced in number while that of secondhand mobile phones has increased dramatically since 2004. The imported mobile phones have reduced in number in 2006 due to the fact that most people who can afford to own mobile phones have already acquired their phones. In general, there is a decreasing trend in imported UEEE due to two main reasons: 1) those people who are capable of buying UEEE have bought it already; and 2) people have switched to cheap brand-new EEE from China.

The imported UEEE will be distributed to the vendors for repairing, reassembling or dismantling. However, the data on excess imported UEEE are difficult to obtain. In some cases, excess UEEE are illegally exported to such countries as Vietnam. Information on illegal trafficking of UEEE into Vietnam will be discussed later on in this section.

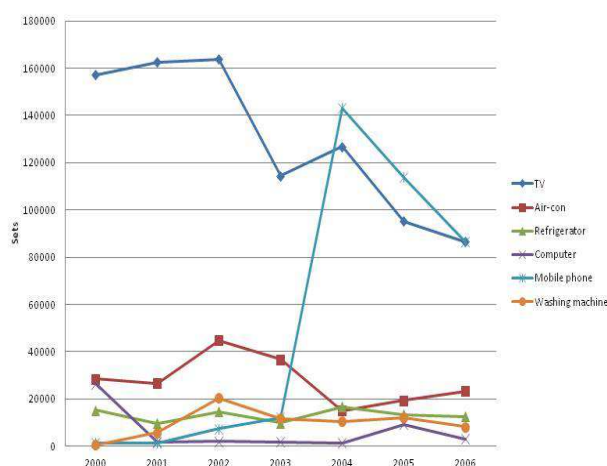


Fig. 1. Statistics on imported UEEE into the Kingdom of Cambodia in 2000-2006

Source: Technical Report on National Inventory of UEEE in Cambodia, 2007

Thailand

Thailand, with the highest GDP per capita among the countries studied, has played important roles both as exporter and importer of hazardous wastes. In 2006, the country exported 20,420 tons of hazardous wastes (UEEE), increasing from that of 17,340 tons exported in 2005. On the import side, the quantity imported has no significant differences, 5,925 tons and 5,379 tons in 2005 and 2006, respectively [5].

In terms of import and export of industrial HW, the Thailand Department of Industrial Work reported that the quantity of HW imported and exported had decreased in 2009 compared with that of 2008 (**Figure 2**).

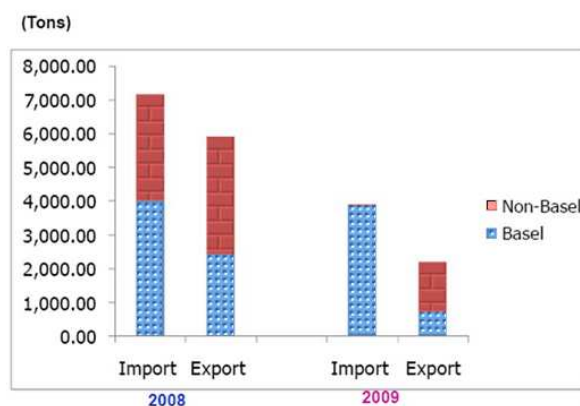


Fig. 2. Statistics on industrial hazardous waste import and export

Source: Thailand Department of Industrial Work 2010

Among the HW exported, electronics scraps are the largest component followed by solder dross/tin alloy and ashes and residues. The destinations of the HW exported vary with the nature of business and the contact firms involved. Most of the countries are in Asia, including Japan, Republic of Korea, Singapore, and China.

The imported HW is mainly electronic wastes, electrical equipment, parts for industrial process, and used toners. The countries of origin include China, Malaysia, and Singapore [6].

Vietnam

Cambodia and Vietnam share certain common characteristics in transboundary movement of HW. Firstly, both countries have large quantity of UEEE. These products have short life span, contributing greatly to the generation of E-waste in the respective countries. Secondly, both countries have strictly prohibited the importation of HW. For the case of Vietnam, UEEE is also prohibited for final disposal/recovery but no specific restrictions on the export of HW.

Shinkuma & Huong [7] stated in their study on material flow of secondhand EEE and E-waste scrap in Asia that although the import of secondhand EEE and E-waste scrap is banned in Vietnam, there are considerable amount of the secondhand products available in the markets. It is suspected that illegal movement of HW from China could have been responsible for the availability of UEEE in the North Vietnam while the illegal movement from Cambodia could be used to explain the similar situation found in the South Vietnam.

Auctions of UEEE in Phnom Penh have a number of Vietnamese dealers participated in these auction sales.

Although import of HW into the country is prohibited, the Vietnamese government allows importation of certain categories of scrap materials for use or recovery as secondary materials for industrial production. Also allowed by the Vietnamese government is to export HW, which has been carried out with the prior consent from the receiving countries such as Singapore and Republic of Korea.

5. THE LEGISLATIVE FRAMEWORK

5.1 *The Basel Convention*

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal aims to control the movement of HW by placing the responsibility for safe disposal of HW on its producer at the same time banning the export of HW to developing countries [8]. It regulates the transboundary movements by two means, which are 1) the written Prior Informed Consent procedure, and 2) the environmentally sound manner for the management and disposal of hazardous wastes. Examples of the wastes regulated by the Basel Convention are biomedical and healthcare wastes, used oils, used lead acid batteries, persistent organic pollutant wastes, chemical wastes, and electronic and electrical wastes. However, while the Convention regulates the movement of wastes, it does not extend to cover functioning secondhand goods and some E-waste scrap (even though the scrap contains materials under controlled in Annex I of the Convention).

All the countries studied have ratified the Basel Convention with Laos being the latest country to join the Convention in 2010. This explains the reason for the delay in planning and implementation of the Convention in Laos and also the lack of data availability in relation to HW transboundary movement in that country. Data from Laos will be shown only when available.

5.2 *Other relevant domestic laws*

Cambodia

In Cambodia, HW is defined as any substances that are radioactive, explosive, toxic, inflammable, pathogenic, irritating, corrosive, oxidizing, or other chemicals which may cause danger to human and animal health or damage plants, public property and the environment [9].

There are several regulations related to HW management and control, Solid Waste Management Sub-Decree (1999), Water Quality Management Sub-Decree (1999), and Air Pollution Control and Noise Disturber Management Sub-Decree (2001), for instance. Apart from these regulations there are also other measures such as licensed charges for some industries to handle HW.

The Sub-Decree on solid waste management has a provision on the export and import issues of HW.

- Article 20: the exportation of the hazardous waste from the Kingdom of Cambodia to abroad could be conducted if there are and agreement from the Ministry of Environment, export license from the ministry of Trade and permit from the import

country. The exportation shall be consistent with the provisions and principle of the Basel Convention.

- Article 21: the importation of the hazardous waste from abroad into the Kingdom of Cambodia is strictly prohibited.

Thailand

Although Thailand has no national definition of waste used for the purpose of transboundary movement of waste; however, the country uses the definition of hazardous waste for the purpose of transboundary movement management instead [10]. HW to be controlled for the import and export are defined in the list of hazardous substances specified in the Notification of Ministry of Industry on List of Hazardous Substances (2003). The hazardous substances are divided into four groups: 1) HW that is ignitable, corrosive, reactive, toxic and leachable substances; 2) HW from non-specific sources; 3) HW that are discarded as commercial chemical products, container residues, and spill residues; and 4) chemical wastes.

The country has also defined the UEEE and their parts and components as hazardous substances that are needed to be controlled for import into the country. The imported UEEE shall follow strictly the procedure specified in the Notification of the Department of Industrial Works on the Criteria for approval of the import of UEEE into the Kingdom of Thailand (2003). Plastic wastes require special consideration when subjected to transboundary movement issues.

Vietnam

The Law on Environmental Protection of 2005 (effective in July 2006) defines the wastes are substance in form of solid, liquid or gas that are discharged from manufacturing processes, services, living activities or other activities [11]. Hazardous wastes refer to wastes that contain toxic, radioactive, inflammable, explosive, abrasive, contagious, poisonous or else harmful. Later in 2006 the Ministry of Natural Resource and Environment issued the list of HW which consists of wastes that are always HW and wastes that are suspicious to be HW (where further analysis on concentration is needed). It should be noted that electric and electronic appliances are considered as HW.

Apart from the above mentioned law, the Vietnamese government has made a decision on extended producer responsibility that will gradually require manufacturers and importers to take back and treat their sold products.

6. ILLEGAL TRAFFICKING OF HW

Illegal imports cases do exist in all countries involving various types of hazardous wastes (e.g., mercury waste in Cambodia, lead acid batteries in Vietnam and Thailand, and used electronic appliances and waste plastics in Thailand). Countries with sea ports tend to suffer more from the illegal transboundary movement as large amount of containers entering at each port daily while only limited number of containers can be inspected. Illegal movement of HW makes it difficult to estimate

the real status of HW movement as there is a large gap between the data with and without including those HW moved through illegal trafficking.

7. MANAGEMENT MECHANISMS EMPLOYED

Mechanisms employed in the HW management vary from country to country; however, it can be divided into 4 major groups. The first mechanism is to adopt legislation to manage HW. For all countries, the regulations on HW do exist however; the level of enforcement may vary. For example, Thailand does have legislative measure to control the import of UEEE and its parts/components. Importation of UEEE is allowed only for 1) activities of resale, reuse, repair/refurbish as its original purposes, 2) disassembling and recycle/recovery with different conditions, and 3) only from parties to the Basel Convention.

The second mechanism is to establish HW inventory in order to be able to track and properly design the management system that will be appropriate for the local conditions. Management system such as data reporting system, tracking system and prior informed consent process should be employed.

The third mechanism is to collect HW separately. Therefore, capacity building of local authorities and citizens to raise their awareness and understanding of various types of HW should be of importance.

The fourth mechanism is on the waste treatment system and facilities. In terms of the treatment facility, Thailand has the highest number of HW related facilities (as of 2009): 139 for HW treatment, 962 for segregation and disposal, and 255 for recycling [5]. Vietnam also has set up a number of such facilities. Cambodia and Laos should also plan for establishing their required treatment facilities.

Table 3 shows the status of regulation and management strategies in some developing Asian countries. It should be noted that the original table was made for the E-waste stream; however, the authors adapted it to cover the other type of HW as well.

Table 3 shows that the status of HW management in each country still has room for improvement. The better the HW facility in a country, the higher the possibility would be to reduce HW transboundary movement.

8. CONCLUSION

The quantity of hazardous wastes generated tends to increase at an alarming rate in most countries. However, the nature of the wastes generated varies with countries; wastes of industrial origin for Thailand and Vietnam, and UEEE for Cambodia, Laos, and Vietnam. Inappropriate treatment or lack of treatment facility remains problematic in most countries. Lack of treatment facility leads to export of HW and illegally transboundary movement.

Table 3. Regulation and management strategies of HW. Adapted from [8]

Level	1	2	3	4
Practice	Rudimentary ←————→ Best			
Legal Framework	Legal framework does not exist	Legal framework to be issued or enforced in the near future	Some enforcement but legal framework is not evenly conducted	Full enforcement and best practice
		KHM, VNM	THA	
Inventory	Inventory for MSW exist but not for HW	HW inventory is under planning and preparation	All HW inventory exist but lack of some data	HW inventory exist and publicly available
	VNM	THA, KHM		
Collection of HW	Unregulated Pick up of HW only the valuable items	HW is collected by local mechanisms, some pilot project	Collection system exists and leads to env. sound disposal	Collection system fully operated
	KHM, VNM	THA		
Recycling Technology	Only recyclable and reusable HW is reused by local	There is a plan to set up HW facilities	Some facilities exist, can accommodate some HW	State-of-the-facilities can accommodate all HW in the country
	KHM		THA, VNM	

Note: KHM-Cambodia, THA-Thailand, and VNM-Vietnam

Majority of the countries in the GMS do not have complete set of data on generation, export or import of HW. HW inventory data/secondhand EEE inventory is needed both for the management of HW at the national level and for the development of international policy. Most countries in the region have their own national laws/regulations to manage transboundary movement of HW and other wastes; however, specific laws and regulations are still needed for specific items such as UEEE, which is not considered as waste and is not controlled by HW regulations.

Most countries have been taking measures for reducing the transboundary movement of hazardous wastes, including the ban on the import of hazardous wastes. However, due to the lack of infrastructure in HW management, illegal trafficking of waste is still one of the most important environmental concerns in the region. International cooperation should be strengthened in order for effective monitoring and control of the illegal movements of HW.

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The Perspectives to Enhance an Effective Human Resource Management (HRM) through Compensatory Consumption within a Chronic Life: Case Study of HIV-infected Patients

Tawamin Kruasom and Sumalee Ngeoywijit

Abstract— *The purpose of the present study was to explore the characteristics related to consumption behavior of people particularly in a chronic situation occurring in human life. The case of HIV-infected patients was selected purposively by which snowball sampling technique. An in-depth interview through semi-structural interview was conducted. The results show that the HIV-infected patients try to compensate or fulfill an individual feeling under a chronic circumstance of their life by concerning with both physical needs and psychological needs. Having confidential group or community of HIV-infected patients is a necessity. Moreover, the true information should be provided for HIV-infected patients such as how to live with HIV, how to take strictly medicine or any effects after taking medicine. That means the effective human resource management within a case of a chronic life as HIV-infected patients should be mentioned seriously in the characteristics of compensatory consumption in order to abate their stress or fulfill their self-esteem or self-actualization.*

Keywords— *Human resource management, compensatory consumption, chronic life, HIV-infected patient, HRM, HIV.*

1. INTRODUCTION

In the past, the valuable resources which were mainly influential to any firms were classified into two factors namely finance and technology. Later, human resource is the one factor that is also valuable in order to create competitiveness for any organizations [1], [2]. The importance of human resource is driven in which characterizing as valuable, rare, inimitable and non-substitutable [3], [4]. Terminologically, human resource (HR) is defined as a person who has worked for any firms by using both of knowledge and potentialities to drive firm's performance through purposes, missions and strategies [5]. Moreover, HR has other functions as in establishing or regulating the strategies to reach the company's goals [6]. Importantly, HR is urged as a kind of one capital that contains of knowledge, skills and abilities [7], [8], [9]. In short, HR is a very important capital in order to enhance objectives, missions and strategies of any firms effectively. Also, HR causes to conduct competitiveness with any competitors in which related business as well [4], [1], [8].

Consumption is an important activity for human life. The reference [10] argues that consumption is a process to satisfy our basic needs for survival. Interestingly, consumption process is also an activity to construct and maintain the consumers' self and identity [11], [12], [13]. With the global changes, the various kinds of

consumption of an individual are done through many ways in order to satisfy his or her needs [14], [15], [16].

Consumers make a decision to consume goods and service not only on functionality but they concern with style, image and quality as well [17]. In Psychology paradigm, consumption can be indicated into the feeling powerful and powerless of an individual [18]. Besides, in the digital revolution, consumers take more roles in their capacities namely increasing buying power, having a greater of variety of goods and services, entering much deeper information, getting easily in interaction, placing and receiving orders, and having higher ability in comparing products and services [14]. Also, with the economic development is a process to make a vast change in consumer' cultures and values [19]. Thus, the effective marketing strategies are needed to lunch in order to encourage consumers [20].

According to consumption has related to both physical needs and abstract needs, there are many studies in the area of consumer research [21]. The concept of compensatory consumption is used as a part of marketing academics and consumer research [22]. However, there was not widely studied [23]. The studies that possibly related with compensatory consumption are mentioned in contemporary study [22], [24], [23]. In contemporary study, compensatory consumption is related with other areas in consumer research; for instance, compulsive buying [25], addictive consumption [26], self-gift giving [27], [28], compensatory eating behavior [29], mood repair [30], [31] and conspicuous consumption [32]. So that, the concept of compensatory consumption is a complicated area in consumer behavior [23]. It is therefore the more researches have to be progressed.

For the current study, the definition by Woodruffe [22] and Woodruffe-Burton [24] in addressing clearly understanding about compensatory consumption was employed. They mentioned that the compensatory consumption was referred to an engagement by which a

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person felt a need, lack or desire but he was not able to satisfy himself primarily at that time so he sought other choices to fulfill that feelings. Additionally, with the broader concept of compensatory consumption, "lack" is related in terms of self-esteem, confidence, patience, happiness or other emotional pressure [22], [24]. Basically, the normal situation in human daily life was selected to study the behaviors of an individual in order to compensate his feelings (e.g. the studies of [22], [24], [23], [18], [12] etc.). Unfortunately, it was little in study in how individual compensated his emotional deficit in a chronic situation by which the perspectives of consumer behavior. This is because, the study of chronic circumstance is taken widely in health care or vaccine and medical therapy (e.g. the study of the reference [33], [34], [35], [36], [37], [38], [39], [40], [41] etc.). Therefore, the aim of the present study is to explore in how individuals behave when they face with a chronic situation. The case of HIV-infected patients that displays through the stigma following Thai contexts was mentioned [36], [41].

This paper is structured into five main sections. The first part is presented the literature review of relative issue in human resource management, HIV and AIDS stigma in Thai contexts, and compensatory consumption. The methodology section explains the data collection by using an in-depth interview. Also, with the findings is then further explained. Fourthly, it is the section of summary and conclusion. Finally, the limitation and future study is also discussed.

2. LITERATURE REVIEW

2.1 Human Resource Management (HRM)

The effective management within a firm is a factor that drives people working completely and effectively. Human Resource Management (HRM) is the implementation concerned with human management [9]. In general practice, it contains of many procedures such as launching any policies, planning in practices and designing any systems by which affected to the behaviors, attitudes and potentiality of employees within a firm [42]. This progress aims to establish competitiveness as well [43]. Additionally, Nickels, McHugh and McHugh [15] states that HRM is the process in consideration of the importance of human resource. Then, the other processes will be followed such as recruiting, selecting, developing, motivating, evaluating, compensating, and scheduling. These above process are implemented in order to reach the firm's goals. As a result, HRM is the process concerned with human resource in order to drive an employee to reach his knowledge, skills and potentiality for reaching the firm's objectives.

2.2 HIV and AIDS Stigma in Thai Contexts

In fact, in 1984, the first case of AIDS was diagnosed in Thailand [44], [35], [37]. Presently, the rapid increase in the amount of new HIV infection has been recording in Thailand [45], [46], [47], [41]. Importantly, Latkin et al. [48] and Khumsaen et al. [41] discussed that HIV illness

has badly affected to all aspects of patients' live. They also mentioned to the influences of social and psychological dimension that progressed from people surrounding HIV-infected patients. Although in international perception following the commitment organized by The United Nation (UN) was announced in the suitable implementation to the HIV or AIDS patients, it had not been completed effectively in Thailand [36].

Terminologically, Liamputtong, Haritavorn, and Kiatying-Angsulee [35] argue that stigma is a social process that affects by the condition from culture, history and situation. It is also displayed through the feeling of shame and guilt. Similarly with the study of Zhou [49], it was found that sociocultural belief, value and morals within a specific context play the important role in constructing stigma. According to Thomas [50], there are three dimensions of stigma. First, it is self-stigma that generated by self-blame or self-deprecation. Second, it is perceived stigma that occurred by the surrounding people become fear. Third, enacted stigma, it occurs when someone is actively discriminated against. The expression of stigma can be mentioned in gossip, verbal abuse and distance of healthy people to HIV-infected patients [50].

Especially, in Thailand, the level of acceptance and understanding in HIV or AIDS patients are not completed. The HIV or AIDS patients are seen dangerous. It is therefore within Thai contexts, it is still generating pressure that can shift to be problematic situation for HIV-infected and AIDS patients [41]. With above reviews, it is very interested to investigate in how HIV-infected patients behave in order to relieve all bad feelings.

2.3 Compensatory Consumption

With the summary of Woodruffe-Burton and Elliott [23], they stated that Dichter [51] had identified to the term of compensatory consumption earlier but there was no one to investigate further. Later on, there was Gronmo [52] who wrote the paper in capturing of theories and concepts of compensatory behaviors. He did specially from a consumer and consumption perspective by which a critical sociology of consumption [23]. On the same way, Woodruffe [22] summarized that Gronmo had focused on understanding how consumers were motivated to satisfy of their needs. By definition, Gronmo [52, p. 68] defined the compensatory consumer behavior as "an reaction to, and as an attempt to make up for, a general lack of esteem or self-actualization"

Additionally, there was a study in exploring eating behavior as compensatory consumption. That is Woodruffe-Burton and Elliott [23, p. 76] who defined the term of compensatory consumption as given below.

"The phenomenon is that a lack of X could be cured by a supply of X, but may also be cured by a supply of Y. If Y is used, this process is called compensation"

Moreover, Gould [53] argued that the concept of compensatory consumption was linked with mood management. Similarly, Woodruffe [22] investigated compensatory consumption with shopping behavior. In

this study, the authors concluded that compensatory consumption were displayed through various kinds of activity such as eating, meeting with other people, shopping, giving gift etc. It is therefore compensatory consumption is usually seen as a regular or routine consumer activity [22], [23]. Besides, Cohen and Areni [31] and Elliott [26] stated that the regular or normal consumption was an important function in order to maintain a positive mood of consumers or it was a process to repair negatively emotional status.

Additionally, Woodruffe-Burton [24] pointed out similarly with Woodruffe [22] for the definition of compensatory consumption as the process of a person seeking and using an alternative means to fulfill individual's need, lack or desire which he cannot satisfy primarily. Additionally, Purinton [12] stated that compensatory consumption occurred when a person facing an obstacle to fill his need and substitute by consumer goods and/or services.

With the existing literature on compensatory consumption and other aspects of consumer behavior, it found that there were many areas related with compensatory consumption. The studies that possibly related with compensatory consumption are mentioned in contemporary study [22], [24], [23]. For instance, there are compulsive buying [25], [54], [55], [56], [57], [58], [59], [19], [60], addictive consumption [61], [26], self-gift giving [62], [21], [27], [63], [28], compensatory eating behavior [29], mood repair [30], [31], [64] and conspicuous consumption [32], [65], [12], [18].

Importantly, with the broader concept that are addressed above, for this study the definition of compensatory consumption is defined as whenever a person feels a need, lack or desire; however, he cannot satisfy in the primarily at that moment so he will seek other choices to fulfill it completely later [23]. Besides, compensatory consumption is related in terms of self-esteem, confidence, patience, happiness or other emotional pressure as well [22], [24]. On the same way, it mentions to an individual attempts to shift problematic situation to unproblematic situation through various kinds of behaviors [12].

3. METHODOLOGY

This study uses an inductive approach [66], [67] with a case study of a chronic circumstance of HIV-infected patients in Thailand in order to gain rich text, deep and better understanding. Moreover, the various methods were used to ensure the reliability and validity of the present study [68], [69]. For triangulation typologies, the observers, theory and methodological triangulation were employed [70], [67]. The in-depth interview through semi-structured pattern and a re-call by telephone were utilized for this study.

The sampling method is purposive which characterizing of interpretive research and a snowball sampling technique is used to seek new key informants. The key informants were interviewed by Thai language. Importantly, the ethical consideration was taken by the approval of the Ethical Committee in the Faculty of Management Science, Ubon Ratchathani University,

Thailand. The interview was taken secretly on an individual basis in strict confidence and was held on the average of one to two hours. For the present sensitive research, each key informant was paid by 300 baht in order to support his transportation and food. It shows the respect of researcher to their time and knowledge [35]. The interview was tape recorded and the respondent offered the opportunity to view the transcripts. Besides, the key informants were informed that the refusal to participate in the study would not affect their care.

For the present study, there were five interviewees that agreed to participate after introduction. The demographic data of each person was addressed in Table 1. For ethical consideration, the names and workplaces of them were supposed.

Table 1. The Demographic Data of Key Informants

Name	Age	Occupation	Years of HIV-infected (Started from first detection)
Mr. A	37	Graphic Engineer	13
Mr. B	35	Teacher	8
Mrs. C	30	Owned Business	6
Mrs. D	27	Civil Servant	3
Mr. E	20	Student	1

4. RESULTS

Stigmatization is a very important circumstance that caused mainly effect in order to have normal living for HIV-infected patients in Thailand. Illness as having HIV affects directly to patients in losing their self-esteem and self-actualization through the social acceptance and understanding. Mood of HIV-infected patients should be managed sensitively for this issue [53]. Moreover, with the sight of other people in the Thai society, HIV-infected patients have to behave or react in order to compensate the feeling in losing self-esteem or self-actualization [52], [22], [24].

“When the doctor told me that I have HIV, everything surrounding me is dark. My brain is likely closed. This event makes me extremely upset and awful with the future. I think about suicide at the first time because I do really know that this disease cannot cure anymore. It's likely waiting for death. I don't want to tell this issue to anyone even if my parents.” (Mr. A)

“...Umm...it's hard to believe that I have got HIV. It is an extremely terrible event for my life. It makes me lose confidence to survive or talk to the public. It makes me get terrible headache for this issue as well.” (Mr. B.)

“I was detected that I had got HIV when I had checked annual health. At first that the doctor told me, everything surrounding me was dark. I feel very uncomfortable. I cannot hear anything for a while. I looked forward to do

suicide. I don't think that I can survive publicly with HIV." (Mrs. C)

"... Although I do really understand what HIV is, at that time I cannot control myself. I am shy and fear to go publicly. I don't want my parents to know this issue. I don't want to get any bad gossip from my friends or neighbors." (Mrs. D)

"I am not expected that I'll get HIV. I cry and keep myself in my room a few day. I don't go to class. I cannot eat and don't want to see anyone. I'm shy and afraid in everything such as how can I survive with the ugly skin. It makes me feel very seriously." (Mr. E)

The results reveal that the all HIV-infected patients need to fulfill their feelings by behaving in various ways such as concentrating with more doing exercise, making merit, doing meditation, selecting in using a qualified cosmetic product, eating healthy food or vitamins etc. Some of them select to continue study in higher level. He believes that having higher degree can fulfill his self-esteem and self-actualization. As a result, obtaining or substituting with a satisfied goods and/or service can be displayed as a kind of compensatory consumption [22], [24], [23], [12].

"After I got HIV, I always play any sports such as jogging or basketball. I'd like to be strong. Because I've learn that if I'm strong, I can live similarly with the normal people" (Mr. A & Mr. E)

"...Yes, I often go to make merit such as making donation for a temple nearby my house or supporting scholarship for students. It can make me happy and feel better when the other people talk to me in the good way." (Mrs. C)

"I like to go some place to do the mediation. It can make me forget my illness. It also makes me understand how our life is. I think it is the best way to reduce my pressure." (Mrs. D.)

"...I always go shopping with some qualified product such as body lotion, skin protection product, vitamins etc. I don't want my skin to be dark. I always read any information through printed materials or internet for finding how to live with HIV for a long time period." (Mr. B & Mrs. C)

"...For me, I'd like to study in Master Degree. If I can do that, I'll be more confident to live. Now, I didn't tell anybody that I get HIV. I'd like to let them know that even though I got HIV, I can succeed..." (Mr. A.)

Additionally, having confidential community for HIV-infected patient is beneficial in sharing or exchanging any opinion in HIV [35]. Having group also reduces HIV patients' stress or anxiety as well.

"I prefer to have group of HIV patient but it has to progress secretly. I'm happy to join my group at the

hospital when my doctor scheduled. It is the good time for sharing any issue happened in my life to my friend in the group" (Mrs. C and Mrs. D)

"...I always chat with my close friends who got HIV same me through internet. It makes us happy and relaxed. Basically, our issues are not only our illness but we talk generally. Sometime we want to forget it. We help together to find out some information about HIV such as how to interpret the amount of CD4 or viral load in our blood. I do really want to thank my all friends in our group that cheer me up with this serious issue." (Mr. A)

"...I came to join the group organized by the hospital. I am in the Group 32. We know each other well. At first we are shy to talk together, but later, we came to be closer. Sharing in any problems and pressures is always mentioned. It can reduce my stress. I'm happy that there is a good listener with my critical problem." (Mr. B)

Therefore, the concerns circumstance with both physical needs and mental needs are very important for HIV-infected patients [41]. Importantly, the confidential group of HIV-infected patient is also needed to provide trust and some beneficial information in real practice [35]. It is therefore giving the true information for HIV-infected patients is very important such as how to live with HIV, how to take strictly medicine or any effects after taking medicine.

"...Of course, for surviving, I need to eat healthy food and do more exercise. ...Also, I have to control my mind to accept what happened in my life." (Mr. A & Mr. B)

"Having friends in both of HIV and non-HIV-infected is advantage for me. I don't want to be strange. ...I want to have friends for sharing any ideas especially with the person who is in the same situation" (Mrs. D & Mr. E)

"We do really need the true information about our illness. Sometime we don't understand how to take medicine or interpret some data after blood checking. Importantly, the effect following taking medicine has to be discussed clearly enough..." (Mr. A & Mrs. B & Mrs. C)

5. SUMMARY AND CONCLUSION

The key informants from the present study reveal that even though the HIV makes them facing stigmatization and lose self-esteem or self-actualization, an effective human resource management has to be considered seriously as well. This is because with the effectiveness of medical treatments, the HIV-infected patients have a longer and higher quality of life [38], [40]. Moreover, in Thailand, by the support of both the National Health Security Office (NHSO) (see more details in the reference [71] and Social Security Office (SSO) (see more details in the reference [72], it makes widely opportunity to obtain a qualified medical treatment form both private and public hospitals. In the future, especially

with the bigger of patients, an effective HRM is needed for HIV-infected patients in Thailand [39]. Alternatively, the related procedure can be applied for other chronic situation as well.

The HIV-infected patients try to compensate or fulfill an individual feeling under a chronic circumstance by behaving in various ways such as concentrating with more doing exercise, making merit, doing meditation, selecting and using a qualified cosmetic product, eating healthy food or vitamins etc. Some of them select to continue study in higher level. He believes that having higher degree can fulfill his self-esteem and self-actualization [52]. These are activities that can compensate their stress or pressure within an abnormal event. That means compensatory consumption of consumers in a critical situation particularly with HIV-infected patients can display in both physical needs and psychological needs [73], [74] in order to reduce their stress or damages in their mind [22], [24], [23], [12].

Interestingly, having confidential community or group for HIV-infected patients is beneficial in sharing or exchanging any viewpoints in HIV. Having group also reduces HIV patients' stress or anxiety as well. Importantly, the confidential group of HIV-infected patient is also needed to provide trust and some beneficial information in real practice [35]. It is therefore giving the true information for HIV-infected patients is very important such as how to live with HIV, how to take strictly medicine or any effects after taking medicine. In summary, an effective human resource management (HRM) for a chronic life should be addressed in order to compensate or fulfill an individual feeling through compensatory consumption behaviors. The conceptual framework for the present study can be displayed in the Figure 1.

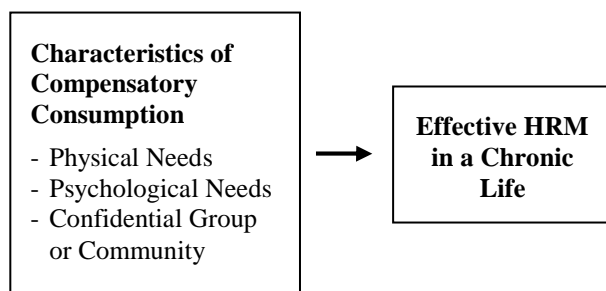


Fig. 1 Conceptual Framework (Authors)

6. LIMITATION AND FUTURE STUDY

A single case of HIV-infected patients for this study provides rich context and in-depth data [75]. However, as the suggestion of Eisenhardt [76] and Grill [77], the selected case is used for theoretical rather than statistical generalizability for conducting theory development. Besides, the sample was chosen by purposive sampling from information-rich cases [78], [79]. The other different chronic circumstance in human life should be studied further (see more in the study of the reference [80]). Moreover, the longitudinal study and different case comparative study are suggested for future research [70].

The different sampling group and event may be addressed in various characteristics in order to interpret the compensatory consumption behaviors.

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GMSARN International Journal

Vol. 7 No. 3 September 2013