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INTRODUCTION

Herbal medicines have been widely used around the world since ancient times, and are recognized for their good therapeutic effects as they have fewer side effects than modern medicines (Ansari *et al.*, 2012). Furthermore, the worldwide use of herbal medicinal products has continued to increase, and nowadays a large number of the global population use medicinal herbal products as a primitive form of health care (Shirwaikar, 2012).

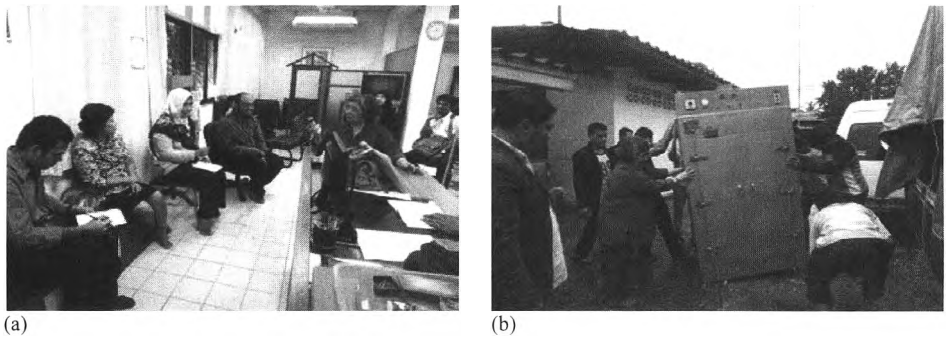
The 2012 National List of Essential Medicines of Thailand contains 71 herbal recipes. The Eleventh National Economic and Social Development Plan of Thailand has plans to permit usage of herbal medicines in hospitals and primary healthcare, indicating that herbal products will be more important and used even more in the near future.

Narathiwas is a province in the southernmost area of Thailand bordering Malaysia. Chanae is a district of Narathiwas province, and has a community hospital called Chanae Hospital following the name of the district. Recently, Narathiwas has become an area of unrest and is targeted by terrorists. The set-up of a herbal factory in this area would be too difficult, because of this dangerous situation. Nevertheless, Professor Krisana Kraisintu initiated projects to set up a mini-plant in three southernmost provinces of Thailand (Narathiwas, Pattani, and Yala) to promote herbal medicinal products using local herbs. As most of the population in these provinces are Muslim. Muslim people must ensure that all foods (particularly processed foods), as well as non-food items like cosmetics and pharmaceuticals, are halal. This is because these products often contain animal by-products or other ingredients that are not permissible for Muslims to eat or use on their bodies. It is necessary for the productions of herbal products follow halal authentication. This article describes the procedure for the set-up of a mini-plant in an area of unrest in Thailand, to be a model of other community hospitals in the country.

METHODOLOGY

The set-up of the mini-plant has three steps:

Initial step Three pharmacists from Rangsit University met with the director of the hospital, doctors, pharmacists, and Thai traditional doctors of Chanae Hospital to prepare for the project at Chanae Hospital. Professor Krisana Kraisintu described the importance and phases of plant set-up. The resolution from this meeting was to train the staff to work in the mini-plant. Machines for production of the medicines were supplied from Sri Sakorn District Public Health Office and Naradhiwas Rajanagarindra Hospital.

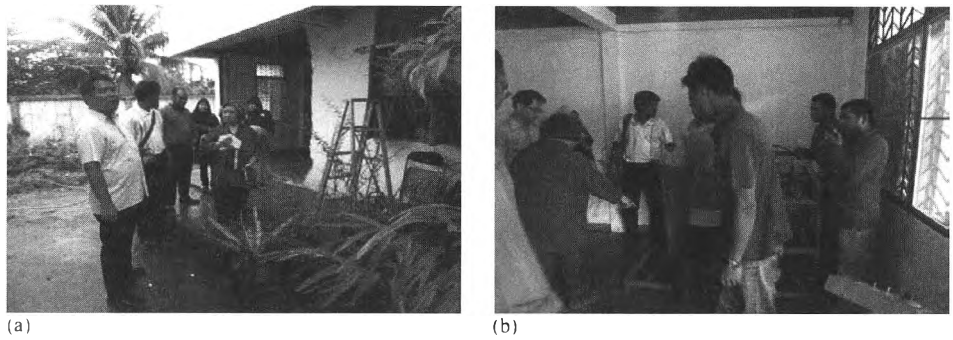


(a) (b)

Figure 1 the first step of mini-plant set up (a) Professor Krisana Kraisintu met with the Chanae Hospital colleagues (b) Dislocation of machines from Sri Sakorn District Public Health Office to Chanae Hospital by native people of Sri Sakorn district

SP - 1

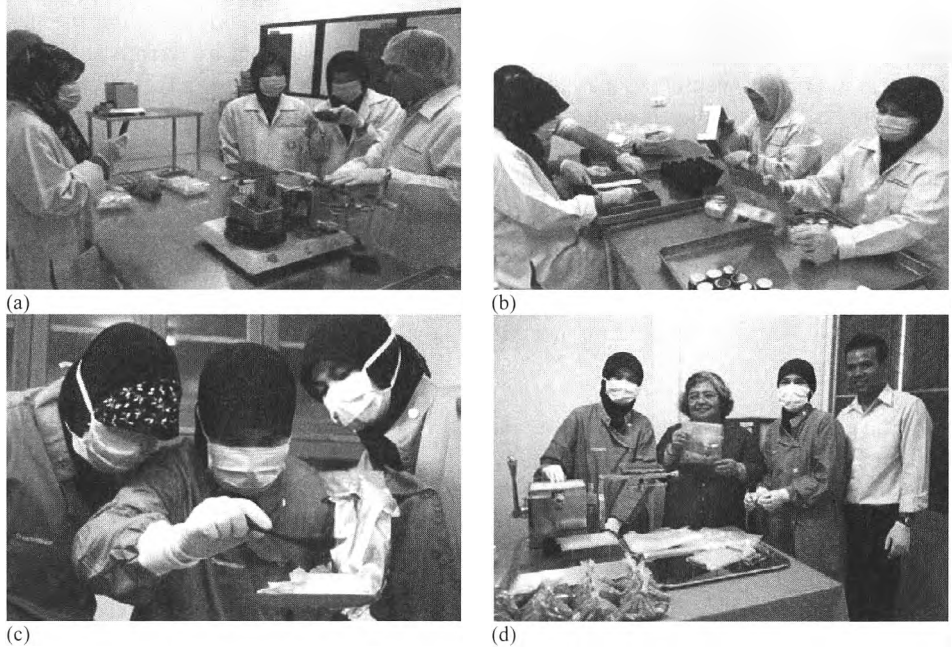
Plant design and set-up After the mini-plant was designed, the equipment was installed. The first floor of the plant has procedures in place regarding cleaning, baking, grinding, and sieving herbal medicines. The second floor contains a production unit, packing unit, and quarantine area for the end products.



(a) (b)

Figure 2 the second step of mini-plant set up (a, b) Installation all machines into the building

Production Before production at Chanae Hospital, two pharmacists and one Thai traditional doctor from the hospital visited the Sun Herb Thai Chinese Manufacturing Plant at Rangsit University to learn about the herbal products production process. Afterwards, pharmacists from Rangsit University monitored the trained staff of Chanae Hospital to evaluate their proficiency of production procedures.



(a) (b)

(c) (d)

Figure 3 Production of halal herbal products (a,b) Chanae Hospital colleagues learn about the herbal products production process at Rangsit University (c,d) Halal herbal products production at mini-plant of Chanae Hospital

SP - 1

RESULTS AND DISCUSSION

The timeline from initial phase to production phase was three months, which was extremely fast. The principal pieces of equipment in the mini-plant were two capsule filling machines, one hot air oven, two grinders, one sieving machine, and one tea bag packing machine.

In the initial phase, six items of herbal medicinal products were produced (Table 1), including rhizome of turmeric (*Curcuma longa* L.), leaf of Asiatic pennywort (*Centella asiatica* Urban.), vine of jewel vine (*Derris scandens* (Roxb.) Benth.), all parts above the ground of kariyat (*Andrographis paniculata* (Burm. f.) Wall.ex Nees), vine of edible-stemmed vine (*Cissus quadrangularis* L.), and leaf of ringworm bush (*Senna alata* (L.) Roxb). All herbal products were prepared as capsules. However, because of its bulky size, there was a problem filling capsules with ringworm bushes, thus it was planned to prepare as a tea instead. Therefore, Chanae Hospital can produce five items of herbal products.

Table 1 Herbal medicinal product items produced in Chanae Hospital

No.	Herbal	Indication
1	Turmeric	Anti-flatulence
2	Asiatic pennywort	Antipyretic, anti-apthous ulcer, treatment of internal trauma
3	Jewel vine	Treatment of muscle pain, anti-inflammatory
4	Kariyat	Treatment of non-infectious diarrhea, relief symptoms of common cold
5	Edible-stemmed vine	Anti-hemorrhoid
6	Ringworm bush	Laxative

All herbal products that are produced at Chanae Hospital are in the official List of Herbal Medicinal Products, and the 2012 National List of Essential Medicines of Thailand. All herbs that are in the list are safe for appropriate for use in humans in Thailand (The Ministry of Public Health of The Kingdom of Thailand, 2012).

Gamma irradiation is an effective procedure for sterilizing herbal products. It can destroy microorganisms that contaminate manufactured products (Ferreira *et al.*, 2010). Thus, all products that were produced at Chanae Hospital were gamma irradiated before use; this step was facilitated by the Sun Herb Thai Chinese Manufacturing Plant at Rangsit University. Therefore, Chanae Hospital is the first community hospital in Thailand that sterilizes herbal products by gamma ray before use. Chanae Hospital is also the first hospital plant that produces herbal medications following halal authentication. An example of turmeric capsules is shown in Figure 4.

Figure 4 Gamma irradiated product (turmeric capsules)

CONCLUSION

The cooperation between an academic institute (Rangsit University) and community hospital (Chanae Hospital) can promote the production of herbal medicinal products. The mini-plant was set-up on the border of Thailand in an area of unrest, and five items of gamma irradiated herbal products have been produced following halal authentication.

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SP - 1