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Studies on decontamination for herbal eyebright raw material and product by gamma radiation

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Abstract: Herbal eyebright products and their raw materials have been irradiated with 1, 2, 3 and 5 kGy by Co-60 gamma radiation source at Hanoi Irradiation Center for decontamination. Initial bioburdens were under the limitation levels established for the traditional medicines according to the decree of 16/2011/TT-BYT issued by Vietnam Health Ministry. These values for both bacteria and fungus slightly increased during storage to three months, reach to about 10^3 and 10^2 CFU/g for bacteria and molds, respectively. However, there are no microbial colonies that could be observed in the samples irradiated with dose higher than 3 kGy. Results suggested that the dose of 3 kGy was enough for decontamination of eyebright raw powders and products. At dose of 5 kGy, the moisture and vitamin A content of the samples were insignificantly changed. These mean the radiation treatment with low dose did not influenced the quality of eyebright products, and radiation treatment can be applied to prolong the storage of not only eyebright, but also other traditional medicines.

I. INTRODUCTION

The use of eyebright in cultural and traditional settings may differ from concepts accepted by current Western medicine. Considering the use of herbal supplements, consultation with a primary health care professional is advisable. Additionally, consultation with a practitioner trained in the uses of herbal/health supplements may be beneficial, and coordination of treatment among all health care providers involved may be advantageous.

Food irradiation is a modern technology applied to assure the quality and sanitary safety of foods. At present, there are more than 30 countries worldwide applied food irradiation technology for processing of more than 40 different kind of food from fresh fruits, cereals, meat and other agricultural and seafood products to dehydrated spices [1-3]. It has shown that irradiation used on alone or in combination with other methods could improve the microbiological safety and extend shelf-life. Due to the wholesomeness as well as economic benefits of the irradiated food, World Health Organization (WHO), Food and Agriculture Organization (FAO) and International Atomic Energy Agency (IAEA) approved irradiation as an effective quarantine method for food similar to the hot and cold temperature treatment [4]. Irradiation is effective method for quarantine control and prevention of foodborn diseases as well as reducing economic loss. The herbal medicines have been used in many countries including Vietnam. However, the herbal materials processed by traditional ways contain high moisture and diverse nutrients, are enriched substrates for the growth of bacteria, fungi and insects, so that reduced both quality and quantity of herbal materials. Some methods

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have been applied to decontaminate and prolong the shelf-life of the raw and processed herbal materials, and gamma irradiation has been proved as an effective one, especially for the processed materials containing low moisture [5].

In this project, both eyebright raw materials and commercial products were collected as samples from Traphaco joint stock company, which has grown into the second largest pharmaceutical firm in Vietnam. Their initial bioburden as well as their contamination levels during storage were investigated in order to verify the advantages of radiation treatment for decontamination and prolong the storage period for the herbal medicine.

II. MATERIALS AND METHODS

2.1. Materials

The eyebright raw materials and commercial products were kindly supported from Traphaco joint stock company, Vietnam. These samples were divided and packaged into PE bags of about 20 g for each. Meat-pepton agar (MPA) and Sabouraud dextrose agar were purchased from Nihon Seiyaku, Japan. Other chemicals were bought from Wako Pure Company, Japan.

2.2. Determination of microorganism contamination

Microbial contamination levels in both eyebright raw material and commercial product were investigated based on number of count forming unit per 1 g sample (CFU/g), which can be developed in MPA and Sauboraud media for bacteria and fungus, respectively according to TCVN 5165-90 [6].

2.3. Radiation treatment and measurements

The samples were irradiated by gamma Co-60 radiation at dose of 0, 1, 2, 3 and 5 kGy as respective symbol of M1-5 under Co-60 source of Hanoi Irradiation Center with dose rate of about 1 kGy per hour. Moisture and vitamin A content in the samples were determined by the methods for determination of water content of soil samples and high performance liquid chromatography (HPLC), respectively [7].

III. RESULTS AND DISCUSSIONS

3.1. Microbial contamination levels of eyebright samples during storage

Table I. Bioburden of the eyebright samples during storage

Sample	Storage period (month)	Total number of colony forming unit (CFU/g)	
		Aerobic bacteria	Fungi & molds
Raw materials	0	590 ± 0,22	46 ± 0,21
	1	150 ± 0,08	23 ± 0,11
	3	600 ± 0,30	13 ± 0,04
Commercial products	0	26 ± 0.15	13 ± 0,05
	1	33 ± 0,20	6 ± 0,01
	3	250 ± 0,090	13 ± 0,06

The total number of bacteria and fungi (CFU) observed from the eyebright samples during storage were presented in Table 1. From the data, we can concluded that contamination levels of aerobic bacteria in both raw material and commercial products of eyebright increased, but fungal levels slightly decreased with storage period. These may due to recontamination of bacteria into the samples during storage or the spores survived after gamma irradiation can germinate into new bacteria [8].

It was very surprising that the contamination level of fungi was reduced. It required further studies to clarify this phenomenon. However, we should apply some methods to control the contamination for eyebright samples during storage, especially for eyebright raw materials. In this study, gamma radiation has been used to decontaminate eyebright and prolong their storage periods. And the contamination levels of eyebright samples were investigated with treatment dose.

3.2. Radiation effects on the microbial level of eyebright during storage.

Table II. Total number of microorganisms contaminated on the eyebright samples with treatment dose after three months storage

Sample	Dose (kGy)	Total number of colony forming unit (CFU/g)	
		Aerobic bacteria	Fungi & molds
Raw materials	0	590 ± 0,22	46 ± 0,21
	1	66 ± 0,26	(ND)
	2	12 ± 0,01	(ND)
	3	(ND)	(ND)
	5	(ND)	(ND)
Commercial products	0	26 ± 0.15	13 ± 0,05
	1	21 ± 0,13	6 ± 0,01
	2	(ND)	(ND)
	3	(ND)	(ND)
	5	(ND)	(ND)

ND: not detected

Table 2 showed the existing of aerobic bacteria and fungi on the eyebright with treatment dose. The results suggested that radiation treatment can be used as an effective tool for reduction of total microorganisms existing in both eyebright raw material and commercial products. The dose of 3 kGy was enough to prolong the storage period of the eyebright products over three months. There are no any contanination of aerobic bacteria and fungi can be observed in the samples that irradiated at dose higher than 3 kGy.

3.3. Radiation effect on the quality of eyebright powders and products

Since water has influence on the growth of contaminated microorganisms in the sample, moisture content in both eyebright material and product were investigated by radiation dose and storage period. In this study, the moisture content were determined by drying the sample to a constant weight. As presented in Figure 1, the mosture content in both eyebright material and product slightly reduced by radiation, then quickly recovered during storage. For each samle, there are no significant changes in moisture content during stogare. It may due to the hydrolysis of water during gamma irradiation, but the sample can absorb the moisture to the saturated content during storage.

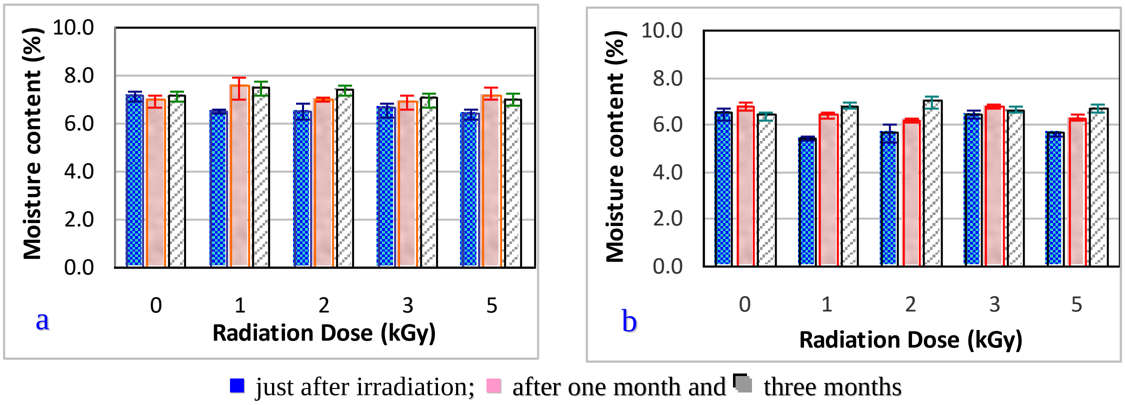

Fig.1. Effects of gamma irradiation and storage period on the moisture content of eyebright powder (a) and products (b)

Table III. Vitamin A content (µg /100g) in the eyebright samples with dose

Absorbed dose (kGy)	Eyebright samples			
	Raw powder after irradiation	Raw powder after 1 month	Capsule after irradiation	Capsule after 1 month storage
0	127.13	113.21	116.10	119.13
1	125.07	116.15	114.08	120.11
2	124.01	111.20	112.05	125.07
3	120.18	115.30	118.08	128.22
5	127.13	118.30	113.09	116.10

Vitamin A was detected with high performance liquid chromatography (HPLC) by procedure of H.HD.QT.145 at National Institute for Food Control. As one can see from the Table 3 that all eyebright samples contain vitamin A. However, the content of vitamin A in powder samples was higher than that in commercial samples (eyebright capsule). It may due to the presence of other additives in the commercial products. Vitamin A seemed not to be affected by radiation treatment, and storage in laboratory condition. However, other ingredients of the eyebright raw material and commercial products should be determined for understanding the influence of radiation treatment on the quality criteria of these oriental drugs.

IV. CONCLUSION

Microbial contamination level of eyebright raw powder and commercial product increased with storage period, but it can be easily controlled by radiation treatment. The dose of 3 kGy is enough for elimination the growth of aerobic bacteria as well as fungi and molds existing on the eyebright samples. Radiation treatment at dose of 5 kGy does not influence on the quality of eyebright materials. Therefore, gamma irradiation should be considered as an effective method for decontamination for not only eyebright raw materials and products, but also for other herbal medicines.

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