Gamma Irradiation in Developing Consumer Friendly Lip Balm

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ABSTRACT: Main base ingredients of lip balm such as petroleum jelly and coloring materials are harmful to customers. Side effects from impurities in petroleum jelly from the manufacturing process have been implicated to cause cancer and long term damage to health. Artificial colours have been found to cause cancer in animals and many people experienced allergic reactions i.e. skin irritation and contact dermatitis. Therefore 'friendly' lip balm was formulated by substituting the base ingredient, i.e. petroleum jelly, with vegetable fats and artificial colour with natural anthocyanin colourants from *Hibiscus sabdariffa* L. (roselle) and *Brassica oleracea* var. *capitata* f. *rubra* (red cabbage) as natural colorants. Anthocyanins are considered secondary metabolites, allowed as food additives and act as powerful antioxidants. The herbal lip balm samples were gamma irradiated (2.5, 5.0 and 10kGy) at Mintec SINAGAMA, Malaysian Nuclear Agency, Bangi. The samples were tested for microbiology quality i.e. total microbial count and presence of yeast and mold. The results showed that there were no microbial and yeast/mold colonies being detected in both non-irradiated samples (control) and after irradiation. The essential oils from herbs and spices included in the herbal lip balms not only improve the taste and aroma but also as a potential a natural preservative due to their antibacterial properties. Gamma irradiation at dose 2.5kGy was suitable as minimum dose to decontaminate the herbal lip balm without affecting the colour and texture. From market survey, 'friendly' lip balm is considered as a safe and attractive product, with multifunctional uses i.e. to prevent chapped lips, freshen the breath, reduces mouth odour and contributes to improving general health quality.

Keywords: gamma irradiation, lip balm, herbal, pigment, health

Introduction

Currently, most lip balms in the market contain artificial colour, synthetic waxes and oils, preservatives, flavour or fragrance. These ingredients can cause harmful effects if used for a long period. Lip balm commonly contains phenol, a poisonous chemical also used as a pesticide, and can be absorbed by the skin. Reactions to phenol include vomiting, nausea, convulsion, paralysis, and even death. Very small amounts can cause rashes, swelling, pimples and hives. Lip gloss and balm may also contain plasticizers like microcrystalline wax, polyisobutane i.e. an allergen, and phthalic anhydride, that is made from naphthalene, the pesticidal active ingredient in moth balls. Short-term skin exposure to naphthalene can cause nausea, vomiting, diarrhoea, confusion and convulsions, and is linked to liver and kidney damage. Lip gloss for children often contains toxic ingredients like coal tar-FD&C colours, paraben i.e. a hormone-disrupters and allergens, and artificial flavour. Coal tar colours have been found to cause cancer in animals and many people experience allergic reactions like skin irritation and contact dermatitis (http://www.lesstoxicguide.ca/index.asp).

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Main base ingredients of lip balm such as petroleum jelly are harmful to customers. Side effects from impurities in petroleum jelly due to manufacturing process have been implicated in causing cancer and long term damage to health (http://www.healthfoodemporium.com/index_dangerous-ingredients.php). Mineral oil and petroleum jelly (petrolatum) in cosmetics and moisturizers are petrochemicals containing neurotoxins and is considered the number two cause of aging. Mineral oil has absolutely no nutritional value (http://home.comcast.net/~sasshea/mineraloilfacts.ht m). By substituting petroleum jelly with vegetable fats that are generally used in food products, the lip balm was safe and free from toxic chemicals and is not dangerous if swallowed or eaten.

This study was carried out to produce a safe consumer 'friendly' herbal lip balm that is free from hazardous chemicals and preservatives. Gamma ray source at MINTec-SINAGAMA, Dengkil was used to decontaminate the herbal lip balm. The non-heating process reduces microbial, yeast and mold load that may be present during the mixing process and packaging. Therefore, no chemical preservatives

were added to the herbal lip balm for preservation. Besides moistening and preventing chap lips, herbal lip balm also freshen the breath and reduced the mouth odour with the presence of the essential oils. Natural anthocyanin pigments from *Hibiscus sabdariffa* L. (roselle) and *Brassica oleracea* var. *capitata* f. *rubra* (red cabbage) were added to give attractive colours and natural health benefits. Anthocyanins are considered secondary metabolites, allowed as food additives and act as powerful antioxidants. Current studies reported that anthocyanins cause cancer cells to break down and halt skin-cancer (http://www.columbusdispatch.com /dispatch/content/science/stories/2007/05/22/sciberries. ARTART05 -22-07B4G66OFHJ.html).

Materials and Method

Preparation of herbal lip balm

Natural anthocyanin pigments from *Hibiscus sabdariffa* L. (roselle) and *Brassica oleracea* var. *capitata f. rubra* (red cabbage) were water soluble extracted and dried in fume hood without any heating process that can destroy the colour and nutrient. Dried pigment extracts were added to herbal lip balm base, mixed individually and packed in containers. Each sample was gamma irradiated (2.5, 5 and 10 kGy) at MINTec-SINAGAMA, Dengkil, Malaysian Nuclear Agency, Bangi. Colour changes of the products were recorded using Colorimeter (Minolta) with L, a, b values i.e. lightness (L), redness (a) and yellowness (b).

Determination of the absence of microbial and fungi/yeast counts

The non-irradiated and irradiated samples were analyzed to determine the microbial count: Total Plate Count (TPC) and Fungi & Yeast Count (FYC).

Sensory evaluation

Acceptability of the irradiated herbal lip balm was determined through sensory evaluation using 20 members (female) of untrained panelists comprising of staffs of Malaysian Nuclear Agency for two weeks application. A 7-point hedonic rating scale was used with 7 is the most acceptable. The attributes evaluated are aroma, colour, sweet taste, fresh taste, softness, mouth odour, spreading ability and overall acceptance.

Results and Discussion

Gamma irradiation at dose 2.5kGy was suitable as minimum dose to decontaminate the herbal lip balms without affecting the colour and texture. The results showed that there were no microbial and yeast/mold colonies being detected in non-irradiated and irradiated samples. Besides improving the taste and aroma, the essential oils from herbs and spices included in the herbal lip balms potentially act as natural preservatives due to their antibacterial properties. Addition of cinnamon and clove essential oils produces multifunctional herbal lip balm i.e. to freshen the breath besides moisten the lips. Both herbs were widely used in medicinal treatment (Hamir, 1978; Zuraini, 2000; Joseph et al., 2005).

Irradiation at 5 and 10 kGy changed the colour of lip balms. There were reductions of the intensity of the colour of the lip balms after the irradiation with higher reductions being observed as the doses increased. This can be observed in **FIG. 1** and **FIG. 2** that showed the decrement of redness values of both lip balms with pigments from *Hibiscus sabdariffa L.* and *Brassica oleracea.* However, the redness values for herbal lip balms with pigment of *Hibiscus sabdariffa L.* were higher and more acceptable than the redness values of herbal lip balm with pigment from *Brassica oleracea.* Lip balm with pigment from *Brassica oleracea* became lighter (higher values in lightness) after irradiation. Pigments from *Brassica oleracea* was not suitable to be used alone in the lip balm due to the dullness in colour before and after irradiation. However, it can be used in combination with other redder pigment from *Hibiscus sabdariffa L.*

The texture of the irradiated lip balms became harder and could not be pressed out from the tubes (**FIG. 3**). Adjustment in quantities of ingredients in the formulations could overcome the problem and improved the texture of the lip balm as well. From the sensory evaluation, herbal lip balm with pigment from *Hibiscus sabdariffa L.* was the most acceptable for all attributes (**FIG. 4**). From market survey, 'friendly' lip balm is considered as a safe and attractive product, with multifunctional uses i.e. to prevent chapped lips, freshen the breath, reduces mouth odour and contributes to improving general health quality.

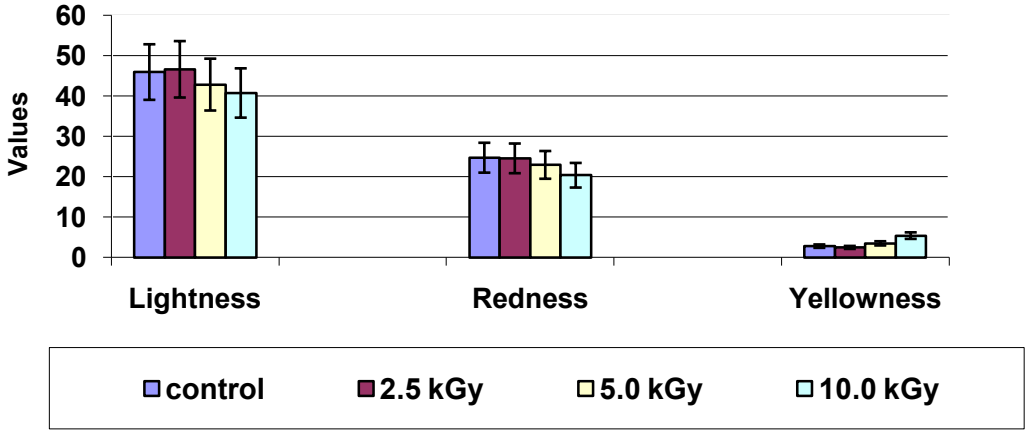

FIG. 1- The L, a, b (lightness, redness and yellowness) values for herbal lip balm with pigment from *Hibiscus sabdariffa L.* after irradiated at 2.5, 5.0 and 10kGy.

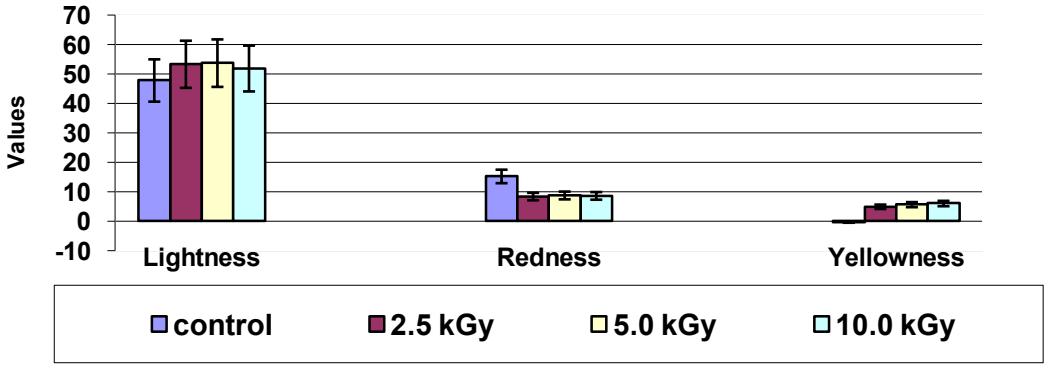

FIG. 2- The L, a, b (lightness, redness and yellowness) values for herbal lip balm with pigment from *Brassica oleracea* after irradiated at 2.5, 5.0 and 10kGy.

FIG. 3- The texture of the irradiated lip balms became harder and cannot be pressed out from the tubes.

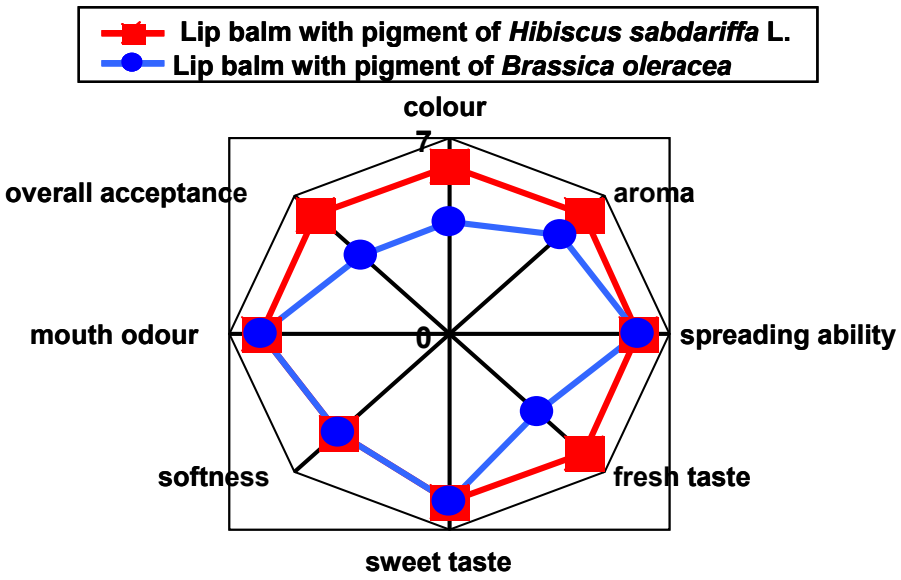

FIG. 4- The acceptance of herbal lip balms in different attributes of sensory evaluation

Conclusion

Gamma irradiation at dose 2.5kGy was suitable as the minimum dose to decontaminate the herbal lip balm without affecting the colour and texture. Anthocyanin pigment from *Hibiscus sabdariffa L.* was the potential and suitable colouring agent for irradiated herbal lip products due to the ability in maintaining the intensity of the colour especially the redness after irradiation.

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