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KEYWORDS: Rice bran oil, Mask, Chitosan, Eudragit

INTRODUCTION

Rice bran oil (RBO) is extracted from rice bran that obtained during milling of rice (*Oryza sativa* L.). It has various components with beneficial nutritive and biological effects such as vitamin B1, B2, niacin, carbohydrates, protein, and minerals such as iron, calcium, and phosphorous. Recently, RBO has attracted wide interest, and is quickly growing in the health and nutritional industry due to its potential benefit to health and several beneficial constituents [1]. However, γ -oryzanol is an important substance in RBO about 0.9-2.1%. It comprised of 38% monounsaturated, 37% polyunsaturated, and 25% saturated fatty acids. The fatty acid composition is 14-22% palmitic acid, 0.9-2.5% stearic acid, 38-46% oleic acid, 33-40% linoleic acid, and 0.2-2.9% linolenic acid, as reported in the Codex standard and other publications [2-6]. In addition, it can reduce harmful low density lipoprotein, without reducing the good high density lipoprotein [5, 7-9]. Moreover, γ -oryzanol has been shown to possess antioxidant, anti-inflammatory, anti-tumor, and hypocholesterolemic activities [2]. The linoleic and linolenic acids (ω -6 and ω -3 fatty acid, respectively) appear to reduce several health risks such as cancer, cardiovascular disease, inflammation, developmental disorders, and cognitive aging [4, 6, 10-13]. However, compositions of RBO are diverse mainly due to differences between varieties of rice, environmental factors, genotype, and extraction method and conditions [3].

This preliminary research aimed to prepare the cold pressed RBO mask made from chitosan blended with different types of eudragit including eudragit[®] RL 100, eudragit[®] RS 100, eudragit[®] RL 30 D, and eudragit[®] RS 30 D. The formulations were examined visually and their physical properties such as pH, viscosity, zeta potential and size were studied.

MATERIALS AND METHODS

Materials Chitosan was purchased from Seafresh, Thailand. Different types of eudragit (eudragit[®] RL 100, eudragit[®] RL 30 D, eudragit[®] RS 100, and eudragit[®] RS 30 D) were gifted from Jebsen & Jessen NutriLife (T) Ltd., Thailand. The rice bran of Hom-Pathum rice (Khaw-Hom-Pathum) was collected from Pathum Thani province, Thailand. This sample was obtained from the mill as liquid oil prepared in the laboratory (Figure 1). Povidone K30, glycerine, and diethyl phthalate was purchased from Sigma, USA. Other chemicals and model drugs were pharmaceutical or analytical grade.

Preparation of cold pressed RBO mask Different formulations of cold pressed RBO mask were prepared by pseudolatex system composing of aqueous phase and organic phase. The main polymer compositions in these formulations were chitosan and different types of eudragit, including eudragit[®] RL 100, eudragit[®] RS 100, eudragit[®] RL 30 D, and eudragit[®] RS 30 D. The chitosan, eudragit[®] RL 30 D, and eudragit[®] RS 30 D were dissolved in aqueous phase, but eudragit[®] RL 100 and eudragit[®] RS 100 were dissolved in organic phase. Firstly, the chitosan (2 g) was dissolved in distilled water (100 mL) and 0.5% acetic acid was added. Then, chitosan solution was mixed with other ingredients which were dissolved in aqueous phase. The cold pressed RBO was dissolved in 300 mL dichloromethane and mixed with other ingredients which were dissolved in organic phase. Then, the aqueous phase was poured into the organic phase under a homogenizer (IKA, Germany) at ambient temperature to obtain oil-in-water emulsions for 30 minutes, respectively. Finally, the oil-in-water emulsion was evaporated by rotary evaporator to remove dichloromethane. The formed pseudolatex was kept in well-closed container at ambient temperature for further evaluation. The cold pressed RBO mask formulations are presented in Table 1.

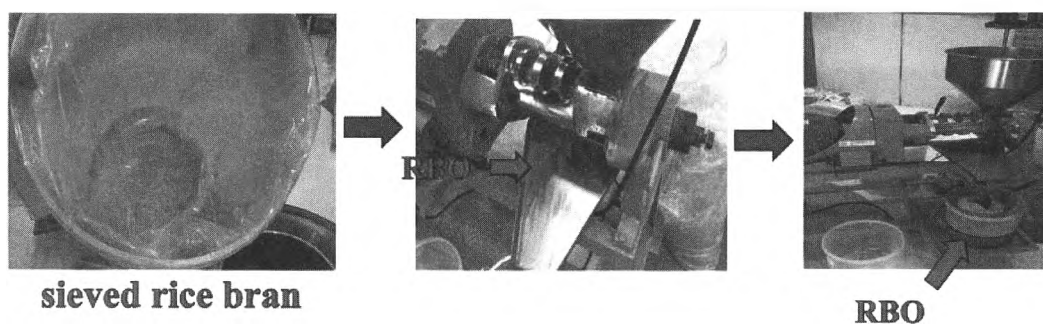


Figure 1 The process of cold pressed RBO from rice bran of Hom-Pathum rice (Khaw-Hom-Pathum)

Table 1 The ingredients of cold pressed RBO mask formulations

Ingredients	Formulations (g)											
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12
Cold pressed RBO	2	2	2	2	2	2	2	2	2	2	2	2
Chitosan	2	2	2	2	2	2	2	2	2	2	2	2
Eudragit [®] RL 100	10	5	5	-	-	-	-	-	-	-	5	-
Eudragit [®] RS 100	-	-	-	5	-	-	5	5	5	-	-	-
Eudragit [®] RL 30 D	-	-	-	-	5	-	-	-	-	5	-	-
Eudragit [®] RS 30 D	-	-	-	-	-	5	-	-	-	-	-	5
Povidone K30	4	3	1	1	1	1	1	1	1	1	1	1
Diethyl phthalate	4	4	4	4	4	4	4	4	-	-	-	-
Glycerine	-	-	-	-	-	-	-	-	4	4	4	4
Light mineral oil	2	2	2	2	2	2	2	2	2	2	2	2
Tween 20	-	-	-	-	-	-	10	-	-	-	-	-
Tween 60	-	-	-	-	-	-	-	10	10	10	10	10
Tween 80	10	10	10	10	10	10	-	-	-	-	-	-
Span 60	-	-	-	-	-	-	-	-	5	5	5	5
Paraben concentrate	1	1	1	1	1	1	1	1	1	1	1	1

Physical appearance and physical properties of the formulations The appearance of these formulations were visually observed by the researcher. Zeta potential and particle size were measured by Zetasizer (Malvern, UK). The pH value was measured using a pH meter (Mettler Toledo, Germany). Viscosity was measured using a programmable viscometer (Brookfield, Brookfield Engineering Laboratories Inc., USA) with a spindle LV 4.

RESULTS AND DISCUSSION

Physical appearance of cold pressed RBO mask Their pH and viscosity are presented in Table 2. The pH values of the formulations were in the range of 6.03-6.36. The formulations were found to be safe when applied on the skin. Furthermore, the R9 to R12 formulas were selected to determine zeta potentials and their particle size, as presented in Table 2. The zeta potential values of these formulations were in the range of 10.7-35.6 mV, which expressed the mainly positive charge of chitosan. They had low polydispersity index, indicating a relatively narrow size distribution of the particles. The zeta potential of R11 formulas could predict the physical storage stability of cold pressed RBO mask. If cold pressed RBO mask formulations had a good physical stability, the zeta potential values are higher than ± 30 mV^[14]. However, only the R11 formula had the suitable particle size, in nanometer scale, of 198.9 nm.

The physical appearance of different cold pressed RBO mask formulations is shown in Figure 2. They were white or slightly yellow colored. R1 and R2 formulas were very sticky cream / emulsion, so they were not further investigated. Thus, R3 to R12 formulas were selected to test for their stability at room temperature (Figure 2B). We found the R3 to R8 formulas to be not suitable for preparing cold pressed RBO mask by pseudolatex systems because they were unstable. Although these formulas were initially stabilized with emulsifiers, they were still inherently unstable and eventually separated (Figure 2B). There were sedimentation and flocculation due to the assembly of the large drops and small flocci.

However, they could be reversed by agitation. Therefore, R9 to R12 formulas were suitable for future development of cold pressed RBO mask formulation (Figure 2B).

Table 1 The pH, viscosity, zeta potential values, and particle size of cold pressed RBO mask formulations

Physical properties	Formulations											
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12
pH	6.03	6.17	6.07	6.22	6.28	6.29	6.31	6.12	6.27	6.26	6.36	6.33
Viscosity (cP0)	-	-	763	804	720	773	802	779	752	793	812	793
Zeta potential (mV)	-	-	-	-	-	-	-	-	33.3	10.7	35.6	18.0
Polydispersity index	-	-	-	-	-	-	-	-	0.46	0.91	0.46	0.61
Particle size (nm)	-	-	-	-	-	-	-	-	5418	3244	198.9	1407

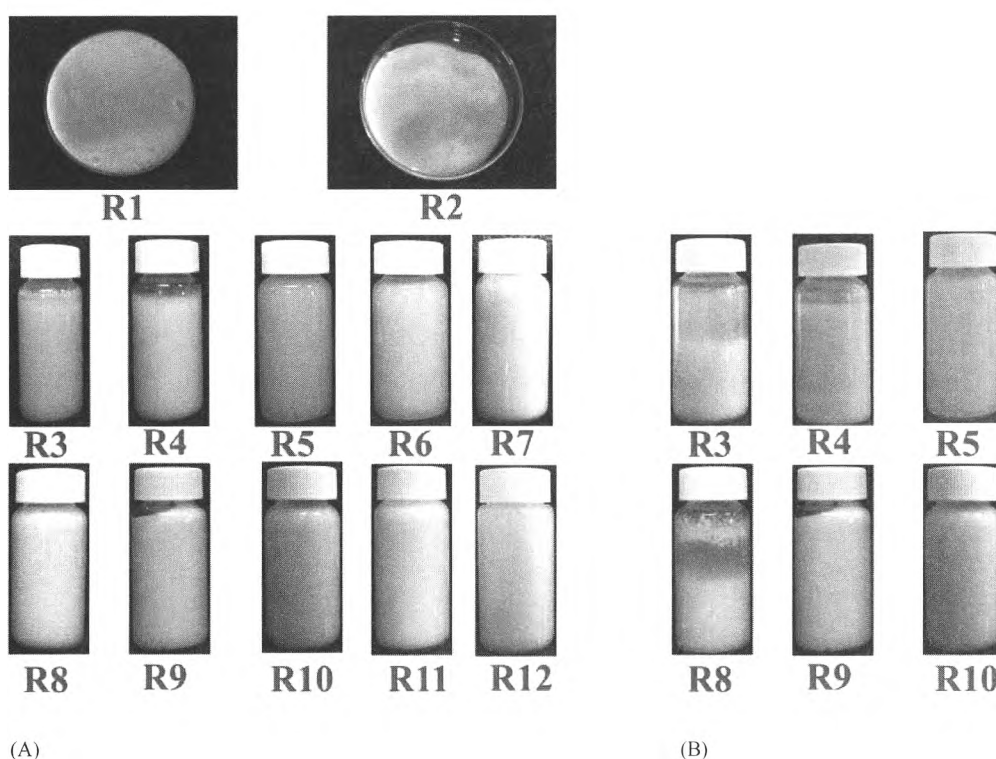


Figure 2 Physical appearance of different cold pressed RBO mask formulations (A) initial preparation and (B) after 1 month at room temperature

CONCLUSION

We have successfully prepared cold pressed RBO mask formulations from chitosan blended with different types of eudragit including eudragit[®] RL 100, eudragit[®] RS 100, eudragit[®] RL 30 D, and eudragit[®] RS 30 D. The pH and viscosity values of these formulations indicated that they were safe for direct application to the skin. The R9 to R12 formulas showed good physical properties; therefore, they were suitable for preparing cold pressed RBO mask. Moreover, these formulations could be further developed for cosmetic purposes.

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