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Comparative study of encapsulated rhizome extract of *Alpinia purpurata* (Zingeberaceae) in alginate and alginate-chitosan

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Abstract. Encapsulation is a coating process of bioactive compound. Alpinia purpurata has been well known as lengkuas merah an Asian tropical herbal which contain phenylpropanoid, phenolic and flavonoid. Phenolic and flavonoid compounds is an agent that can be used as anti cancer. This research aim is to create a product of Alpinia purpurata extract which encapsulated in alginate or alginate-chitosan. Theproduct of encapsulated has been observed towards SEM (Scanning Electron Microscophy) and spectrocophy Infra-Red method. Encapsulated product of lengkuas merah extract made through extrusion method in alginate and chitosan with ratio 1:1 (w/w) then dripped in 2% $CaCl_2$.The Alpinia purpurata/alginate/chitosan microcapsules (APCAM) is better than alginate microcapsules (APAM).

Key words; *Alpinia purpurata, lengkuas merah, SEM,, encapsulation, alginate/chitosan*

Introduction

The genus *Alpinia* (Zingiberaceae family, Alpinioideae subfamily, Alpinieae tribe) is native to tropical and subtropical Asia (Kress et al., 2002). Several species of the Zingiberaceae family present antioxidant property mainly due to the considerable presence of flavonoids such as rutin, quercetin, alpinetin and different types of kaempferol in the genus *Alpinia* (Williams & Harborne, 1977; Mpalantinos et al., 1998; Vankar et al., 2006). Many Alpinia species are well-known medicinal herbs that have been shown by several previous studies to have various effects, namely, antioxidant (Habsah, 2000; Chen, 2008) and anticancer (Lee, 2005; An, 2008) activities.

Microencapsulation is a technique by which the sensitive ingredients, called core materials, are entrapped in coating or wall materials. The coating material protects the sensitive ingredients from the external influences, controls the release of the ingredient, and sometimes converts liquids into powders, easy to handle (Frascareli et al., 2012; Bakowska-Barczak and Kolodziejczyk, 2011). So far, various kinds of microencapsulation techniques, such as emulsification, coacervation, spray drying, spray cooling, freeze drying, fluid bed coating, and extrusion, have been developed (Qv et al., 2011), among which, extrusion is one of the simple and convenient technologies.

Alginate, one of linear anionic polysaccharides, has been considered one of the most suitable biopolymer for microencapsulation. The advantages of using alginate as coating material include: non-toxicity, formation of gentle matrices with calcium chloride to trap sensitive materials, low cost, and an accepted food additive and be safely used in foods (Chávarri et al., 2010). However, alginate beads show poor stability, resulting in the limitation of alginate application in microencapsulation. Previous research reported that coating alginate microcapsules with chitosan had improved the stability of the alginate beads (Krasaekoopt et al., 2004). Chitosan is a hydrophilic, biocompatible and biodegradable polysaccharide with low toxicity. The strong electrostatic interaction of the amino groups of the chitosan with the carboxylic groups of the alginate leads to formation of the complex alginate/chitosan microcapsule (Finotelli et al., 2010).

In the present study, alginate and chitosan were used as coating materials for producing microencapsulated *Alpinia purpurata* extract by extrusion technique. And particle surface, microstructure, and *kind of bonding* property of encapsulated extract were investigated.

The encapsulated extract will mainly be applied in functional food.

Material and Methods

Materials

Methanol extract from *Alpinia purpurata*. Alginate was supplied by .... . chitosan having degree of deacetylation >90%, was purcased from ..... . all other reagent used of analitycal grade.

Microencapsulation of *Alpinia purpurata* extract

Accurately weighed amount of sodium alginate (2.5%) was dissolved in water by using magnetic stirrer. In another beaker 2% chitosan previously dissolved in acetic acid solution (1%). Then *Alpinia purpurata* extract was added into alginate solution according to ratio of extract to alginate 1:1.5. The mixing solutions were stirred uniformly, and extruded into calcium chloride solutions with the content of 2.5% to immobilize for 45 min.The concentration of the polymers and the concentration of the cross-linker agent were used optimized condition, modification (mingyan, 2013). After that, the products were filtered and washed with distilled water, dried to get Alpinia purpurata-alginatemicrocapsules (APAM). Next, APAM were shook in chitosan solutions with the content of 2.0% for 2 h, dried at 30°C to obtain Alpinia purpurata-alginate-chitosan microcapsules (APCAM). Sollubility profiles of microcapsules were examined in alcohol, netral, acid and alkali solution condition.

Physicochemical properties of *Alpinia purpurata*microcapsules

SEM analysis

The morphology of the microcapsules was observed under scanning electron microscope (JEOL), at an acceleration voltage of 20 kV.

Fourier Transform Infra Red Spectroscopic Analysis (FTIR)

Interaction between polymers and their functional groups in the polymeric structures were studied using FTIR (Model: Frontier FT-IR, Spectral Range: 4000 - 450 cm-1). Spectra of the polymer were taken in the wavelength region 500-4000 cm-1.

Result and discussion

Microencapsulation of *Alpinia purpurata* extract

Alpinia purpurata extract Microencapsulation were prepared by exrusion technique using alginate and chitosan as coating materials. The mixing solutions betwen *Alpinia purpurata* extract and alginate solution was dropped into calcium chloride solution (2%). Various salts were selected as a cross linking agent like calcium chloride, aluminium chloride, ferric chloride and sodium chloride. Out of which, calcium chloride was selected as it formed comparatively spherical and rigid microspheres. The resulted *Alpinia purpurata* microcapsules were regularly spherical after drying. With or without chitosan as coating were tried which gave the formation of well formed micropheres. Chitosan content was found that the introduction of chitosan could make surface of microcapsules more smooth and could make the diameters of microcapsules reduced after drying at 30°C, which might be correlated with the electrostatic interaction between alginate and chitosan to form a stable polyelectrolyte complex (Li et al., 2002). In this study, the microcapsules coated with chitosan were mainly to stabilize Ca-alginate microparticles (Selina et al., 2008). When chitosan reacted with alginate completely, Ca-alginate microparticles were more stable.

The desirable microcapsule should protect core material from acid-damaged destruction. When it reached small intestine, it should release the core material rapidly (Yoo et al., 2006). The solubility test profiles of *Alpinia purpurata* microcapsules was investigated in alcohol, netral, acid and alkali solution. But microcapsules can not be soluble in all of condition. further research is recommended in order to achieve the right conditions.

Physicochemical properties of *Alpinia purpurata*microcapsules

SEM analysis

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The SEM images of *Alpinia purpurata* microcapsules are illustrated in fig.1. it could be found that the microparticles all had spherical appearances. Nevertheless the APACM showed a smooth outer surface after the introduction of chitosan in preparation. As shown in Fig. 2 (b)

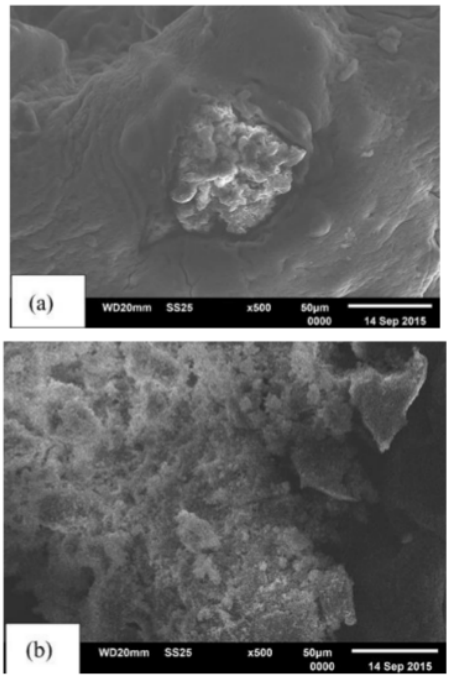

Fig.1 – SEM image of Alpinia purpurata microcapsules. (a) before coating chitosan. (b) after coating chitosan.

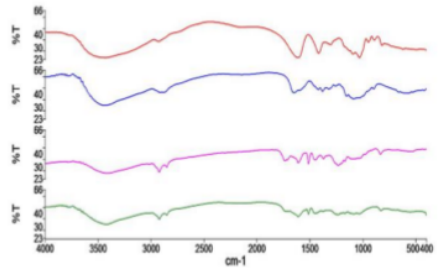

Fig. 2 – Comparison analtsis of the spectroscopy of (1) Alginate, (2) Chitosan, (3) *Alpinia purpurata* microcapsules coated by alginate, and *Alpinia purpurata* microcapsules coated by alginate and chitosan.

Fourier Transform Infra Red Spectroscopic Analysis (FTIR)

The infrared spectra of alginate, chitosan, and *Alpinia purpurata* extract-loaded microcapsules are shown in Fig. 2. The spectrum of APAM was similar to that of alginate, but different from that of Alpinia purpurata extract, suggesting that Alpinia purpurata extract was embedded well. After microencapsulation, the absorption band at 1627 cm−1 and 1415 cm−1 of alginate both shifted to higher frequency, near 1639 cm−1 and 1423 cm−1, respectively, indicating that there was electrostatic interaction between alginate and *Alpinia purpurata* extract in microcapsule. It could also be observed that no new absorption band appeared among spectra of APACM and wall materials (alginate and chitosan), showing that the formation of APACM was promoted by physical interaction such as electrostatic interaction rather than chemical reactions. The results suggested that whether APAM or APACM, they were formed by electrostatic interaction, which was beneficial to sustained release of phycocyanin in microcapsules.

Conclusion

SEM And FTIR analysis show that coating between alginate and alginate chitosan show that there are no reaction with chemical raction merely by physical reaction. So can be used to encapsulate bioactive compound on Alpinia purrpurata extract.

Reference

An N, Zou ZM, Tian Z, Luo XZ, Yang SL, Xu LZ. Fitoterapia 2008; 79:27–31.

Bakowska-Barczak, A.M., Kolodziejczyk, P.P., 2011. Black currant polyphenols: their storage stability and microencapsulation. Ind. Crop. Prod. 34, 1301–1309.

Basu SK. Herbal medicines concepts and perspectives. In: Dutta Banik S, Basu, Sk (Eds.) (2000-2001). Environmental perspectives and human responses[M]. S. Graphics, Kolkata, India: National service scheme (NSS), Govt. of India, 2002, 3: 27-44.

Chávarri, M., Maranón, ˜ I., Ares, R., Ibánez, ˜ F.C., Marzo, F., Villarán, M.C., 2010. Microencapsulation of a probiotic and prebiotic in alginate-chitosan capsules improves survival in simulated gastro-intestinal conditions. Int. J. Food

Microbiol. 142, 185–189.

Chen IN, Chang CC, Ng CC, Wang CY, Shyu YT, Chang TL. Nutr 2008; 63: 15–20.

Finotelli, P.V., Silva, D.D., Sola-Penna, M., Rossi, A.M., Farina, M., Andrade, L.R., Takeuchi, A.Y., Rocha-Leão, M.H., 2010. Microcapsules of alginate/chitosan containing magnetic nanoparticles for controlled release of insulin. Colloid Surface B 81, 206–211.

Frascareli, E.C., Silva, V.M., Tonon, R.V., Hubinger, M.D., 2012. Effect of process conditions on the microencapsulation of coffee oil by spray drying. Food Bioprod. Process. 90, 413–424.

Habsah M, Amran M et al. J Ethnopharmacol 2000; 72: 403–410.

Krasaekoopt, W., Bhandari, B., Deeth, H., 2004. The influence of coating materials on some properties of alginate beads and survivability of microencapsulated probiotic bacteria. Int. Dairy J. 14, 737–743.

KRESS, W.J.; PRINCE, L.M.; WILLIAMS, K.J. Thephylogeny and a new classification of the gingers (Zingiberaceae): evidence from molecular data. American Journal of Botany, v.89, n.10, p.1682-96, 2002.

Kumar VP, Chauhan NS, Padh H, et al. Search for antibacterial and antifungal agents from selected Indian medicinal plants [J]. J Ethnopharmacol, 2006, 107(2): 182-188.

Lee CC, Houghton P. J Ethnopharmacol 2005; 100: 237–243.

Li, S., Wang, X., Zhang, X., Yang, R., Zhang, H., Zhu, L., Hou, X., 2002. Studies on alginate-chitosan microcapsules and renal arterial embolization in rabbits. J. Control. Release 84, 87–98.

Meng, Q., Chen, W., 2010. Preparation and sustained-release performance of chitosan-sodium alginate sodium-sodium ferrous chlorophyllin microcapsules. Food Sci. 31 (20), 137–140 (in Chinese).

MPALANTINOS, M.A. Identificação de substâncias antihipertensivas de *Alpinia zerumbet* Pers. 2001. 197p. Tese (Doutorado) - Núcleo de Pesquisas de Produtos Naturais, Universidade Federal do Rio de Janeiro, Rio de Janeiro.

Prajapathi ND, Prajapathi T, Jaipura S, et al. Advances in medicinal plants [M]. Jodhpur: Asian Med Plant Heal Care Trust, 2005, 1: 59-71.

Qv, X., Zeng, Z., Jiang, J., 2011. Preparation of lutein microencapsulation by complex coacervation method and its physicochemical properties and stability. Food Hydrocolloid. 25, 1596–1603.

Selina, O.E., Chinarev, A.A., Obukhova, P.S., Bartkowiak, A., Bovin, N.V., Markvicheca, E.A., 2008. Alginate-chitosan microspheres for the specific sorption of antibodies. Russ. J. Bioorg. Chem. 34 (4), 468–474.

VANKAR, P.S. et al. Antioxidant properties of some exclusive species of Zingiberaceae family of Manipur. Agronomy and Food Chemistry, v.5, n.2, p.1318-22, 2006.

Victorio CP, Kuster RM, Lage CLS, et al. Detection of flavonoids in Alpinia purpurata (Vieill.) K. Schum. leaves using high performance liquid chromatography [J]. Rev Bras Plant Med Botucatu, 2009, 11(2): 147-153.

WILLIAMS, C.A.; HARBORNE, J.B. The leaf flavonoids of the Zingiberales. Biochemical Systematics andEcology, v.5, n.3, p.221-9, 1977.

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