

## THE EFFECT OF CONCENTRATION TWEEN 80 ON METFORMINE ENCAPSULATED AT CHITOSAN-ALGINATE MATRIX

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### ABSTRACT

This research purpose to study the effect of concentration tween 80 on metformine encapsulation on chitosan-alginate matrix and investigated some characteristic of metformine after encapsulation process. The encapsulation of metformine performed using chitosan and calcium alginate polymers with tween 80 assurfactant. The concentrations of tween 80 were varieties 0, 1%, 2%, 3%, 4% dan 5% (w/v). The results showed that metformine the highest encapsulation on concentration of tween 80 is 3% (w/v). From the results of the PSA showed 8,5% nano-sized particles and 91,5% micro-sized particles. Thus, it could be concluded that the addition of surfactant tween 80 could increase the encapsulation efficiency and

affected the particle size. Encapsulation resulted have the spectra FTIR vibration on 1679.91  $\text{cm}^{-1}$  that indicated the carboxyl functional group of alginate interaction between with the amine functional group of chitosan.

**KEYWORDS:** Encapsulation, Metformine, Tween 80.

### INTRODUCTION

Metformine as a primary drug of diabetes mellitus that is consumed by patient of type diabetes 2.<sup>[1-2]</sup> Metformine is permeated by digestive system better and the patient of diabetes mellitus must consume every day in long time.<sup>[3]</sup> Most side effects of metformine that consume continuously is acidosis of lactate acid. To reduce of the side effects this medicine is by development of drug with control release system. This system can to improve therapy effectiveness and to reduce side effects. Drug control release system was produced by using encapsulated metformine with natural polimer.<sup>[4]</sup> This method is used to trap active

component of medicine and discharging it was below condition of system controlled. Some materials have been encapsulated can applied in some process are in food industry and pharmacy.<sup>[5]</sup> Polymer natural that used in encapsulated application process are chitosan, alginate, selulose, agarose, guam gum, and selulose acetate.<sup>[6]</sup> Matrix encapsulation for system carrier of drug, polymer like chitosan and alginate a more most used because there are have the character of is porous, biocompatible, not toxic, and good biodegradable. Alginate-chitosan has a weakness that is difficult to mix, so that must added with surfactant as an emulsifier to the alginate-chitosan mixture.<sup>[7]</sup> Tween 80 is a nonionic surfactant that have a value of HLB (Hydrophilic Lipophilic Balance) of which tends to dissolve in water.<sup>[8]</sup> Tween 80 can reduce the surface tension between the drug and the medium while forming micelles so that the drug can be carried by micelles and dissolve in the medium. At concentrations of 1-10%. Tween 80 can act as a solubility enhancer.<sup>[9]</sup> Pursuant to the mentioned hence at this study is studied about influence of concentration of tween 80 to metformin encapsulation on chitosan-alginate matrix for deliver drug control system.

## MATERIAL AND METHODE

The equipments utilized in this experiment were Spectrophotometer UV-Vis Shimadzu-1700 was for glibenclamide efficiency and dissolution analysis, Spectrophotometer InfraRed (FTIR Perkin Elmer Frontier-89485) was for spectrum function group analysis, and SEM for morphology analysis. Some materials with pro analysis that use are acetic acid, CaCl<sub>2</sub>, AgNO<sub>3</sub>, NaOH, K<sub>2</sub>HPO<sub>4</sub>·2H<sub>2</sub>O, NaOH.

### Encapsulation of metformine on alginate chitosan

About six gram of metformin deliberated to use analytic balance and entered into chemical glass. After that, it enhanced by 12 condensation mL alginat 2% (b/v). The mixture swirled with stirrer magnetic until homogeneous. The mixture dripped into condensation of CaCl<sub>2</sub> 0,15 M use pipette drip and formed gel. Item hushed by during 10 minute, filtered last and cleaned with aquades until neutral and free of Cl<sup>-</sup>. The mixtured hushed during 30 minute. Later; Then, item soaked in condensation of tween 80 with various concentration (0, 1%, 2%, 3%, and 4%) and hushed during 10 minute. It filtered and soaked in condensation of chitosan 1%. After that, let during 10 minute, filtered last and dried in room temperature.

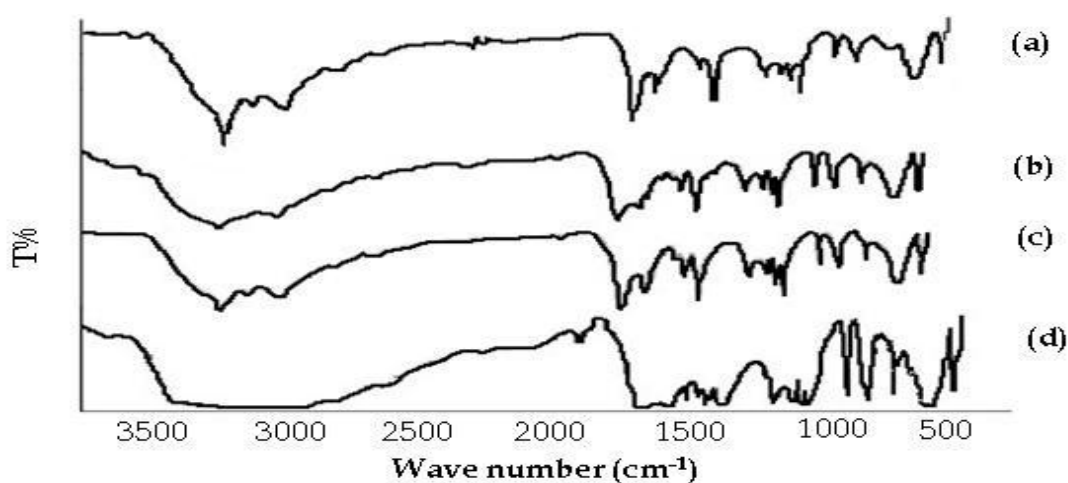
### Encapsulation efficiency

About 10 mg pirazinamid encapsulated on alginate-chitosan dissolved to in 10 phosphate buffer mL of pH 6,8. Mixture the dissolved with stirrer magnetic [at] homogeneous room

temperature until. Condensation analysed with spectrophotometer of UV at wavelength 268 nm.<sup>[1]</sup> Absorbance read to be to be used to determine of concentration of metformine encapsulated. Particle without metformine made as condensation of blank. All was repeat three times.

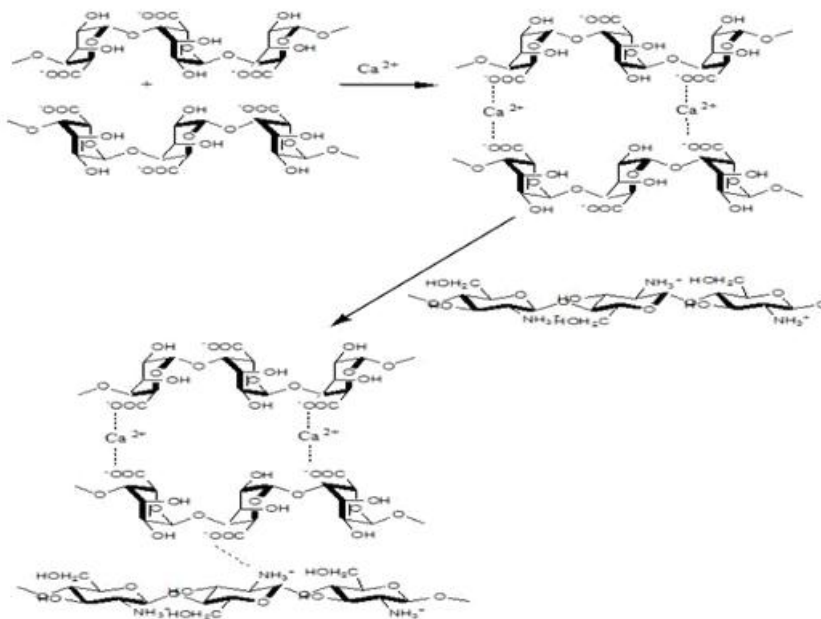
## RESULTS AND DISCUSSION

Encapsulation is a one of method to protect a material by using a polymer as a coating<sup>1</sup>. Encapsulation aims to increase the stability and solubility of a compound, to control the release of active compounds, to produce stable solid particles that are coated by certain coatings and to minimize nutrient loss from a compound<sup>2</sup>. Control release of active compounds can prevent the increase in concentration of the drug in the digestive tract simultaneously so as to prevent irritation of the digestive tract, especially irritation in gastric<sup>3</sup>. The encapsulation processes was aim to entrap metformine use natural polymer alginate and chitosan. Both of these polymers have characteristics biocompatible, biodegradable, and not toxic. Item soaked in condensation of tween 80 with concentration variation of 0, 1%, 2%, 3%, 4% and 5% (v / v). Addition of 80 tween this aim to to lessen the happening of agglomeration of alginat-kitosan and to maintaining item size measure which usually become smaller after soaked in kitosan and dried [at] room temperature. The soaked done during 10 minute for the purpose of entire part of capsule of alginat earn cladding with tween 80. Metformine and solution of alginate was homogenized to use stirrer magnetic with comparison mixture 1:2 (b / b). After encapsulated, the metformine encapsulated was analysis the functional group by infrared fourier transmissision spectrofotometer.



**Fig. 1:** The infrared spectra from chitosan (a), alginate (b) dan chitosan-alginate (c) metformine; chitosan-alginate-metformine-tween 80 3% (d).

The characteristics spectra of chitosan and alginate are existence of functional group– OH and – NH<sub>2</sub> shown by absorption in wave number 3443.03 cm<sup>-1</sup> and in wave number 1639. cm<sup>-1</sup> as indicated vibration of N-H. The vibration at wave number 1649.21 cm<sup>-1</sup> showed the existence of – NH<sub>2</sub> functional group for chitosan. The functional group alginate showed at wave number 1622.72 cm<sup>-1</sup> for C=O, the functional group of C-O ester with strong absorption in wave number 1027.51 cm<sup>-1</sup>. The functional group of C=O at wave number 1818 cm<sup>-1</sup>, and functional group of CO emerge at wave number 1165.96 cm<sup>-1</sup> with low intensity, its meaning of functional group C-O of alginate a lot have bond with Ca<sup>2+</sup> as crosslink agent of functional group – COO.<sup>[7]</sup>



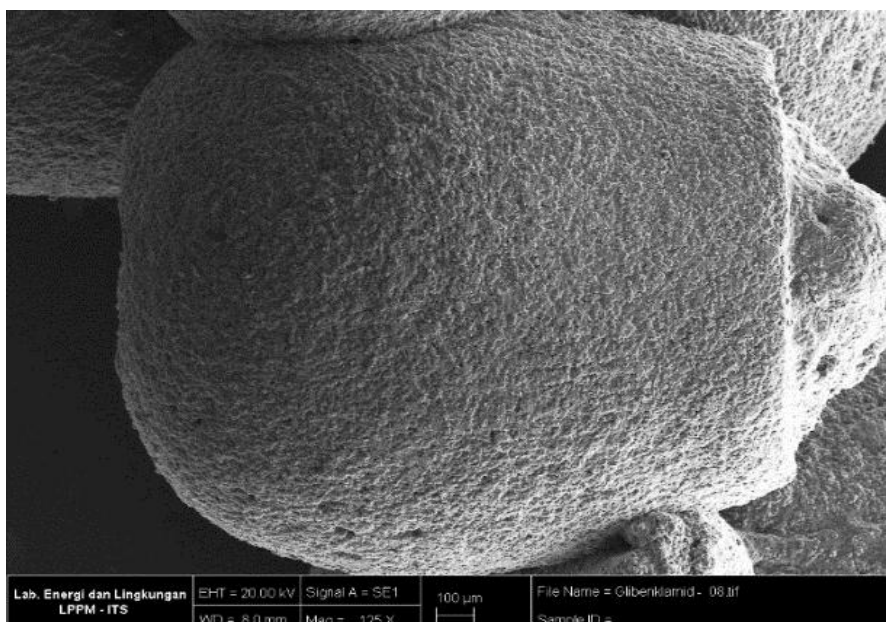
**Fig. 2: Hypothetical reaction of Chitosan- Ca-alginate.<sup>[7]</sup>**

Encapsulation efficiency is analysis to know how many metformine can encapsulated on chitosan-alginate-tween 80 matrix. Efficiency of encapsulation metformine in matrix presented in Table 1.

**Table 1: Efficiency of metformine encapsulation.**

Composition alginate- Chitosan	[ Tween 80] % (b/v)					
	0	1	2	3	4	5
1:1	65,03	67,89	75 ,03	80,03	75,01	73,04
1:125	70,12	72,67	77,07	82,01	78,43	75,02
1,15	75,03	78,04	79,30	90,03	82,01	80,07
1:2	70,02	73,02	80,15	87.72	81,01	80,3
2:1	65,07	72,05	75,22	76,19	70,25	67,04

Tables 1 showed about efficiency encapsulation of metformine on alginate-chitosan matrix. At results showed that efficiency encapsulation are influenced by concentration of tween 80. percentage of efficiency enkapsulasi mount along with make-up of concentration of surfaktan. But, start concentration 4% happened degradation. Matter this is caused by concentration of tween 80 residing in of CMC (Critical Micell Concentration). Moment Concentration of surfaktan under CMC, surfaktan can degrade surface tension because micel not yet been formed, so that stability internal of drop become better and can quicken system of dispersi mikrokapsul Besides, surfaktan also can make coat which either in around surface capsule, so that agglomeration of alginat-kitosan can decrease and hence efficiency tend to increase, while moment above CMC, surfaktan shall no longger can make coat [in] around surface of capsule, so that possibility of agglomeration of alginat-chitosan can be formed.



**Fig. 3 SEM images of metformine encapsulated 500x.**

Fig. 3 Electrolyte combination of alginate-chitosan without existence of addition of Tween 80 can result the existence of agglomeration at surface of matrix because alginate and chitosan have one of the nature of difficult mixed. This matter can perceive result of SEM test alginate- chitosan encapsulation of metformine at Picture 3 which have been done by Cahyaningrum<sup>[7]</sup> that showing the existence of agglomeration at some part on the surface of matrix of metformine encapsulated without existence of addition of Tween 80. While at result of SEM metformine encapsulated with existence of addition of Tween 80 owning surface of smooth matrix and do not there are agglomeration.



## CONCLUSION

Concentration of tween 80 influence efficiency value of encapsulation that is is ever greater concentration of tween 80 hence is ever greater of value efficiency of encapsulation, but efficiency highest encapsulation at concentration tween 80 is 3%. Analysis functional group showed the existence of functional group interaction - COO- alginate with NH<sub>2</sub> chitosan. The analysis of surface morphology showed that the surface of metformine encapsulated do not an agglomeration.

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