RESEARCH PROJECT

NANOCOMPOSITE MESOPOROUS SILICA NANOPARTICLES MODIFIED WITH ALGINATE (MSN-ALG) FOR DRUG DELIVERY

Submitted By :

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DEPARTMENT OF CHEMICAL ENGINEERING

FACULTY OF ENGINEERING

WIDYA MANDALA CATHOLIC UNIVERSITY

SURABAYA

2018

LETTER OF APPROVAL

The research entitled :

Nanocomposite Mesoporous Silica Nanoparticles Modified With Alginate (MSN-ALG) For Drug Delivery

Which was conducted and submitted by :

Name : Kevin Soesanto

NRP : 5203015008

has been approved and accepted as one of the requirement for Bachelor of Engineering Degree in Chemical Engineering Department, Faculty of Engineering, Widya Mandala Surabaya Catholic University, by following supervisor/s and has been examined by the commitees on May, 22nd 2018.

Surabaya, June 8th 2018

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Surabaya, June 8th 2018

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PREFACE

The authors would like to thank God for His blessing that the Research Project entitled Nanocomposite Mesoporous Silica Nanoparticles Modified With Alginate (MSN-ALG) For Drug Delivery has been accomplished. This report is a prerequisite in achieving Bachelor of Engineering degree in Chemical Engineering.

The authors realize that the completion of this report is achieved by the help of many people. There for, the authors would like to thank the persons below:

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5. Sandy Budi Hartono, Ph.D as Principal supervisor as Head of Chemical Engineering Department
6. Suryadi Ismadji, Ph.D as Dean of Engineering Faculty

7. Our parents and family who have given a lot of help and support, both materially and morally
8. Our lecturers, friends and also those who are too many to be listed by name that had contributed their kind assistance

The authors realize that this report is far from perfect, therefore any critics and comments which will better improve the research is gladly accepted. Lastly the authors hope that the report will be useful to all readers who need information regarding the research of the report.

Surabaya, June 8th 2018

The authors

ABSTRACT

Curcumin is a substance that contained in turmeric yellow pigment. Curcumin has several benefits, which can be used as anti-bacterial, anti-inflammatory, anti-oxidant and anti-neoplastic .But, the curcumin characteristic has poor water solubility and low bioavailability. The low bioavailability of curcumin certainly minimizes its therapeutical effects. This problem can be overcome by the application of mesoporous silica nanoparticle as a drug delivery system.

Several research which has been conducted, by using mesoporous silica nanoparticles (MSN) as a drug carrier. These studies proved that MSN could maximize drug delivery process. The mechanism was by maintaining drug into a smaller size through encapsulation within the porous structure of MSN to improve drug delivery process in human body. However most of these studies used mesoporous silica pore structure with 2D mesostructure.

In this research, we use mesoporous silica nanoparticles (MSN) type IBN-2 which has 3D pore structure to overcome pore blocking issue, as a result of blockage of drug particles which were loaded into mesoporous silica. MSN is modified with alginate. The alginate is used to give effect of a controlled release at certain pH. Alginate is an anionic polymer, and has negative surface charge. Therefore, MSN is first coated with APTES to change the surface charge which also tend to be negative, so the alginate coating process runs optimally. Before that curcumin is loaded into the MSN, and then the alginate coating process is conducted.

This research is conducted by varying the effect of APTES concentration, alginate concentration, and in-vitro release pH in various concentrations according to pH conditions in the human body. The synthesis are followed by various analysis using Spectrophotometer UV-Vis, and

Fourier Transform Infrared Spectroscopy to determine the characteristic of drug carriers. The purpose of this research is to determine the optimum concentration and condition of mesoporous silica to improve the effectiveness of drug delivery process in specific area. Sample with ratio of MSN and APTES 1.2 mg : 3.0 ml with concentration of alginate 1 mg/ml showed better function of controlled release in certain pH.

CONTENTS

LIST OF TABLES

LIST OF FIGURES