SKRIPSI

SYNTHESIS OF SILICON NANOPARTICLE WITH ADDITION OF CURCUMIN AND THEIR APPLICATION FOR DRUG DELIVERY

Diajukan oleh:

Aaron Raharjo NRP 5203020010

Nicholas Aaron Suwarno NRP 5203020011

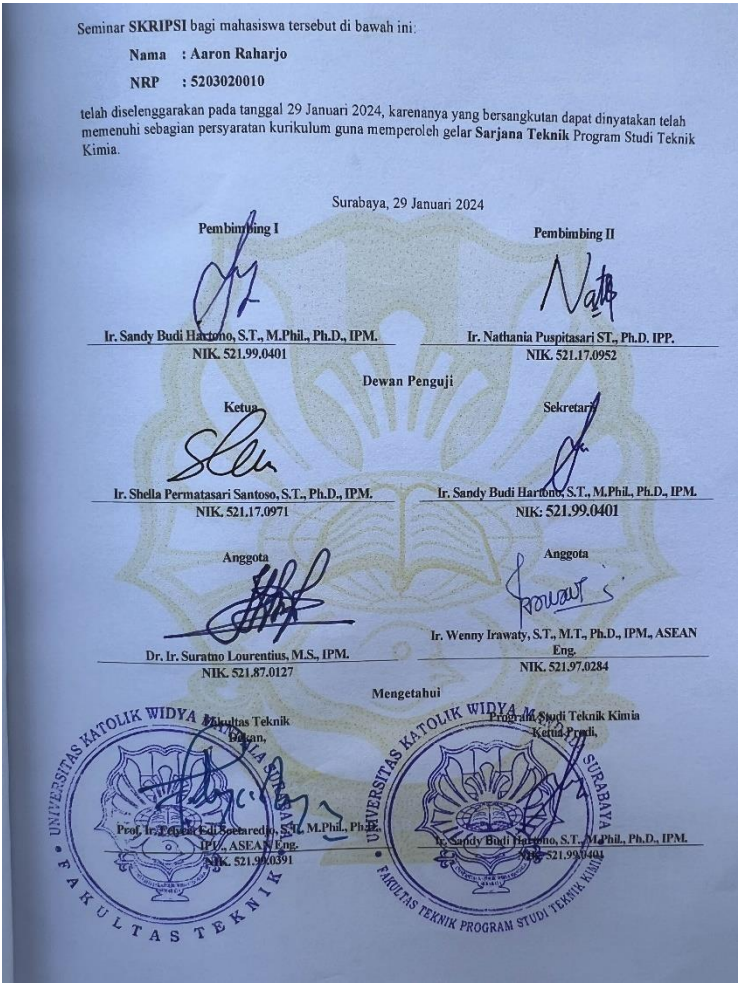
PROGRAM STUDI TEKNIK KIMIA

FAKULTAS TEKNIK

UNIVERSITAS KATOLIK WIDYA MANDALA SURABAYA

2024

LEMBAR PENGESAHAN



Seminar **SKRIPSI** bagi mahasiswa tersebut di bawah ini:

Nama : Aaron Raharjo

NRP : 5203020010

telah diselenggarakan pada tanggal 29 Januari 2024, karenanya yang bersangkutan dapat dinyatakan telah memenuhi sebagian persyaratan kurikulum guna memperoleh gelar **Sarjana Teknik** Program Studi Teknik Kimia.

Surabaya, 29 Januari 2024

Pembimbing I

Ir. Sandy Budi Hartono, S.T., M.Phil., Ph.D., IPM.
NIK. 521.99.0401

Pembimbing II

Ir. Nathania Puspitasari ST., Ph.D. IPP.
NIK. 521.17.0952

Dewan Penguji

Ketua

Ir. Shella Permatasari Santoso, S.T., Ph.D., IPM.
NIK. 521.17.0971

Sekretaris

Ir. Sandy Budi Hartono, S.T., M.Phil., Ph.D., IPM.
NIK: 521.99.0401

Anggota

Dr. Ir. Suratno Lourentius, M.S., IPM.
NIK. 521.87.0127

Anggota

Ir. Wenny Irawaty, S.T., M.T., Ph.D., IPM., ASEAN Eng.
NIK. 521.97.0284

Mengetahui

Fakultas Teknik
Dekan,

Prof. Ir. Cyrilla Sri Setyaredjo, S.T., M.Phil., Ph.D., IPU., ASEAN Eng.
NIK. 521.99.0391

Program Studi Teknik Kimia
Ketua Prodi,

Ir. Sandy Budi Hartono, S.T., M.Phil., Ph.D., IPM.
NIK: 521.99.0401

LEMBAR PENGESAHAN

Seminar **SKRIPSI** bagi mahasiswa tersebut di bawah ini:

Nama : Nicholas Aaron Suwarno

NRP : 5203020011

telah diselenggarakan pada tanggal 29 Januari 2024, karenanya yang bersangkutan dapat dinyatakan telah memenuhi sebagian persyaratan kurikulum guna memperoleh gelar **Sarjana Teknik** Program Studi Teknik Kimia.

Surabaya, 29 Januari 2024

Pembimbing I	Pembimbing II
Ir. Sandy Budi Hartono, S.T., M.Phil., Ph.D., IPM.	Ir. Nathania Puspitasari ST., Ph.D. IPP.
NIK. 521.99.0401	NIK. 521.17.0952

Dewan Penguji

Ketua	Sekretaris
Ir. Shella Permatasari Santoso, S.T., Ph.D., IPM.	Ir. Sandy Budi Hartono, S.T., M.Phil., Ph.D., IPM.
NIK. 521.17.0971	NIK: 521.99.0401

Anggota	Anggota
Dr. Ir. Suratno Lourentius, M.S., IPM.	Ir. Wenny Irawaty, S.T., M.T., Ph.D., IPM., ASEAN Eng.
NIK. 521.87.0127	NIK. 521.97.0284

Mengetahui

Fakultas Teknik	Program Studi Teknik Kimia
Dekan,	Ketua Prodi,
Prof. Ir. Faycal Bouhafs, M.Sc., M.Phil., Ph.D., IPU., ASEAN Eng.	Ir. Sandy Budi Hartono, S.T., M.Phil., Ph.D., IPM.
NIK. 521.99.0391	NIK. 521.99.0401

LEMBAR PERNYATAAN PERSETUJUAN PUBLIKASI KARYA ILMIAH

Demi perkembangan ilmu pengetahuan, saya sebagai mahasiswa Program Studi Teknik Kimia Universitas Katolik Widya Mandala Surabaya:

Nama : Aaron Raharjo

NRP : 5203020010

Menyetujui karya ilmiah saya:

Synthesis Of Silicon Nanoparticle With Addition Of Curcumin And Their Application For Drug Delivery

untuk dipublikasikan di internet atau media lain (Digital Library Perpustakaan Universitas Katolik Widya Mandala Surabaya) untuk kepentingan akademik sebatas sesuai dengan Undang-Undang Hak Cipta.

Demikian Pernyataan Persetujuan Publikasi Karya Ilmiah ini saya buat dengan sebenarnya.

Surabaya, 29 Januari 2024

Yang menyatakan,

Aaron Raharjo

NRP 5203020010

LEMBAR PERNYATAAN PERSETUJUAN PUBLIKASI KARYA ILMIAH

Demi perkembangan ilmu pengetahuan, saya sebagai mahasiswa Program Studi Teknik Kimia Universitas Katolik Widya Mandala Surabaya:

Nama : Nicholas Aaron Suwarno

NRP : 5203020011

Menyetujui karya ilmiah saya:

Synthesis Of Silicon Nanoparticle With Addition Of Curcumin And Their Application For Drug Delivery

untuk dipublikasikan di internet atau media lain (Digital Library Perpustakaan Universitas Katolik Widya Mandala Surabaya) untuk kepentingan akademik sebatas sesuai dengan Undang-Undang Hak Cipta.

Demikian Pernyataan Persetujuan Publikasi Karya Ilmiah ini saya buat dengan sebenarnya.

Surabaya, 29 Januari 2024

Yang menyatakan,

Nicholas Aaron Suwarno

NRP 5203020011

LEMBAR PERNYATAAN

Dengan ini, saya tersebut diatas juga menyatakan bahwa hasil karya ilmiah dalam bentuk Skripsi ini benar merupakan hasil karya saya sendiri dan bukan merupakan hasil karya orang lain, baik sebagian maupun seluruhnya, kecuali dinyatakan dalam teks. Seandainya diketahui ada pelanggaran dan penyelewengan dari peraturan akademik Program Studi Teknik Kimia Universitas Katolik Widya Mandala Surabaya, maka saya sadar dan menerima konsekuensi bahwa Skripsi ini tidak dapat digunakan sebagai syarat untuk memperoleh gelar Sarjana Teknik.

Surabaya, 29 Januari 2024

Yang menyatakan,

Aaron Raharjo

NRP 5203020010

LEMBAR PERNYATAAN

Dengan ini, saya tersebut diatas juga menyatakan bahwa hasil karya ilmiah dalam bentuk Skripsi ini benar merupakan hasil karya saya sendiri dan bukan merupakan hasil karya orang lain, baik sebagian maupun seluruhnya, kecuali dinyatakan dalam teks. Seandainya diketahui ada pelanggaran dan penyelewengan dari peraturan akademik Program Studi Teknik Kimia Universitas Katolik Widya Mandala Surabaya, maka saya sadar dan menerima konsekuensi bahwa Skripsi ini tidak dapat digunakan sebagai syarat untuk memperoleh gelar Sarjana Teknik.

Surabaya, 29 Januari 2024

Yang menyatakan,

Nicholas Aaron Suwarno

NRP 5203020011

TABLE OF CONTENTS

FIGURE CONTENTS

TABLES CONTENTS

PREFACE

We wish to give praise and thanks towards the Good Lord for its His grace that allows us to complete our scientific research in thesis form to complete one of the requirements for fulfilling the curriculum to obtain the Bachelor of Engineering degree in the Chemical Engineering Study Program at Widya Mandala Catholic University, Surabaya. The title of the Thesis, "Synthesis of Silicon Nanoparticles with Addition of Curcumin and Their Application for Drug Delivery", with contents which includes the introduction, literature review, research methods, results & discussions, conclusions & suggestions, bibliography.

We would like to thank all the parties who has helped in the process of completing this thesis, especially towards.
Lord Jesus who continues to provide us with strength, health and the best solution for our predicament.

1. Ir. Sandy Budi Hartono, S.T., M.Phil. Ph.D., IPM. as the Supervisor who has provided a variety of inputs and has taken the time to provide guidance and direction;

2. Ir. Nathania Puspitasari, S.T., Ph.D., IPP. as Supervisor II who has provided a variety of input and has taken the time to provide guidance and direction;

3. Ir. Shella Permatasari Santoso, S.T., Ph.D., IPM., Ir. Wenny Irawaty, S.T., M.T., Ph.D., IPM., ASEAN Eng., and Dr. Ir. Suratno Lourentius, M.S., IPM. as the examining lecturer;

4. All lecturers and staff of the Chemical Engineering Study Program, Faculty of Engineering, Widya Mandala Catholic University Surabaya, who have indirectly provided assistance in completing this thesis report;

5. Our parents have provided both the material and non-material support so that the author can complete this thesis report, as well as other parties who cannot be mentioned one by one. Finally, the author hopes that this thesis report can contribute to the progress of science and technology, as well as to the readers.

This thesis that we have assembled is certainly not without its errors & weaknesses, so we hope to receive advice and criticism that would assist in improving the quality of the research and thesis in the future. It is hoped that the readers adhere to the principles of implementation, suitability, and flexibility, with reference to developments in science and technology. So, hopefully this thesis can be useful for all of us.

ABSTRACT

Silicon has become one of the main resources to be researched and modified into a much efficient products for various applications. In this research, silica particle is synthesized by the bottom-up method using sugar with the addition of curcumin as reducing agent and stabilizing agent. Silicon nanoparticles synthesized through the bottom-up method using the materials such 10 ml of Tetra-Ethyl Orthosilicate (TEOS) and 0.5 grams of glucose in 100 ml of water and irradiated using microwave for 30 minutes at 70˚C. With the addition of curcumin into the variable, glucose used are instead change into 0,45 g and 0,05 g of curcumin with the rest are the same number of materials and tested at various temperatures at 50, 70, and 90˚C by microwave irradiation for 30 minutes. The most optimal conditions were found in 90˚C with the amount particles produced up to 379,4 mg. Characterization for the silicon nanoparticles were analyzed with instruments X-Ray Diffraction (XRD) to analyze the silicon's crystallinity and particle sizes. The XRD readings shows that the sharp particle peak at 22,2327 which indicates the presence of high crystallinity silica particles along with the particle size of 0,25 nm by the Scherrer's equation. From the many adsorptions studies the drug tested in this report will be the non-steroid anti-inflammatory drug: sodium diclofenac. Kinetics for the silica particles from the combination of curcumin and glucose (SP-GC) provides a high adsorption capacity up to 73,9% and higher adsorption capacity at 50˚C up to 77,4%. The kinetic study which displays the most fitting result for the silica nanoparticles adsorption towards sodium diclofenac is the Elovich model and Bhattacharya-Venkobachar equation model. In the release study, SP-GC tends to have a burst release up to 27.2% until 30 minutes and slows down releasing up to 84% after 5 hours and lastly continues to release slowly up 96.8% at 25 hours giving the therapeutic effect for a long time.