ANALYSIS OF BHA AND BHT EXTRACTION USING MWCNTS-CS BEADS FOR CHEMICAL LEARNING RESOURCES

BACHELOR THESIS

Submitted as a requirement to achieve a bachelor degree

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FACULTY OF TARBIYA AND TEACHER TRAINING

ISLAMIC STATE UNIVERSITY OF SUNAN KALIJAGA

YOGYAKARTA

2020

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BACHELOR THESIS APPROVAL LETTER

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To
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Assalamu'alaikum. wr. wb.

After reading, checking, giving guidance, correcting and repairing, advisor committee has decided that a bachelor thesis of :

Name : Fithriyatul Fadhilah

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have been approved to be submitted to Faculty of Tarbiya and Teacher Training, Department of Chemistry Education, State Islamic University of Sunan Kalijaga Yogyakarta as one of the requirements to get Bachelor Degree (S-1) in Chemistry Education.

By those conditions, we hope the bachelor thesis can be examined as soon as possible.

Thank you.

Wassalamu'alaikum. wr. wb.

Yogyakarta, 17 September 2020
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About : Bachelor Thesis

To
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We hereby conclude our points, thank you for your attention.

Wassalamu'alaikum wr.wb.

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We hereby conclude our points, thank you for your attention.

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has conducted the bachelor thesis entitled :

Analysis of BHA and BHT Extraction Using MWCNTs-CS Beads for Chemical Learning Resources

which is my own opus or research. As long as I know, there is no opus or research written or published by another person except as guidance or citation in following opus grammar standardly.

Yogyakarta, 17 September 2020

Author,

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MOTTO

Allah will not give you a burden that you can't handle

(Q.S. Al-Baqarah : 286)

Man jadda wa jadda

If it's yours, it will be yours

(Anonim)

DEDICATION

Every challenge of work that increases your ability requires a great self-effort as well as the guidance of elders, especially those who were very close to our hearts. This research is wholeheartedly dedicated to my parents

who have given me strength when I thought of giving and own source of encouragement when a much hitch happened, who continually gave me lessons in spiritual, moral, emotional, and financial support.

To the hundreds of friends helped me unconditionally, and my alma mater, Department of Chemistry Education, State Islamic University of Sunan Kalijaga of Yogyakarta.

ACKNOWLEDGMENT

I would like to acknowledge the countless thank to the Most Merciful God who always gives his blessing in my life and there is no doubt about it. Finally, the author can complete this bachelor thesis entitled "**Analysis of BHA and BHT Extraction Using MWCNTs-CS Beads for Chemical Learning Resources**".

Sincerely thank to the Rector of UIN Sunan Kalijaga Yogyakarta, Prof. Dr. Phil. Al Makin. I would also like to thank the Dean of Faculty of Tarbiya and Teacher Training UIN Sunan Kalijaga, Dr. Hj. Sri Sumarni, M.Pd and all of faculty member for their assistance with many technical aspects of my study.

The succes of this research was quite impossible to do without any support from several institutions. I would like to thank for Karmanto, M.Sc., Department of Chemistry Education of UIN Sunan Kalijaga for golden opportunity to take the Student Mobility Program and Credit Transfer Scholarship in Prince of Songkla University so that I can carry out the project of chemistry in one semester. I also thankfull for Department of Chemistry, Faculty of Science, and Prince of Songkla University for the opportunity and financial support during my research through Thailand's Education Hub for ASEAN Countries (TEH-AC) Scholarships.

In particular, I would like to express my sincere gratitude to Asst. Prof. Dr. Chongdee Buranachai as my advisor in PSU for the opportunity and guided me to complete the project, knowledge, and giving motivation during my research. I would like to express my deepest appreciation to my advisor Muhammad Zamhari, S.Pd.Si., M.Sc who given guided, valuable comments, suggestions for completing this Bachelor Thesis. Last but not least, I am extremely grateful to my parents and my family for their support, prayers, caring me in my whole life.

I realize there are some unintended errors in writing this paper. I really allow to give some suggestion from all of the readers to improve in content in order to be made as one of the good examples for the next one. I also hope that our report will be useful for the other science educators.

Yogyakarta, 17 September 2020

Author

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ANALYSIS OF BHA AND BHT EXTRACTION USING MWCNTS-CS BEADS FOR CHEMICAL LEARNING RESOURCES

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ABSTRACT

The 2013 curriculum requires educators who are able to apply learning resources in daily life that is close to the environment. Multiwalled carbon nanotubes-chitosan (MWCNTs-Cs) composite beads combine the advantages of chitosan in forming a stable biocompatible framework and carbon nanotube that provide a good adsorption capacity towards the removal of organic and inorganic pollutant. Butylated hydroxyanisole (BHA) and butylated hydroxytoluene (BHT) as synthetic phenolic antioxidants in food that are harmful to health if excessive consumption. This study aimed to examine the potential of analysis of BHA and BHT extraction using multiwalled carbon nanotubes-chitosan beads for chemical learning resources. The analysis study was carried out using observation methods and laboratory experiments to assess the feasibility of the process. The data analysis technique used is descriptive analysis. The analysis of the distribution of school chemistry materials was carried out by using the literature study method with an analysis of qualitative descriptive data of the curriculum and syllabus analysis. The results of this study indicate that the adsorbent preparation process was carried out to develop micro solid phase extraction techniques and quantified by using GC-FID. Based on the results of the study, the curriculum analysis process of adsorbent development is very potential for learning resources.

Keywords: *Multiwalled carbon nanotubes-chitosan (MWCNTs-Cs), Butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), and learning resources.*

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CHAPTER 1

Introduction

1.1 Background

The rate of innovation in the fields of science and technology is growing rapidly nowadays, so it is very important to prepare more young talents in the jobs of science and other jobs that are still related to the scientific dimension (OECD, 2019). That matter is proven by the discovery of many products and applications around us based on nanotechnologies, such as anti-bacterial paint, mobile phones with OLED display, toothpaste, nano-spray, adsorbent, etc. Nanotechnology covers a wide variety of fields, such as chemistry, physics, engineering, biology, drugs, and others (Aji, 2016). The knowledge about nanotechnology will continue to evolve in the future, then learning about the context of nanotechnology is also important to be implemented in schools, especially Senior High schools (Lee, 2005).

Multiwalled carbon nanotubes (MWCNTs) are a kind of carbon based on nanotechnology called carbon nanotubes (CNTs) that can be used as adsorbent materials. MWCNTs are the most widely used because of their hydrophobic property, adsorption capacity, and large surface area (Makkliang, 2015). Carbon nanotubes have proven to possess a good adsorption capacity towards the removal of organic and inorganic pollutants because of the hollow and layered structures with nanoscale of their structures (Osler, 2017). However, the hydrophobic property of CNTs are difficult to disperse in hydrophilic fluid without surface modification of CNTs (Kharissova, 2013). Chitosan (Cs) modification has proven to be an effective method for improving the dispersion stability of CNTs. Recent studies have shown that modification of CNTs with polymers leads to enhance their adsorption capacity. Shawky *et al* (2011) prepared an MWCNTs-Cs nanocomposite to remove mercury from wastewater. In addition, it can also be used in the biomedical field as a biosensor for bilirubin adsorption of hemoperfusion (Zong, 2016).

Chitosan is a common polymer that has been used for the modification of CNTs (Murthy, 2013; Osler, 2007; Zarate-Trivino, 2015; Chahatary, 2013). Chitosan is a natural biopolymer from chitin, which is the result of utilizing waste in coastal areas.

Chitosan has a good sorption capability by chemical or physical adsorption due to the presence of various functional groups. One of all is the presence of amine groups in chitosan promotes the formation of hydrogen bonding between the functionalized nanotubes and chitosan, consequently an improvement of the CNT dispersibility (Zarate-Triviño, 2015). Besides, chitosan can change the smooth MWCNTs surface became rough until this nanocomposite had a distinctly larger diameter than did the MWCNTs. Furthermore, these coated macromolecular layers can reduce the strong interaction among nanotubes, prevent their aggregation, and increase the number of adsorption sites for target analytes in the sample of the product (Shao, 2011).

Generally, people used cosmetic products to clean their skin and make it more beautiful. However, they decide to use them without reading the label to identify the ingredients and other information (Amasa, 2012). Besides, most cosmetic products contain hazardous chemicals, such as BHA (butylated hydroxyanisole) and BHT (butylated hydroxytoluene). BHA and BHT are closely related synthetic chemicals used as preservatives in moisturizers and lipsticks. The International Agency for Research on Cancer has classified BHA as a possible human carcinogen. Furthermore, BHT may act as a tumor promoter in certain situations. Many research proofed that high doses of BHT can cause mimic estrogen, the main female sex hormone, and prevent the expression of male sex hormones, which results in adverse reproductive effects (Schrader, 2000).

Not only in cosmetics, BHA and BHT compounds are also used in food production. Cereals, fast food, butter, and pet food are the food that is usually processed with BHA and BHT. These antioxidants are used for food preservation and prevent lipid oxidation in food products (Ghatak, 2016). By the U.S. Food and Drug Administration (FDA), the permissible concentration of BHA and BHT are 0.02% (w/w). Excessive consumption of BHA and BHT can cause a negative impact on the human body. The development of analytical methods for the determination of BHA and BHT is needed to reduce health risks from potential exposure (Siritham, 2018). Various analytical methods reported the determination of BHA and BHT. One of the methods used in this study is a micro solid phase extraction method with chitosan-multiwalled carbon nanotubes as an adsorbent to take the target analytes in the spiked sample and then followed by gas chromatography injection. Gas chromatography (GC) with flame ionization detector (FID) is an effective method because it allows us to determine

nanogram amounts of a complex matrix simultaneously (González, 1998). An easy way to find out the content of BHA and BHT in a product is by reading the compositions or ingredients written on the product label. However, awareness of consumer to read and select the products before used are very low (Rostikawati, 2016).

Reading the information on product labels is a form of scientific literacy. Education has an important role in developing the skills, abilities, and knowledge needed by students to be successful in facing globalization and environmental challenges that occur in the 21st century (Saavedra, 2012). One of the challenges in the 21st century is the development of technology in the field of nanotechnology. Nanotechnology is regarded worldwide now as the technology of the 21st century and hence there is an imperative need to educate future generation scientists and engineers about this emerging field (Meyyappan, 2004). Nanomaterials are additional sources of new information that can be applied as teaching materials. Students need to be equipped with adequate knowledge by paying attention to the application of the knowledge they have acquired during the learning process to be able to compete in the global world. But in reality, students in Indonesia still gets low ranking compared to students from other countries (Aji, 2016).

Based on the results of Ekohariadi's research (2009), the low ability of student's scientific literacy is influenced by several factors, such as student's attitudes towards science, teaching and learning activities in the classroom, and the amount of time spent studying science. One of the important components in learning activities in the classroom, which lies in the content component or material that will be taught by students. The subject matter is usually described in the learning resources used in schools so that the majority of teachers tend to use material directly from textbooks during the learning process (Sanjaya, 2008). The lack of learning resources in the learning component is also one of the causes of the decline in student literacy levels. Based on the description above, it is necessary to conduct the research by utilizing nanomaterials as adsorption materials which can improve the new knowledge for students about nanotechnology. This research discusses adsorbents development from MWCNT-CS for BHA & BHT extraction as an alternative source of learning chemistry.

1.2 Problem Formulation

Based on the background of the research, some problems can be formulated, such as :

a. How to develop MWCNTs-Cs beads sorbent for BHA and BHT extraction?

b. How to analyze the process of adsorbent development for chemical learning resources?

1.3 Scopes

This research is limited to :

a. Develop MWCNTs-Cs beads sorbent for BHA and BHT extraction

b. Analyze the adsorbent development process for learning resources based on curriculum and syllabus chemistry learning

1.4 Research Objectives

This research aims to :

a. Study the process of MWCNTs-Cs beads development for BHA and BHT extraction.

b. Examine the potential of development of MWCNTs-Cs beads sorbents for BHA and BHT extraction for learning resources.

1.5 Expected Benefits

Based on the research objectives to be achieved, this research can obtain only BHA and BHT as the target analytes and expected to be used as learning resources.

CHAPTER 5

Summary

5.1 Conclusion

Based on the results of research and analysis that has been carried out obtained several conclusions as follows :

a. The process of adsorbent development was done by combining MWCNTs and chitosan to form the beads for BHA and BHT extraction. This combination produced a high absorption capacity.
b. Analysis of the adsorbent development is potential as learning resources by reviewing aspects of the curriculum.

5.2 Suggestion

Based on the research results and the conclusions described above, the suggestions that can be given is that the potential of the adsorbent development process from MWCNTs-CS as an alternative learning resource can still be developed by reviewing other chemical materials.

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