Series: Advances in Engineering Research

Proceedings of the International Joint Conference on Science and Engineering (IJCSE 2020)

< >

International Joint Conference on Science and Technology (IJCSE) 2020 was successfully held on October 3, 2020 at Universitas Negeri Surabaya, Surabaya, Indonesia. This conference features three international conferences organized by Universitas Negeri Surabaya including the 3rd International Conference on Vocation Education and Electrical Engineering (ICVEE), the 4th Mathematics, Informatics, Science and Education International Conference (MISEIC), and the 2nd International Conference on Research and Academic Community Services (ICRACOS). The joint conference was completely conducted online

using Zoom as a platform. This event was also broadcasted live via an official YouTube channel of Universitas Negeri Surabaya. Through this scientific forum, Universitas Negeri Surabaya invited scientists, education experts, practitioners, and students all over the world to share and discuss their ideas, research findings, and issues about relevant topics, as well as to build scientific networks. This event shows the the commitment of Universitas Negeri Surabaya in supporting research activities of the community.

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Proceedings of the International Joint Conference on Science and Engineering (IJCSE 2020)

Preface International Joint Conference on Science and Technology (IJCSE) 2020 was successfully held on October 3, 2020 at Universitas Negeri Surabaya, Surabaya, Indonesia. This conference features three international conferences organized by Universitas Negeri Surabaya including the 3rd International Conference on Vocation Education and Electrical Engineering (ICVEE), the 4th Mathematics, Informatics, Science and Education International Conference (MISEIC), and the 2nd International Conference on Research and Academic Community Services (ICRACOS). The joint conference was completely conducted online using Zoom as a platform. This event was also broadcasted live via an official YouTube channel of Universitas Negeri Surabaya. Through this scientific forum, Universitas Negeri Surabaya invited scientists, education

experts, practitioners, and students all over the world to share and discuss their ideas, research findings, and issues about relevant topics, as well as to build scientific networks. This event shows the the commitment of Universitas Negeri Surabaya in supporting research activities of the community.

A total of 330 papers were submitted to IJCSE 2020. The papers have various topics including electrical, electronics, telecommunication, instrumentation and control, informatics engineering, pure and applied mathematics, science and technology, computer science, and education in mathematics, science, computer science, and engineering. After subsequent reviews on the content, format, and language, 77 papers were selected to be published in this proceeding. The authors of the selected papers came from three different countries, namely Pakistan, Taiwan, and Indonesia. The rest of the papers were selected to be published elsewhere or rejected.

We would like express our best gratitude to keynote and invited speakers for their invaluable contribution and worthwhile ideas shared in the conference. We would also thank to all authors for their contribution to this proceeding as well as our reviewers for their constructive comments and suggestions to improve the quality of the presented papers. The organizing and editorial committee of IJCSE 2020 hopes that the presented papers can serve a reference for the relevant topics and you can enjoy reading this volume of the proceeding.

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Proceedings of the International Joint Conference on Science and Engineering (IJCSE 2020)

77 articles

Proceedings Article

Design and Implementation of Different Types of Smart Dustbins System in Smart Campus Environments

Arifin N. Asyikin, Aulia A. Syahidi, Subandi

In Indonesia, waste is still a very serious problem. Garbage causes bad odors, air pollution, disease, and even flooding. Whenever and wherever each individual produces waste, waste can come from households and industries which have various types and forms. Public awareness to dispose of trash in the...

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Early Warning System for Flood Disasters Using the Internet of Things

Yuyun, Hamka Zulfaesa, Latief Arda Abdul

Floods are one of the most frequently occurring natural disasters in Indonesia. It is therefore of special concern to reduce the risk of flood fatalities and other damage. The purpose of this study is to design a flood early warning system based on the Internet of Things (IoT). In this work, we use an...

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Deformation of 3D Object of Human Body Internal Organs Using Finite Element Method Approach Accelerated by GPU

Cakra Adipura Wicaksana, Wahyuni Martiningsih

Few years ago, there are some research or publication about 3D simulation especially virtual surgery that still continuous growing, that is 3D deformable

object. The 3D deformable object resembles or mimic some object. The purpose of the research is to continue or add previous research especially in...

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New Smart Virtual Content for Hanzi Characters in Mandarin Laboratories

S Sunarti, Tiksno Widyatmoko, Lukluk Ul Muyassaroh, Dewi Kartika Ardiyani, Edy Hidayat, Maria Mintowati

Industrial technology is developing rapidly accompanied by learning technology, especially in some virtual applications. Virtual Laboratory is one of the virtual learning applications that is currently being developed in the 4.0 industrial revolution. The use of virtual laboratories in Revolution 4.0...

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Design of Sea Wave Power Hybrid Power Generation Through Utilization of Wave and Wind Energy as Renewable Electric Energy Sources for Leading, Outermost and Disadvantaged Areas

Masus Subekti, Parjiman, Nur Hanifah

This study conducts the design of sea wave hybrid power plants by combining wave energy with wind energy. Vertical energy of ocean waves is converted into pressurized water energy to rotate turbines connected to direct current generators, while wind energy uses wind turbines connected to direct

current...

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Automatic Control Based on Voice Commands and Arduino

Alfiantin Noor Azhiimah, Khusnul Khotimah, Meini Sondang Sumbawati, Agus Budi Santosa

Control that is widely used today was control by voice commands. This study aimed to determine the application of voice and Arduino-based control automation which had been developed from 2014-2020 based on 25 journals that would be studied. Journal assessments were carried out by taking into account...

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The Relationship Problem Solving Skills to Critical Thinking Skills in Aircraft Maintenance: A Conceptual Study

Bayu Dwi Cahyo, Luthfiyah Nurlaela, Meini Sondang Sumbawati

Aircraft safety and security is a major factor in aviation. Therefore, ensure the aircraft maintenance and repairs carried out correctly, effectively, and efficiency needed to support these factors. This study aims to explain the importance of an aircraft mechanic to have critical thinking skills and...

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Application of Retrieval Information on Android-Based Online Music Course Application

Albertus Dera Andika, Farid Baskoro, Eppy Yundra

This research was conducted to develop a basic design of an android-based online music course application, and to implement an Information Retrieval system to search and find data located on the online music course application. This application was designed using Android Studio software, and thus can...

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Analysis of Online Learning Implementation in Undergraduate Students of Building Construction Education in the Pandemic COVID-19

Kusnan, Suparji, Gde Agus Yudha Prawira Adistana, Muhammad Imaduddin, Wahyu Dwi Mulyono, Heri Suryaman

Surabaya State University (Unesa) as an educational actor limits physical distance by implementing online learning activities to break the spread of COVID-19. Online learning is usually carried out at a maximum of three meetings and combined with face-to-face. However, in the even semester 2019/2020...

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Effectiveness of Online Learning of Construction Equipment Courses During the COVID-19 Pandemic

Hasan Dani, Puguh Novi Prasetyono, Suryanto HS Mas, Danayanti Azmi Dewi, Nusantara, Amanda Ristriana Pattisinai, Feriza Nadiar

The whole society is affected by the pandemic of coronavirus or COVID-19, even in Indonesia's education sector. One of the government's policies to constrict the spread of COVID-19 is by physical distancing. The education sector's impact is which must be using an online learning platform, which is also...

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Automatic Hand Sanitizer Container to Prevent the Spread of Corona Virus Disease

Puput Wanarti Rusimamto, Nurhayati Nurhayati, Eppy Yundra, Reza Rahmadian, Arif Widodo, Much Ade Dermawan

COVID pandemic has influenced human life in various sectors. Various attempts were made to reduce the virus transferring by work from home, social distancing, and also including hand hygiene. So far, most of the available hand sanitizers do not operate automatically. This article aims to make an automatic...

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Analysis of the Use of Virtual Meeting in the Implementation

of Proposal/Thesis Examination During Covid-19 Pandemic

Dodik Arwin Dermawan, Rindu Puspita Wibawa, Martini D E Susanti

In the early 2020s, Indonesia was shocked by the Coronavirus Disease (Covid-19) outbreak which struck almost all parts of the world. The Indonesian government spontaneously implemented a policy of learning from home, working from home, and worship at home. All face-to-face activities are diverted online....

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Curriculum Development is Conducted to Improve Competencies of Air Transportation Managemental Study Program for Cadets of Aviation Polytechnique Surabaya

Ariyono Setiawan, Luthfiyah Nurlaela, Munoto, I Gusti Putu Asto Buditjahjanto, Bambang Suprianto, Yuyun Suprapto, I Gede Susrama Mas Diyasa, Dama Yanti Hilda

The purpose of this study is to provide an analysis of the effect of curriculum development on air transportation management competencies by contributing to cadets at Surabaya Aviation Polytechnic. The design of this study uses quantitative research methods that emphasize numerical data analysis such...

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Implementation of Google Classroom-Based Learning

Management System on the Subject Digital Signal Processing and Propagation Antennas as One of the Effective Learning Media in the Middle of Pandemic COVD-19

Farid Baskoro, Miftahur Rohman, Fendi Achmad

Effective learning is quality learning in relation to the effectiveness of the learning process interaction itself to achieve the expected goals. This study aims to determine the effectiveness of lectures in the middle of the Covid 19 pandemic, where learning by face-to-face method is vulnerable to the...

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Diverse Forms of V-learning Students' Acceptability During the Pandemic Covid-19

Ita Fatkhur Romadhoni, Dwi Kiristiastuti, Luthfiyah Nurlaela, Any Sutiadiningsih, Nugrahani Astuti, Lucia Tri Pangesthi, Sri Handajani, Niken Purwidiani, Suhartiningsih, Asrul Bahar

Covid-19 pandemic encourages online learning to prevent wider spread. Various types of learning platforms were implemented, but there needs to be an evaluation of student acceptance of the platforms. This study aims to assess the impact of v-learning on student acceptance during a pandemic. The v-learning...

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Schoology and Slido: The Perfect Platform Combination for

Distance Learning During the Covid-19 Pandemic

Vania Zulfa, Prastiti Laras

The Covid-19 pandemic that occurred worldwide caused a social policy for all citizens to break this Covid-19 chain. However, this policy impacts all aspects of life, including the field of education in Indonesia. The government decided to move the learning process from face-to-face learning to online...

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The Design and Implementation of Web Crawler Distributed News Domain Detection System

I Gusti Lanang Putra Eka Prismana, Dedy Rahman Prehanto, I Kadek Dwi Nuryana

Spreading data or info through internet to increase the chances of success in a business through analysis of market trends is very common today. Web Crawl is one important thing, so that the incomplete data will not be appeared, and the data received is the most recent data. Exploration Web crawler technology...

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The Implementation of Project Based Learning Model Towards the Learning Outcome of Subject Wood Structure I

Tuti Iriani, M. Agphin Ramadhan, Nurul Anisa

This study aims to compare student learning outcomes using two different

tasks in the Project Based Learning (PBL) learning model in a wooden structure course 1. The research method used is Quasi Experiment with pretest-posttest design conducted in 4 meetings. The subjects of this study were 36 UNJ Civil...

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Blood Donor Matching Information Systems and Determining Tools for Blood Cluster and Human Rhesus Based on IoT

Aditya Chandra Hermawan, Ita Mubarokah, Farid Baskoro

Until now, the process of testing human blood groups is still done manually by mixing blood and antisera. Testing is done by observing the agglutination reaction of blood samples. Then the testing process takes a long time, without storing donor data. this is less effective if the blood is tested a lot...

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Home Monitoring and Control Using Smartphone and Speech Processing

Mochamad Mobed Bachtiar, Bima Sena Bayu Dewantara, Dwi Prastyo

Monitoring and control of home electronic equipment in general is still done manually, this is less efficient if we are not at home but want to monitor the condition of the electronic equipment. With the remote control using a smartphone can be a solution to simplify the control system and monitoring...

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Design and Development of Chatbot Using Dialog Flowin Surya Sembada PDAM Surabaya City

Ariyono Setiawan, Yuyun Suprapto, I Gede Susrama Mas Diyasa, Chilyatun Nisa, Maulana Idris, Feronika Nur Maghfiro, Yuri Setiawan, Dama Yanti Hilda

Surya Sembada City Surabaya Water Supply Company is a company that provides clean water production. In its service, many complaints are obtained from customers. During this time complaints are carried out manually, of course, less effective. With the development of information technology, the chatbot...

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The Development of the Sub Instruments of Digital Literacy on the Subjects of Electronics Circuit in Vocational School

Nur Kholis

In this study has the objective to develop sub instruments digital literacy of subjects of electronics circuit in vocational school students. The resulting sub instrument is used to measure the competency of students with the three domains such as affective, cognitive, and psychomotor. This study uses...

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The Effect of Project-Based Learning Model (PjBL) and Direct Instruction (DI) on Result Learning of the Basics Building Construction and Survey Engineering From Student Learning Motivation

Tri Rijanto, Kusnan Evany Iqrammah

This study aims to: (1) obtain information on differences in result learning, students who use the project based learning model and the direct instruction model in DKTB, (2) answer the differences in result learning of participants students who have high motivation to learn, and students who have low...

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The Effects of Self-Efficacy on the Competency of Cadets in Aviation Polytechnic of Surabaya

Ariyono Setiawan, Munoto, Eko Hariadi, Luthfiyah Nurlalela, Yuyun Suprapto, I Gede Susrama Mas Diyasa, Dama Yanti Hilda

This research purposes to analyze the effects of self-efficacy on the Competency of Cadets in Surabaya Aviation Polytechnic. This study uses the quantitative approach. The researcher decided to use a polytechnic institution located in Surabaya namely Surabaya Aviation Polytechnic which has competence...

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Design Automatic Hand Sanitizer Microcontroller Based using

Arduino Nano and Ultrasonic Sensors as an Effort to Prevent the Spread of Covid-19

Meini Sondang Sumbawati, H Aditya Chandra, Tri Wrahatnolo, Ibrohim, L. Endah Cahya Ningrum, Khusnul Khotimah, Ali Nur Fathoni

The government through the Ministry of Education and Culture (Kemendikbud) has made a decision to suspend teaching and learning activities in schools. The learning process that starts face to face directly in the classroom turns into distance learning /brave. However, the government decided to reopen...

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Work Analysis of Constant Current Regulator BF 1200 With Current Loop and Gauss Jordan Method as Learning Media for Cadets

Hartono, I.S. Rifdian, H. Slamet

Runway lights at the airport are 1-5 km in length, which always connected in series so the pilots look the same bright lights from the beginning of runway until the end of runway. The same bright lights will be on if runway lights connected in series and every lamp obtains the same current flow. The...

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Technology Compatibility Factors in the Implementation of the Ovo Digital Payment Application

Rahadian Bisma, Yuanita Puspita, Endang Sulistiyani

Digital developments are increasingly reaching the financial world, leading to a variety of new payment service innovations, one of which is OVO. The emergence of digital payment technology is not necessarily in accordance with the habits of users in using digital payments using mobile devices. Therefore,...

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Comparison of Machine Learning Algorithms for Autism Spectrum Disorder Classification

Erina S. Dewi, Elly M. Imah

Autism Spectrum Disorder is one of the fastest-growing neurodevelopmental disorders in the world. These neurodevelopmental disorders often attack children, affecting social development and behavior. Effective early detection of ASD is needed to reduce the risk of ASD in children. This study classified...

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Worksheet of Entrepreneurship Students to Train Ecopreneurship Characters

Tutut Nurita, An Nuril M. Fauziah, Siti N. Hidayati

Entrepreneurship is one of the courses in science education study programs that examine the development of products in the form of finished goods, services, learning resources and learning media for science and services that

begin from analyzing market needs, testing the feasibility of products, producing...

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Training Science Literacy Skills Through Article Writing on Local Wisdom in East Java

Firas Khaleyla, Dwi Anggorowati, Pramita Yakub, Fida Rachmadiarti

Science literacy is one of main skills students should have in the 21st century. One method to train science literacy is by writing scientific article. The purpose of the study was to improve science literacy of students through scientific writing in exploration of local wisdom in East Java on Conservation...

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Contribution of Housewives to Increase the Immunity of Family Members During Covid-19 Pandemic

Dwi A. Rahayu, Reni Ambarwati, Rinie P. Puspitawati, Isnawati, Nur Kuswanti

Currently we are battling with the outbreak of a new type of infectious disease known as coronavirus disease 2019 (COVID-19). This virus causes severe acute respiratory coronavirus 2 syndrome (SARS-CoV-2). The spread of SARS-CoV-2 from human to human becomes the main transmission source; hence the rate...

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The Effect of Chemiclife Media on Chemical Bond Material Based on Completeness and Student Learning Outcomes

Fawzia Aulia Praptiwi, Rivaldi Dwi Kurniawan, Rusly Hidayah

The aim of the research is to obtain the validity of Chemic-life media on chemical bond material. This research use 4D model (Define, Design, Develop and Disseminate) modified by Ibrahim, for this research the stages of dissemination have not been carried out. Chemic-life Media was tested on 12 students...

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Biology Online Classes During Covid-19 Pandemic in Indonesia

Eva Kristinawati Putri, Wisanti, Reni Ambarwati, Dwi Anggorowati Rahayu, Firas Khaleyla

Indonesia reduces the spreading of COVID-19 infection by physical distancing. There is no argue that this policy affects all aspects, including education. Online learning has replaced the ordinary procedure of learning, whether we are ready or not. Organizing an online learning becomes an evitable challenge,...

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Description of Knowledge, Attitude, and Consumption Behavior of Supplements Drink for the Elderly to Improve the Immunity Systems

Tukiran, Mauren Gita Miranti

At the end of March, Indonesia was shaken by a plague that attacks the respiratory system resulting in death. The virus is known as Covid-19 from Wuhan, China. Until May, cases of the spread of Covid-19 have increased in Indonesia with a mortality rate of 6.61%. Some areas have been identified as red...

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Teaching Strategy in Effective Science Learning Based on Classroom Discourse and Empirical Research

Taufik Muhtarom

The purpose of this article is to explain the results of a study of effective teaching strategies in learning science in the classroom based on classroom discourse and relevant research. The method used is the literature review by collecting and reviewing the results of scientific studies about learning...

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The Development of Optical Module Based on Science Process Skills

Wahyudi, Nurhayati, Dwi F. Saputri

The optical concept is an important concept that must be mastered by pre-service teacher. The concept is not only obtained theoretically but also through scientific process skills. This requires an optical module based on process skills to assist students in mastering optical concepts. This study aims...

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Improvement of Self-Efficacy and Student Learning Outcomes on Acid Base Material Using 9E Learning Cycle Model

Tukiran, Fitroh A. Mubarokah, Harun Nasrudin

The aim of the research was to find the effectiveness of developed teaching materials to increase students' self-efficacy and learning outcomes using 9E learning cycle on acid base matter. The teaching materials was applied in SMAN 7 Surabaya toward 36 students of grade XI-6. This research used 4D model...

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Students' Reasoning With Logical Mathematical and Visual Spatial Intelligence in Geometry Problem Solving

Jafar A. Aziz, Dwi Juniati, Pradnyo Wijayanti

Reasoning in solving geometry problem used by students to recognize shapes, identify properties and analyze relationships between geometric objects. This study aimed at investigating the students' reasoning in geometric problem solving with predominance of different intelligence types. This research...

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Tomini Bay as a Source of Chemistry Learning

Sandy A. Kusumah, Sri Atun, Hari Sutrisno

This study aims to identify the potential of Tomini Bay resources that can be utilized as a source of chemistry learning. This is a qualitative research using primary data and secondary data. Data collection were conducted through the combination of field research and literature studies. All data were...

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The Effect of OPPEMEI Model on Students' Creative Thinking Skill and Cognitive Learning Achievement

I Gusti Ayu Tri Agustiana, Rudiana Agustini, Muslimin Ibrahim, I Nyoman Tika

The study was conducted to find out the effect of OPPEMEI model on creative thinking skill and cognitive learning achievement and their correlation in the third semester students of the Elementary School Education Department, Faculty of Education Science of Universitas Pendidikan Ganesha. This study...

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Developing Android-Based Comic for Learning Quadrilateral to Improve Seventh-graders' Geometric Thinking

Dany Samsurya Kurniawan, Mega Teguh Budiarto, Atik Wintarti

This research was conducted to develop android-based comic learning media and describe the increase in geometric thinking skills after learning to use android-based comic learning media. This comic development process uses the Gall and Borg development model. The stages were needs analysis; product planning...

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Applying of Search, Solve, Create, and Share (SSCS) Learning Model to Improve Students' Mathematical Quantitative Reasoning

Sugiarti, Mega T. Budiarto, Tatag Y.E. Siswono

The purpose of this study was to determine whether the application of the search, solve, create, and share (SSCS) learning model can improve students' quantitative mathematical reasoning. This study was a pre-experimental research with one group pretest-posttest design. The population in this study were...

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Vandemicum of Nanogold and Nanosilver to Improve Quality Life of Cancer Patients

Titik Taufikurohmah, Najlatun Naqiyah, Sumarlik, Muhammad F. Ilhamuddin, Ananto Sidohutomo

The purpose of this study was to examine the success of the nanogold and nanosilver drug vandemicum in improving the quality of life of cancer patients. Vandemicum can be interpreted as a guide to treatment in the health sector. The quality of life of cancer patients is influenced by the individual's...

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3D Blender Animation Media as Self-Assessment Implementation in Corrosion Engineering Course

Aisyah E. Palupi, Arya M. Sakti, Bellina Yunitasari, Suparji, Setya C. Wibawa

In the midst of an increasingly widespread coronavirus (COVID-19), online lectures are a solution to keep running teaching and learning activities instead of class meetings. The purpose of this study was to create learning media using a 3D blender animation media and a self-assessment platform as well...

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Production of Herbal Mixes (Jamulacang) Instant as an Effort to Increase Immune to Prevent Covid 19

Any Sutiadiningsih, Niken Purwidiani, Agung Prijo Budijono, Yunus, Veni Indrawati, Meda Wahini

This program of activities was carried out in an effort to help prevent the

spread of the epidemic and prevent the transmission of the Covid-19 virus. This prevention effort was carried out by the PKM implementation team by making instant herbal mix herbs made from raw ginger, ginger, secang, cardamom,...

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Self Concept in Social Behavior Based Android to Boost Family's Immunity in Preventing Covid-19 Spread

Ari Wahyudi, Sugeng Harianto, Agus M Fauzi, Refti H Listyani, Farid Pribadi

The purpose of this study is to develop self concept in social behavior based Android to boost the immunity of family members as the prevention of Covid-19 spread. The developments are (a) self-concept in physical terms including family, school, and children's play environment, (b) self-concept in social...

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Effect of Cross Section Dimensions to Stiffness and Deflection on Reinforced Concrete Beams

Berkat Cipta Zega, Hakas Prayuda, Dimas Putra Mulia

The strength of reinforced concrete can be planned in various ways, either doing manual calculations, compressive strength testing, or testing using applications. Therefore, an accurate result approach can be obtained, one of which is by using the Response-2000 application program. This research aims...

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Issues on Academic Writing Consultation: Alternative Online Platforms for Graduate Students

Eppy Yundra, Utama Alan Deta, Yetty Septiani Mustar, Muhammad Abdul Ghofur, Sueb

During the global pandemic, academics have experienced a challenging transition period that affects the learning process, leading to disruption in adjusting the existing learning modes. More specific problems faced by graduate students upon the research consultation and writing scientific reports from...

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Sugar and Cooking Oil Consumption in Surabaya

Amalia Ruhana, Choirul Anna Nur Afifah

The consumption patterns of urban communities has been shifted and leading to fast foods. Fast foods contained high sugar and fat so they tasted delicious and became favorite for many people. Excessive consumption of sugar and fat might lead to overweight and obesity, which increased the risk of coronary...

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Fruktooligosaccharides of Yacon Tubers (*Smallanthus sonchifolia*) on Variation in Height of Planting Area, Harvest Time and Storage with Natural Inhibitors

Leny Yuanita, Wahyu Budi Sabtiawan, Prima Retno Wikandari, Dhita Ayu Permata Sari

Yacon (Smallanthus sonchifolia) was a potential plant to be developed: its tuberswere as antidiabetic sweetener, anti hypercholesterolemic, contains antioxidant polyphenols especially chlorogenic acid and cancer prevention; the leaves contain high protein and as an anti-fungal. The main bioactive compounds...

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Designing and Developing Electric Squeezer Machine for Mangrove Syrup Production

Lila Yuwana, Suyatno, Susilo Indrawati, Alfi Tranggono Agus Salim, Sudarsono, Niniet Indah Arvitrida

Generally, syrup production requires press machine to minimise time production. This paper reports detail design and construction of mangrove fruit press for syrup production purpose. The previous survey of syrup production in Wonorejo Rungkut Surabaya indicated that time production took a long duration...

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Internet of Things-Based Monitoring System of Patients Using W1209 Digital Thermostat and Pulse Sensor

Lilik Anifah, Puput Wanarti Rusimamto, Nurhayati, Subuh Isnur Haryudo, Warju, Haryanto

Some diseases are transmitted through doplets or touch and contact with patients. Transmission can also occur with objects that are often touched by patients. This contact is impossible to avoid for medical personnel who care for patients, therefore the effort made is to minimize contact with patients...

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The Effect of the Addition of *Turmeric* and *Temulawak* on the Hedonic Value of Starfruit Syrup

Luthfiyah Nurlaela, Eppy Yundra, Ita F. Romadhoni

One of the efforts that can be made to prevent the spread of Covid-19 is to increase the body's immunity, especially for residents who are affected. The purpose of this study was to determine the results of the starfruit syrup made with the addition of the herbal ingredients of turmeric (Curcuma longa)...

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Nutridrink TOGA as an Alternative to Maintain Body Immunity Against Covid

Aghus Sifaq, Ananda P. Bakti, Mauren G. Miranti, Siti S. Wulandari, Retno M. Dewi

Family medicinal plants have played an important role since ancient times in maintaining health, maintaining stamina and treating diseases. Therefore, the TOGA plant has become part of local wisdom in the life of Indonesian society until now. This study aims to determine the level of acceptance of family...

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Development of Codeigniter-Based Tracer Study Application

Mohammad Syahidul Haq, Vicky D. Wicaksono, Kartika R. Adhe, Ahmad A. Zawawi

Tracer study provides important information on the relationship between higher education and professional work, it assesses the relevance of higher education by comparing aim of learning and data of alumnae, it informs stakeholders about the information of alumnae, and the most importantly, The Tracer...

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Coconut Milk as an Alternative of Cosmetic Material for Thinning Hyperpigmentation on the Face Skin

Nia Kusstianti, Sri Usodoningtyas

Coconut milk is a milk-white liquid and comes from grated coconut meat

which is moistened and then squeezed and filtered. Coconut milk can be used to soften the skin, and can eliminate black spots on the face, because it is rich in natural fatty acids and contains antiseptics. Hyperpigmentation is a...

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UNESA Physical Test – An Alternative Way to Measure Fitness Using Step and Chair-Based Test

Oce Wiriawan, Donny A. Kusuma, Nurhasan, Abdul Hafidz, Arifah Kaharina

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Rifqi Firmansyah, Muhammad Badruddin A. Mustofa, Muhammad Eko Prasetya, Pressa P. Surya Saputra

The progress of space technology in various countries is increasing rapidly. In Indonesia, there is a Non-Government Organization Ministry of Indonesia who carries out government duties in the field of aerospace research, development and utilization. The institute is known as LAPAN (National Institute...

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Rudiana Agustini, Nuniek Herdyastuti

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Meini Sondang Sumbawati, Munoto, Ismet Basuki, Euis Ismayati, Tri Rijanto

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Sri Dwiyanti, Siti Sulandjari, Dindy S. Megasari, Nia Kusstanti, Mutimmatul Faidah, Sri Usodoningtyas

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Novi Sukma Drastiawati, R. Soekrisno

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Suryanti, HP Paksi, VD Wicaksono, W Widodo, I Sucahyo

The Government of Indonesia has issued rules on how to avoid covid-19 transmission, namely through various means including social distancing (SD)

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The Effectiveness of the Addition of EM4 and Molasses in Increasing Levels of N, P and K in Environmentally Friendly Liquid Fertilizers Made From Banana Pseudostem

Susilo Indrawati, Diky Anggoro, Heru Sukamto, Nurrisma Puspitasari, Sungkono, B. Indarto, Suyatno, Gontjang Prajitno, Niniet I. Arvitrida, Lila Yuwana

According to the statistics agency in 2017, banana production had the largest portion in Indonesia. Furthermore, banana production increased from 6.28 million tons to 7.04 million tons. Consequently, this tremendous production lead to an increasing of pseudostem waste. Through a research-based community...

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Muhammad Saud, Marwa Aymen, Shah Faisal, Meliana Handayani, Muhammad Anns

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P. Puspitaningayu, N. Funabiki, R.W. Sudibyo, H. Briantoro, Nurhayati, T. Wrahatnolo

The promising purpose of wireless body area networks have brought a new paradigm in many aspects such as healthcare, lifestyle, and entertainment. One of the most popular sensors is the accelerometer which meant to monitor movements of its user. With the help of MEMS technology, an integrated chip which...

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Alifah, Titin Siswantining, Devvi Sarwinda, Alhadi Bustamam

Diabetic retinopathy, which is one of the complications in diabetes, is an eye disease that can lead to blindness. The damage happens in retina as result of a long period of diabetic mellitus. People usually do research using image data in diabetic patients. This paper presents the idea of using feature...

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Humaidillah Kurniadi Wardana, Imamatul Ummah, Lina Arifah Fitriyah

Diabetes Mellitus (DM) is a frightening type of disease because DM causes complications for the patients if it is not treated quickly. From year to year DM in Indonesia undergone a significant increase and was ranked 6th in the world. In this study, a fuzzy logic system was created for the early diagnosis...

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Mohammad Munib Rosadi, Retno Eka Pramitasari, Ali Hasbi Ramadani

Based on observations, there were some students who felt sleepy or were not interested in the materials being taught, even though the presenter had prepared good presentation and explained it coherently, especially in engineering subjects. Therefore, tools in the form of learning media are needed. This...

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Rifqi Firmansyah, Muhamad Yusuf, Pressa P. Surya Saputra, Muhammad Eko Prasetyo, Fahmi Mahardi Mochtar, Fandik Agung Kurniawan

Water heaters are currently needed especially in the industrial world. This heater is used to maintain the temperature of the liquid so that the products produced are appropriate with standard specifications. Along with technological developments in recent years, circulating water heaters still use conventional...

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Juan Ardi Kusuma, Firman Yasa Utama

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Maria Paristiowati, Zulmanelis, U Dessy Indira, K Novita Lutfi

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Anita Qoiriah, Rina Harimurti, Andi Iwan Nurhidayat, Asmunin

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Ichdar Domu, Navel Oktaviandy Mangelep

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The Study of Amylase's Reaction Kinetics From Soybean Sprouts (*Glycine max L.*) in Hydrolyzing Starch

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ABSTRACT
Amylase is an enzyme that has a role in hydrolyzing starch. This enzyme can be obtained from germinated seeds, one of them is soybean seed sprouts. The research aimed at studying the reaction kinetics in hydrolyzing the substrate, which is called starch, has been done. The research was conducted in three stages: 1) preparation of amylase which included germination of soybean seeds, isolation of amylase, purification with ammonium sulfate 35% (w/v); 2) optimization of amylase activity (germination time, enzyme concentration, temperature, and pH), optimization of germination time, pH, temperature, enzyme concentration, substrate concentration (starch); and 3) determination reaction kinetics of amylase in starch hydrolysis. The reaction kinetics study included the values of V_{max} (maximum reaction velocity) and K_M (Michaelis-Menten constant). Determination of amylase activity using the DNS (Dinitrosalicylate) method. The data that has been collected were analyzed by a descriptive quantitative method. The result showed that: 1) the optimum concentration of the amylase enzyme is 2.5% (v/v), the optimum temperature in hydrolyzing starch is 30 °C, and the optimum pH is 7; 2) value of V_{max} is 6.869 Units/minutess; and 3) value of K_M is 11.87 Units/mL. This information is very important to increase the economical value and efficiency of amylase in the industry.

Keywords: *Analysis optimization, Soybean, Reaction kinetics*

1. INTRODUCTION

Amylase is an enzyme that can hydrolyze starch molecules, a polymer made up of glucose units, which consist of glucose units. This enzyme is one of the main enzymes used in the industry. The need for α-amylase is very large, about 30% of the world's total enzyme production. The demand for amylase reaches at least 25% of the total enzyme requirement [1]. Amylase has a potential application in various industrial processes such as food, fermentation and the pharmaceutical industry [2] paper, pharmaceutical and detergent industries, clinical, medicinal and analytical chemistry, and their wide application in starch saccharification and the textile, food, brewing and refining industries [3][4]. This enzyme has been used for the hydrolysis of starch to fructose and glucose syrup [5]. This high amylase requirement has not been supported by its availability.

Amylase enzyme can be obtained by utilizing materials that are abundantly available in nature, there are: from plants, animals and microorganisms [6][2]. Amylase comes from plants that are easily obtained, namely from germinated seeds [7], one of which is sprouts from soybeans [8]. By utilizing soybean seeds as a source of amylase, it is a breakthrough in technological innovation that will support the achievement of a prog to meet the needs of local and global enzymes that utilize biological sources.

Utilization in industry involving enzymes in general and amylase in particular needs to consider efficiency, which is determined by the product of the hydrolysis reaction. The velocity of enzymatic reactions in hydrolyzing or breaking down substrates/materials is determined by many factors, including temperature, enzyme concentration, pH, and substrate concentration. The substrate concentration affects the velocity of the reaction catalyzed by the enzyme. At very low substrate concentrations, the reaction rate is also very low, but this velocity will increase with escalating the substrate concentration. At the maximum velocity limit (V_{max}), the enzyme becomes saturated with its substrate, and cannot function fast [9]. The use of substrates or raw materials to be hydrolyzed excessively is less efficient in terms of its economical value. Therefore, the enzymatic reaction

kinetics of amylase needs to be observed, especially the value of V_{maks} dan K_M (Michaelis-Menten constant).

2. METHOD

2.1. Materials

This study used germinated commercial soybean seeds as a source of amylase and starch as amylase substrate. Starch in this study was obtained from the market

2.2. Soybean Amylase Extraction

This stage begins with sprouting soybeans. A small amount of 50 g soybean seeds washed thoroughly, soaked in water for 12 hours, then drained. Seeds are germinated under wet and dark environment conditions for 4 days. The sprouts that have grown are ready to be extracted and the amylase enzyme is isolated by blending with adding a little distilled water, the ratio between seeds and distilled water is 50 g of seeds: 400 mL of distilled water. This step will create a slurry. The slurry was centrifuged at 1500 rpm for 10 minutes. The formed-filtrate is a crude amylase extract and ready to be tested for its activity.

2.3. Preparation of the DNSA (3,5-dinitrosalicylic acid) reagent

The preparation of the DNSA reagent was carried out by dissolving 1 g of 3,5-dinitrosalicylic acid in 20 mL of distilled water, then put it into 100 mL volumetric flask and homogenize. Furthermore, 1 g of NaOH is added to the volumetric flask; 0.2 g of phenol; 0.05 g of Na_2SO_3; and 1 mL of Na-K-tartaric 40%, then add distilled water to the limit of the miniscus, then homogenize.

2.4. Determination of amylase activity

The determination of amylase activity begins with the production of a standard glucose curve. The first stage was making a standard solution of glucose with a vary concentration of 50 ppm, 100 ppm, 150 ppm, 200 ppm, and 250 ppm. Each standard solution of 1 mL was put into a separate test tube. For glucose solution blank replaced with distilled water. Each 0.5 mL of standard solution, blank or hydrolyzate sample was put into the test tube, then added with 0.5 mL of distilled water and 2 mL of DNS reagent and vortexed. Each tube was placed in boiling water for 10 minutes, then cooled on a room temperature. Next, measuring the absorbance using UV-VIS-spectrophotometer at a wavelength of 550 nm. Making a standard glucose curve by mapping the concentration of the standard solution versus the absorbance, then the linear regression equation is determined, namely Y = AX + B. By using the linear regression equation, the mapping result of glucose standard concentration vs absorbance can be known that the glucose ration is a result of amylase activity in hydrolyzing the substrate. This catalytic activity is expressed in IU/mL. One international unit is expressed as the total amount of enzyme capable of acting as a catalyst to convert 1 µM of substrate/minutes under standard conditions. Calculation of enzyme catalytic activity:

$$\text{Unit/ml} = \text{Glucose formed x P x } \frac{1}{T}$$

Information:
P: dilution
Q: incubation time (minutes)

2.5. Determination of the optimum amylase temperature

Soybean amylase activity was determined using the DNSA test. Six test tubes were filled with 1 mL of 1% starch solution (in phosphate buffer pH 7). Each tube was added with an amylase enzyme solution that was obtained from the extraction of soybean sprouts in the optimum germination time. The next step, each tube containing amylase and the substrate was reacted in temperature variations, there were 25, 30, 35, 40, and 45^{o}C for 10 minutes. Each hydrolyzate that has been obtained is then tested for glucose concentration which was formed by adding 0.5 mL of distilled water and 2 mL of DNSA reagent and vortex. Each tube was placed in boiling water for 10 minutes, cooled at room temperature. Then, measuring the absorbance using a UV-VIS spectrophotometer at a wavelength of 550 nm. By entering the absorbance value into the glucose standard regression equation, it will be known that the glucose level is formed as amylase activity. The temperature that shows the highest glucose yield indicates the optimum temperature.

2.6. Determination of the optimum pH of amylase

Six test tubes were filled with 1 mL of 1% starch solution (in buffers of pH 5, 6, 7, 8, and 9). Each tube was added with amylase enzyme solution and reacted at optimum temperature for 10 minutes. Each hydrolyzate that has been obtained was then tested for glucose concentration which was formed by adding 0.5 mL of distilled water and 2 mL of DNS reagent and vortexed. Each tube was placed in boiling water for 10 minutes, then cooled to room temperature. Finally, measuring the absorbance using a UV-VIS-spectrophotometer at a wavelength of 550 nm. By entering the absorbance value into the glucose standard regression equation, it will be known that the glucose level is formed as an amylase activity. The pH that shows the highest glucose yield shows the optimum pH.

2.7. Determination of the optimum substrate concentration

Six test tubes filled with 1 mL of starch solution of varies concentration 0 (control); 0.5; 1; 1.5; 2; and 2.5 ppm (in the optimum pH buffer). Each tube was added with amylase enzyme solution and reacted at an optimum temperature for 10 minutes. Each hydrolyzate that has been obtained was then tested for glucose concentration, which was formed by adding 0.5 mL of distilled water and 2 mL of DNSA reagent and vortex. Each tube was placed in boiling water for 10 minutes, cooled at room temperature. After that, measuring the absorbance using a UV-VIS-spectrophotometer at a wavelength of 550 nm. By entering the absorbance value into the glucose standard regression equation, it will be known that the glucose level is formed as amylase activity. The substrate concentration that showed the highest glucose yield showed the optimum substrate concentration

2.8. Enzymatic Reaction kinetics of amylase

The reaction kineticss that have been tested were V_{max} and K_M. V_{max} and K_M were determined using the Lineweaver-Burg equation. The result of 1/[substrate] vs 1/[reaction velocity] mapping results obtained by the straight-line equation y = ax + b. The intercept with the Y axis where the value of X = 0, the value 1/Vmax is obtained, and the intersection point on the X axis (Y = 0) will give the value -1/K_M.

3. MATH AND EQUATIONS

3.1. Glucose Standard Curve

Table 1 shows the absorbance results of the standard solution of glucose in the concentration variations of 50 ppm, 100 ppm, 150 ppm, 200 ppm and 250 ppm.

Table 1. The absorbance of the glucose standard solution in various concentration

Glucose standard	Concentration (ppm)	Absorbance
Standard 1	50	0.183
Standard 2	100	0.354
Standard 3	150	0.507
Standard 4	200	0.646
Standard 5	250	0.803

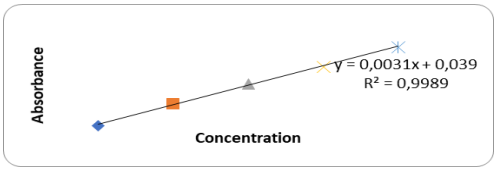

Figure 1 Glucose standard curve

Based on the result of glucose concentration mapping versus absorbance, a linear regression equation is obtained, Y = 0.003 X + 0.039 with a value of R^2 = 0.998. This equation is used to determine the glucose concentration in a sample as a result of amylase activity.

3.2. Determination of the Optimum Enzyme Concentration for Amylase

Data Table 2 shows the results of testing the amylase activity of various enzyme concentrations. The measurement result of mobile amylase are presented in Table 2.

Table 2. Amylase activity ad data in various enzyme concentration

Enzyme concentration (%)	Glucose yield (ppm)	Amylase activity (Unit / 2mL)	Amylase activity (Units / mL)
0	34.44	34.44	0
2.5	52	52	8. 78
5	71. 56	71. 56	18. 56
7.5	87.11	87.11	26. 33
10	145. 22	145. 22	55.39
15	158. 56	158. 56	62.06

Information: Measurements were made at a temperature of 37ºC, pH 7 and an incubation time of 10 minutes

Table 2 shows that at 0% enzyme concentration the enzyme has no activity, at 2.5% enzyme concentration is 8.78 U/mL and increases within elevation of enzyme concentration. This proves that the enzyme concentration has an effect on amylase activity.

3.3. The Determination of the Optimum Temperature

The determination of optimum temperature was done by reacting amylase with 1% starch substrate in temperature variations of 25, 30, 35, 40, and 45ºC, pH 7 for 15 minutes. Then measured the level of glucose formed, and the highest glucose level states the optimum temperature. The result of varied tests in incubation temperature are shown in Table 3.

Table 3 Amylase activity with temperature variations

Temperature (°C)	Glucose yield (ppm)	Amylase activity (Unit / 2mL)	Amylase activity (Units / mL)
25	101.00	101.00	50.5
30	105.00	105.00	52.5
35	100.33	100.33	50.2
40	97.67	97.67	48.8
45	87.00	87.00	43.5
50	71.33	71.33	35.7

The activity of crude amylase extract from soybean seeds at temperature variations is shown in Table 3. At a temperature of 25 °C, the amylase activity was 50.5 U/ mL and increased at 30 °C, which was 52.5 U/mL. Temperature 30 °C is the optimum temperature for mobile amylase in soybean seed sprouts, because it has the highest activity so that the amylase works optimally in degrading starch to glucose. After reaching the optimum condition, the amylase activity will decline again, namely at temperatures of 35 °C, 40 °C, 45 °C, and 50 °C, which is 50.2 U/mL, 48.8 U/mL, 43.5 U/mL, and 35.7 U/mL. The optimum temperature of the amylase enzyme is 30 °C with amylase activity of 52.5 U /mL.

3.4. The Determination of Amylase Catalytic Activity in Various Incubation Time

The optimum incubation time was carried out by reacting amylase with starch substrate in 0, 5, 10, 15, 20 minutes and then measuring the levels of sugar formed from each treatment using the DNSA method. The results of varied tests in incubation time are shown in Table 4.

Table 4. Amylase activity in various incubation times

Incubation Time (minutes)	Glucose yield /ppm)	Amylase Activity U/mL
5	87.83	43.92
10	88.67	44.33
15	78.17	39.08
20	72.67	36.33
25	0.26	0.13

The activity of crude mobile amylase extract from soybean seeds at various incubation times is shown in Table 4. At 5 minutes the amylase activity is 43.92 U/mL, at 10 minutes it is 44.33 U/mL, at 15 minutes the amylase activity is 39.08 U/mL. at 20 minutes the amylase activity was 36.33 U/mL, and at 25 minutes it was 0.13 U/mL. Based on the data, the results of amylase activity have been decreased with increasing incubation time. The optimum incubation time was 10 minutes/

3.5. Determination of amylase catalytic activity in various pH

The optimum pH had been done by reacting amylase with starch substrate at various pH values 5, 6, 7, 8 and 9. Then measuring the sugar-formed content from each treatment with the DNSA method. The reaction was carried out at the optimum temperature and enzyme concentration. The results of pH test variations are shown in Table 5.

Table 5. Amylase activity in various pH

pH	Glucose yield/ppm)	Amylase Activity U/mL
5	0,19	0,09
6	0,19	0,10
7	0,25	0,12
8	0,18	0,09
9	0,18	0,09

The activity of crude amylase extract from soybean seeds at various pH is shown in Table 5. At pH 5 the amylase activity is 0.09 U/mL and increasing within elevation of pH used, namely 0.10 U/mL at pH 6, and 0.12 U/mL at pH 7. At pH 7 the amylase activity shows the optimum activity because it has the highest activity, where amylase works optimally in degrading starch to glucose. After being at the optimum condition, the amylase activity will decrease again, namely at pH 8 and 9 of 0.09 U/mL. The optimum pH of the mobile amylase enzyme is pH 7 with amylase activity of 0.12 U/mL.

3.6. Determination of Amylase Catalytic Activity in Various Substrate

The substrate concentration used in this study was 0 (control); 0.5; 1; 1.5; 2; and 2 mL. The enzymes were used 10% (optimization result item c), incubation temperature 37ºC, pH 7, and incubation time of 15 minutes. The results of the substrate concentration test are shown in Table 6.

Table 6. Amylase activity in various substrate concentrations

Substrate Concentration (%)	Glucose yield (ppm)	Amylase Activity (Unit/mL)
0	0,00	0,00
0.5	4,02	4,02
1	5,06	5,06
1.5	5,51	5,51
2	5,66	5,66
2.5	6,21	6,21

The activity of crude amylase extract from soybean seeds on substrate variations is shown in Table 6, the concentration of 0% substrate indicates that the relative amylase activity of amylase is 0 U/mL, at a substrate concentration of 0.5% of 4.02 U/mL and increases with respect to the increase in substrate concentration, namely, at 1% substrate concentration of 5.06 U/mL, at a substrate concentration of 1.5% of 5.51 U/mL, at a 2% substrate concentration of 5.66 U/mL, and at a substrate concentration 2.5% of 6.21 U/mL. This process that the substrate concentration affects amylase activity

3.7. Enzymatic Reaction Kinetics of Amylase

Based on the data in TABLE VI, it can be studied the kinetic of the enzymatic reaction of soybean amylase in hydrolyzing starch, namely V_{max} and K_M, using the Line-Weaver Burg equation.

Table 7. Correlation between starch substrate concentration and amylase activity

Substrate Concentration (ppm)	Amylase Concentration (Unit/1mL)	1/ [Substrate]	1/ [Rate]
0,5	4.02	2.00	0.249
1	5.06	1.00	0.198
1,5	5.51	0.67	0.181
2	5.66	0.50	0.177
2,5	6.21	0.40	0.161

Based on Table 7, a linear regression equation is made and the results are shown in Figure 2.

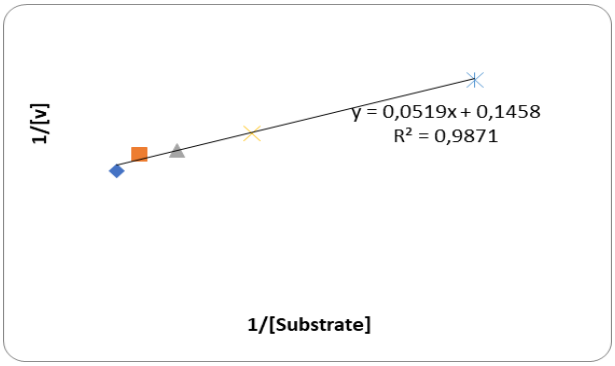

Figure 2 Line Weaver-Burg equation

The mapping result of 1/[substrate] vs 1/[v] obtained a linear regression equation y = 0.052x + 0.146 with a value of R^2 = 0.987. The intersection point with the Y axis where the value of X = 0, the value of Y = 0.145 ($1/V_{max}$) is obtained, then V_{max} = 6.869. The intersection point with the X axis (Y = 0) will get the value of X = 2.843, then K_M = 11.87 U/mL. Thus it can be said that the maximum activity for amylase is 6.869 U/mL. The V_{max} value of the soybean sprouts amylase in this study (6.869 U/minutes) was greater than that of amylase enzyme in sweet orange (*Citrus sinensis*) juice clarification (0.0134 - 0.0325 U/mL [10].

4. CONCLUSION

Based on the research results, it can be concluded that: 1) the optimum concentration of the amylase enzyme is 2.5% (v/v), the optimum temperature in hydrolyzing starch is 30 °C, optimum pH is 7; 2) the value of V_{max} is 6,869 U/mL; and 3) value of K_M is 11.87 U/mL. This information is very important to increase the economic value and efficiency of amylase in the industry

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