Series: Advances in Computer Science Research

Proceedings of the Mathematics, Informatics, Science, and Education International Conference (MISEIC 2019)

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Motivated by the success of our MISEIC 2017 and 2018, the Faculty of Mathematics and Natural Sciences Universitas Negeri Surabaya proudly presents the Mathematics, Informatics, Science, and Education International Conference (MISEIC 2019), held on 28 September 2019 in Surabaya, Indonesia, with the theme: “Trends, Advancement, and Innovation in Mathematics, Informatics, Science and Education toward Sustainable Development Goals”. The Sustainable Development Goals are the blueprint to achieve a better and more sustainable future for all. The Goals interconnect and in order to leave

no one behind, it is important that we achieve each Goal and target by 2030 (The UN). This annual international conference aims to fade the frontier among the Scientists, Engineers, and Educators toward the achievement of the Goals through the breakthrough, progression, and revolution in Mathematics, Informatics, Science and Education.

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Series: Advances in Computer Science Research

Proceedings of the Mathematics, Informatics, Science, and Education International Conference (MISEIC 2019)

Assalamu'alaikum wr wb.

The honorable Keynote speakers: Prof. Hernando Ombao, Ph.D, Assoc. Prof. Boon Chuan Low, Prof. Tomonori Ichinose, and Dr. Yusuf Fuad, M.App.Sc.

Dearest guests, presenters, and participants of the Mathematics, Informatics, Science, and Education International Conference (MISEIC 2019).

Praise be to Allah SWT for His blessing moment, hence we can attend this valuable moment to share some ideas in this conference. It is my pleasure, as the Rector and on behalf of Universitas Negeri Surabaya to welcome all of you,

from abroad and within Indonesia, to participate in the Mathematics, Informatics, Science, and Education International Conference (MISEIC 2019).

The Sustainable Development Goals (SDGs), also known as the Global Goals, were adopted by all United Nations Member, including Indonesia, as a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030. The Global Goals address the global challenges we face, including those related to poverty, inequality, climate, environmental degradation, prosperity, and peace and justice, which can be described in 17 Sustainable Development Goals (SDGs). We can play important role and do significant action to support the achievement of these goals as we are educator and researchers as well.

Inspired by the spirit of Sustainable Development Goals, the MISEIC 2019 brings the theme "Trends, Advancement, and Innovation in Mathematics, Informatics, Science and Education Toward Sustainable Development Goals". We do hope that this conference will be the home for the researchers, the lecturers, and the practitioners in Mathematics, Informatics, Science and Education to communicate their original scientific ideas based on their updated research. Their contribution will be valuable input for the development of these fields.

We are grateful to all institutions, sponsors, all organizing and scientific committee members, and all participants for making this conference possible and successful. We wish you all have a pleasant stay here in Surabaya, the Heroic City.

May you have a very successful conference.

Prof. Dr. Nur Hasan, M.Kes

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52 articles

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Biodiversity and Existing Condition of Coral Reef Ecosystem in Kondang Merak Beach Malang

Tarzan Purnomo

Coral reefs are one of the compilers of ecologically and economically important tropical marine ecosystems, but are very vulnerable to damage. Declining sea water quality due to climate change, coastal land use, and inaccurate coastal management patterns can threaten its sustainability. This study aims...

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Biodiversity of Invertebrates in Kemantren Coast, Lamongan

Dwi Rahayu, D A Rahayu, R Ambarwati, U Faizah

Kemantren beach is located in the Kemantren Village, Paciran District, Lamongan Regency. This beach is consists of sand and coral substrate. Kemantren beach is one of the small coastal islands of Java that has already reclaimed with spot of high ecotourism potency and habitat for numerous types of invertebrate...

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The Dynamics of Scientific Literacy Skills of Biology Students in Histology Lectures Using Scientific Literacy-Based Worksheet

Nur ducha, D Hariani, W Budijastuti

Scientific literacy skills are essential for students, as it related to how students can understand their environment and their various life problems. The purpose of this research was to study the dynamics of scientific literacy skills of biology students in histology lectures. This research used a descriptive...

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Chlorogenic Acid Yacon Tubers [Smallanthus Sonchifolia (Poepp. Et Endl.) H. Robinson]. On The Use of Natural Inhibitors

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and Storage Temperature Variations

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

The aim of the study was to obtain the optimum content of chlorogenic acid (CA) yacon tubers on the use of natural inhibitors through a combination of immersion in natrium chloride, ascorbic acid and citric acid with 14 days storage at 5 and 15°C temperature variations. Yacon tubers are obtained from...

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The Study of Self-Cleaning Properties of TiO2 Coated on Cotton Fabrics

Dina Maharani, D K Maharani, M M S Basukiwardoyo, S T Alawiyah, Rusmini Rusmini

This research study about self cleaning activity of TiO2 coated on cotton fabric. TiO2 nanoparticles is known as good semiconductor which have photocatalytic properties. Cotton fabric was coated by TiO2 to produce self cleaning textiles. Coating of TiO2 nanoparticles on cotton fabrics was carried using...

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Constructing Recommendation about Skills Combinations Frequently Sought in IT Industries Based on Apriori Algorithm

Latifah, Tubagus Mohammad Akhriza, Laras Dewi Adistia

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To adapt the IT curriculum to the requirements of the IT industry skills, several methods have been proposed. Among them is the method of mining job advertisement data to find skills that are being sought by the industry. However, so far no significant research has focused on providing recommendations...

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Analysis of the Effect of Temperature and Time for Ultrasonication on Graphite Structure

Diah Kusumawati, Diah Hari Kusumawati, Muhammad Nurhuda

Graphite is a carbon allotrope with special bonding characteristics. These bonds can be altered given ultrasonic waves to be another form of bond or loosened. Changes in bonds will cause changes in bond characteristics to other forms of carbon allotropes. By varying ultrasonication process (time and...

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Dynamical Analysis Discrete of Euler Scheme for Harvested Predator-Prey Model with Ratio-Dependent Response Function and Prey Refuge

A Hadi, Abdul Hadi, Siti Nurul Afiyah, Vivi Aida Fitria

In this research, Euler method is applied to discretize a harvested predator prey model with ratio-dependent response function and prey refuge. The existence and stability of fixed points has been analyzed. Stability of each

fixed point shown that the fixed points are stable for small size of time step....

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Applying Spherical Triangle Concept in Simulator to Determine Distance and Direction of Ship

Damoyanto Purba, Novita Hindri Harini, Agus Dina Mirianto, Zainullah Zuhri

Since Electronic Chart Display and Information System (ECDIS) is a very important navigator for the safety of seafaring, a cadet of Seafaring Polytechnic should learn it at class. Cadet should master how to use it properly to improve effectiveness and efficiency in seafaring. But, ECDIS only in the ship...

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Risk and Return Portfolio of Food and Beverages Companies in Ramadhan 2019

Achmad Kautsar, Nadia Asandimitra, RA Sista Paramita, Musdholifah Musdholifah, Ulil Hartono, Trias Madanika Kusumaningrum, Yuyum Isbanah

Ramadan Effect, one type of market anomaly, is a seasonal anomaly which shows a difference in average returns in the month of Ramadan compared to other months in one year. The phenomenon of increasing public consumption in the month of Ramadan is suspected to be a phenomenon that causes returns in Ramadan,...

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A Numerical Study of Diffusion-Convection Equations

Imam Solekhudin

In this paper, problems involving time-dependent diffusion-convection equation are studied. To study these problems, a numerical method is employed to solve the equation numerically. The method used in this research is a Laplace Transform Dual Reciprocity Method (LTDRM). Using this method, the time-dependent...

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The Fuzzy Optimal Solution of Fuzzy Transport Problems Using A New Fuzzy Least Cost Method

Farikhin Farikhin, Muhammad Sam'an, Bayu Surarso, Bambang Irwanto

The fuzzy transport algorithms is used by researchers for finding optimal solution of Fuzzy Transport Problem (FTP), one of them is the Least Cost Method or LCM. The concept of LCM is to choose the least cost from the FTP table to be used as the base cell. If there is the same lowest cost, it is freely...

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The Layer Profile of the Students' Understanding of Image

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Making and Image Having in Completing Mathematical Problems

Alfian Abdillah, A. S. Abdillah, Mardiyana Mardiyana, Siswanto Siswanto

Mathematical understanding is an important aspect in learning mathematics. Pirie and Kieren's theory classified that eight layers of mathematical understanding, including image making and image having. In solving the problems, these layers can show the students such a way of solving problems. The purpose...

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Students' Proof Scheme for Mathematical Proving and Disproving of Divisibility Proposition

Ditya Rahmawati, Ditya Rifky Rahmawati, Yusuf Fuad, Endah Budi Rahaju

This study aimed to investigate and describe students' proof schemes for disproving mathematical proposition. Previous studies examined students' proof scheme of Calculus, Elementary Numbers Theory, Quadratic, and Geometry's Propositions. This study examined student proof schemes of Divisibility's Proposition...

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The Fraction Magnitude Knowledge through Representations at Students with Mathematics Difficulties

Ijtihadi Amalina, Ijtihadi Kamilia Amalina, Yusuf Fuad

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Elementary school students' knowledge of fraction magnitude may predict their mathematics achievement. Students' mathematics achievement is influenced by their mathematics difficulties. This study exposes students' representations in estimating fractions to indicate their fraction magnitude knowledge....

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The Use of Educational Game Media and Its Effect on Student Achievement of 6th Grade Elementary School Students in Mathematics Learning

Aqsyari Syam, Agustan Syamsuddin, Aqsyari Pujian Syam, Irwan Akib

This study aims to find out the description of the use of educational game media and its impact on the mathematics learning outcomes of grade VI elementary school students. This study included quasi-experimental research with a pre-test-post-test control group design. This study involved 29 sixth grade...

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Hybrid Learning versus Traditional Course in Mathematics Classroom for Higher Education: Students' Achievement and Students' Experiences

Rudianto Artiono, Yuliani Puji Astuti, Mega Teguh Budiarto

This study aimed to examine the outcome of lectures conducted using hybrid

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learning in Integral Calculus courses. It focused on students' achievement and students' experiences. Teaching materials were developed using the Plomp development model in the form of learning videos which met valid, practical...

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Understanding the Quadrilateral Concept of Junior High School Students Based on APOS Theory in Terms of Differences in Cognitive Styles

Ahmad Anam, Achmad Choirul Anam, D Juniati, Pradnyo Wijayanti

This study was designed to describe the understanding of quadrilateral concepts in junior high school students based on the APOS theory (Action, Process, Objects, and Schemes). The research used qualitative approach to explain the understanding of two junior high school students who had equal mathematical...

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The Development of Cooperative Learning Tools with Teams Games Tournament (TGT) Types to Overcome Students' Mathematical Anxiety in Algebraic form Material for The Seventh Grades of Junior High School Students

Syahda Mahfudhoh, Syahda Umroh Mahfudhoh, Dwi Juniati, Agung Lukito

This research was aimed to (1) describe the development the good cooperative learning tools with TGT types on algebraic form material and (2) know the

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effectiveness of the learning on algebraic form material using TGT to reduce the students' mathematical anxiety. This research was a development research....

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Student's Mathematics Anxiety in Solving Mathematical Problems of Logarithms Material

Istifada Hayati, Istifada Nurul Hayati, Budiyono Budiyono, Isnandar Slamet

The process of learning mathematics, anxiety is a supporting and inhibiting factor for student learning achievement, especially in learning logarithm material. Difficulties in the form of anxiety are one of the emotional factors of students. Anxiety can also be a useful stimulus because each student...

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The validity of Teaching Materials Based on Hybrid Learning: The 21st Century Challenge

Budi Prawoto, Budi Priyo Prawoto, Rudianto Artiono, Dwi Nur Yunianti

This study aims to develop calculus teaching materials based on Hybrid Learning. It can be used to prepare students with the 21st-century challenge. This research is expected to help students in facing the learning process in the future. Also this research aims to help the students to engage in the...

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Flexibility of Guardian and Artisan Selected Students in Solving Fraction Problems

Yenny Novitasari, R Setianingsih, Y F Novitasari

The aim of this study is to describe flexibility of students with guardian and artisan personality types in solving fraction problems. This study is a descriptive study using qualitative approach. The subjects consisted of two 8th grade students that were measured by Personality Classification Test (PCT)...

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Students' Ability to Arrange Learning Devices Using Discovery Learning Model in Innovative Learning II Course

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Pradnyo Wijayanti, P Wijayanti, Ismail Ismail, I Kurniasari

Based on curriculum development in primary and secondary schools, Unesa Mathematics Department through the KKNI curriculum has tried to adjust 2013 curriculum, which is to teach students about learning with scientific and constructivist approach. This is done in the subject of Innovative Learning II...

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Prospective Students' Math Talk in Solving Secondary School Mathematics Problem

Dini Fardah, Dini Kinati Fardah, Puspita Anggraini Setyaningrum, Evangelista Lus Windyana Palupi, Anggietyas Damaningrum, Ahmad Wachidul Kohar

To activate the cooperation or collaboration skill of the students, educator often make small groups of students and give some topics to be discussed. However, we often ignore the activities that occur within the group. This article describe the process of problem solving occurred in 3 groups of prospective...

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Development of Student Worksheet for Improving the Self-efficacy and Ability to Argue of Chemistry Teacher Candidates Study on Junior High School Students Behavior Based on Keirsey Personality Type

Farah Erika, Zainul Arifin Imam Supardi, Tukiran Tukiran

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The purpose of this study is to explain the validity of student worksheets based on argumentation and self-efficacy learning that has been developed. The development of the student worksheets refers to the design of the Wademan model development research model. The student worksheet applied phases of...

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Training Digital Literation by Digital Book Format Electronic Publisher Themes of Climate for Junior High School Students

Siti hidayati, Siti Nurul Hidayati, Siska Vernanda, I W Dasna, Munzil Munzil, S Wonoraharjo

This electronic document is a “live” template and already This study aims to train the digital literacy of seventh-grade junior high school students with electronic books in electronic publisher format. The book used in this study has been validated previously included in the category of very feasible....

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The Effectiveness of Predict-Observe-Explain Strategy to Reduce Misconception in Thermochemistry

Imroatuz Zakiyah, Wahono Widodo, Tukiran Tukiran

Thermochemistry is one of materials that had low student’s understanding ability on National Examination in 2013-2015 which only gets 55.45%. This low percentage because of student still has misconception. Misconception can cause students having low ability to understand a concept. This

misconception...

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The Role of Local Wisdom-based Student Worksheet on Scientific Reasoning

Nory Sholiyah, Enik Setiyawati, Nurdyansah Nurdyansah

The aim of this research is to analyze the students' scientific reasoning skill by the use of Students' Local Wisdom-based Worksheet. This is a Quasi Experimental research with One Group Pre-test Post-test design. Research population are the entire students of science education of UniversitasMuhammadiyahSidoarjo....

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Developing Instructional Video to EnhanceBiology Pre-Service Teachers'Metacognitive Skills

Endang Susantini, Sifak Indana, Isnawati Isnawati, Sonia Dianita Sayitri

An instructional video might help learners to conceive learning attainment better or acquire specific skills. This study aimed to describe video quality, metacognitive skills, and responses of pre-service teachers. The video was developed using ASSURE model consisted of six stages; analyzing learner,...

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Improving Science Literacy Skills for High School Students Through Guided Inquiry-Based Learning

Ernita Aulia, Ernita Vika Aulia

The main objective of this study was to describe the effectiveness of guided inquiry-based learning to improve high school students' science literacy skills. The science literacy skills was the ability to engage with science-related issues, scientific ideas, and reflective thinking. Evaluation criteria...

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The Effectiveness of the Learning Devices Using Investigation-Based Multiple Representation to Improve Students' Problem Solving Ability on Reflection and Refraction Materials

Desfhie Yolenta, Budi Jatmiko, Tjipto Prastowo

The aim of this study was to explain the effectiveness of the Investigation-Based Multiple Representation (IBMR) learning model to improve the physics problem solving abilities of high school students on reflection and refraction of light. The effectiveness of the learning device was analyzed based on...

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The Regularity of Science in Moonlight Sonata Instrument is used in The Design of Physics Learning

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Sofa Maria

The main purpose of edutainment is to increase enthusiasm for learning. However, the implementation of physics learning still lacks emphasis on the learning process that meaningful and relevant, especially in Indonesia. This study were purposed to make the design of physics learning by integrating science...

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Integration of Scientific Article Writing in the Animal Systematics Course to Train Scientific Literacy

Ulfi Faizah, Reni Ambarwati, Dwi Anggorowati Rahayu

One of the 21st century skills needed by students is scientific literacy skill. Students who take Animal Systematics courses which are need to train in scientific literacy skills through scientific writing activities. This study aimed to describe about integration of writing scientific articles in systematic...

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The effect of problem based learning with gallery walk strategy to creativity and communication skills

Titin Sunarti, Dilla Ayu Septiana

This research aimed to analyze the effect of Problem Based Learning with Gallery Walk Strategy to creativity and communication skills in physics. This strategy was effective to conceptual topic. Therefore in this research, the

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chosen topic was global warming. This research was conducted to two groups...

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The Development of Learning Devices with the Etnoid (Ethnoscience Android) Assisted Guided Inquiry Model on Vibration and Wave Materials

Faudina Permatasari, Madlazim Madlazim, Wahono Widodo

This research was conducted in two stages; preparation stage which was aimed to develop the device, followed by implementation stage of learning in classroom using the pretest posttest design. The validation test consisted of media validation tests by media expert lecturers from the chemistry department...

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The Development of Student Worksheets (LKPD) in Learning Science through Group Investigation Learning to Train Critical Thinking Skills of Junior High School Students

Enik Kurniawati, Tjandrakirana Tjandrakirana, Sifak Indana

The purpose of this study is to produce a Student Investigation Worksheet (LKPD) based on Group Investigation learning to train the appropriate Junior High School students'critical thinking skills based on validity, practicality, and effectiveness. LKPD was developed with a 4-D research design namely...

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Chemical Materials Mastery of High School Students in East Java

Bertha Yonata

This article reveals student achievement in the Indonesia National Examination on Chemistry Material at the high school level in the East Java Province from 2015-2016, 2016-2017, and 2017-2018. The chemistry exam consists of Basic Chemistry, Analytical Chemistry, Inorganic Chemistry, Organic Chemistry,...

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Exploration of Balai Materia Medica Batu: Field-Trip Supporting Biotechnology Learning

Hasan Subekti, Herawati Susilo, Ibrohim Ibrohim, Hadi Suwono, Aris Rudi Purnomo

Field trips provide an opportunity to learn about life in the real world through exploration activities. This descriptive study aims to describe the process and response of students to the action of field trips to Materia Medica Batu (MMB) to support biotechnology courses. The participants in this study...

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Use of Computerized Games on Chemistry Learning

Achmad Lutfi, Rusly Hidayah, Ika Arum Hidayah

This study aimed to determine the impact of the use of computer-friendly games on Chemical Adventure as a medium to study Chemistry on learning outcomes, learning interests, and student responses. The form of research used was Pre-Experimental Research with a single group design Pretest-Posttest One...

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Enhancing the Digital Literacy of Pre-Service Biology Teacher through Animal Systematics Course

Reni Ambarwati, Ulfi Faizah, Dwi Anggorowati Rahayu

Digital literacy is one of the important skills that must be mastered by Biology Teacher. An effort has been applied to integrate the learning of Animal Systematics with the training of digital literacy for pre-service biology teachers. This research aimed to evaluate the digital literacy of pre-service...

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A Critical Analysis of Dramatization on Evacuation Drill

mita anggaryani

This paper presents a critical analysis of dramatization used in an evacuation

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drill in Indonesian elementary schools. Practical safety procedures become more prioritized than theoretical knowledge when it comes to saving a life from the risk of a natural disaster. Evacuation drill provides practice...

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Development of SEA-MEA (Self Efficacy Academic-Means Ends Analysis) Learning Model to Increase Problem Solving Skills

Djoni Setiawan, Wasis Wasis, Budi Jatmiko

Problem solving skills are urgently needed in everyday life and teachers should train in this global era. One of the models that can train problem solving skills is problem based learning (PBL) model. PBL model still has some weaknesses. Students find difficulties in the learning, the result of learning...

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Competency Profile of Junior High School Teachers in Developing High Order Thinking Questions of Science Subject

Rinie Puspitawati, Rinie Pratiwi Puspitawati, Bil Bila Ade Laila, Nurul Hikmah

This research aim is to describe the ability profile of junior high school teachers in developing high-level thinking questions for science subjects. This research was a quantitative descriptive study of junior high school teachers from Java and Eastern Indonesia. Data was obtained by collecting questions...

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Student Response on Solving Waste Problem in Department of Biology through Conservation of Natural Resources and Environment Course

Winarsih Winarsih

Conservation of Natural Resources and Environment (CNRE) is mandatory course to be taken by all student in Faculty of Mathematics and Natural Sciences. Main learning outcome of this course is for students to be able to solve problem relating to application of natural resources and environment conservation...

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Development of OrSAEv Model Learning Materials to Improve Tsunami Disaster Mitigation Skills (Preliminary Study)

Sapitri Rahayu, Madlazim Madlazim, Tjipto Prastowo, Eko Hariyono

This study aims to determine the tsunami evacuation skills that have been applied in schools. This research is qualitative and quantitative. This trial phase was conducted at State Junior High School 1 Besuki, tested to 15 students of class VII. The sample selection is chosen from the population using...

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The Practicality of Scrap-mod as a Learning Media on Molecular Geometry

Rusly Hidayah, Tiara Yusi Destari

The aim of this research is to obtain the practicality of scrap-mod as a learning media on a molecular geometry matter. It is reviewed based on the activities of the students and responses of the student. This research used the R&D (Research and Development) method which is a limited trial stage. Data...

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The Application of Rhizobacteria and Indigenous Microorganism on Cow Rumen in Soybean Plants (Glycine max L.)

Meli Astriani, Abdul Latief Abadi, Siti Zubaidah, Endang Suarsini

Soybeans are national food crop commodity with a high level of consumption per year. Efforts to increase soybean production are accomplished through fertilizer application. The utilization of chemical fertilizers, however, can negatively impact the environment. One alternative to the application of fertilizer...

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Analysis of Consumption Habits of PostPartum Herbal

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Concoction in Postpartum Mothers

sri banun istiqomah, Sri Banun Titi Istiqomah, Sri Fatmawati, Wiwit Denny Fitriana, Taslim Ersam

Postpartum period is the period after the fetus and placenta are born until the recovery of uterine devices such as the condition before pregnancy which lasts for about 42 days. During the puerperium, the body of a mother will experience physiological changes in the physical and psychological changes....

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In-vitro Propagation of Elephantopus scaber Using Seeds as Explants in Various Culture Growth Media

Yuliani, Fida Rachmadiarti, Sari Kusuma Dewi, Mahanani Tri Asri

Elephantopus scaber plant contains various secondary metabolites, such as flavonoids, phenolics, saponins, terpenes, triterpenoids, sesquiterpenes lactones, elephantopyns, and deoxyelephantopin, which can act as antimicrobial, antifungal, and bioinsecticides. Elephantopus scaber can be potentially grown...

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Hepar Histology of Mice(Mus musculus L) Indicated by Pre-Diabetes Mellitus Type 2 (Pre-Type 2 DM) After Red Rice Yeast Treatment

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Rudiana Agustini, Erlix Rakhmad Purnomo, Agus Widodo

The hepar is an organ that has a complex and vital role, which can be damaged. Hepar damage can be seen from the condition of the cells. His study aimed to provide a histological description of mice hepar (Mus musculus L.) that was indicated by pre-type 2 DM (pre-type 2 DM) after the treatment of red...

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Endemic Bacteria Potential for Decomposing Pesticide Prophenophos and Chlorantraniliprole from Pesticide-Exposed Soybean Field in East Java

Mahanani Asri, Mahanani Tri Asri, Evie Ratnasari, Lilik Suyatmi, Yuliani Yuliani

Pest control in soybean field in general still uses synthetic pesticide. Soil bacteria from pesticide-exposed field are potentially able to decompose pesticide residue in during certain period of time. This research aimed to find out the potency of isolated endemic bacteria from soybean field in Jombang,...

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Synthesis and Characterization of Nanogold and Nanosilver as Leprosy Drug Candidates and Their Activity Tests in Leprosy Patients; Case Study

Titik Taufikurohmah, Djodjok Soepardjo, Hari Armadianto, Rusmini Rusmini

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One of nanogold uses is as leprosy drug, because it has activity to increase cell proliferation and collagen biosynthesis. These two activities are necessary in the process of recovery and closure of wounds, including in leprosy. Nanosilver can act as anti-bacterial material, including against leprosy...

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ATLANTIS PRESS

Advances in Computer Science Research, volume 95

Mathematics, Informatics, Science, and Education International Conference (MISEIC 2019)

Hepar Histology of Mice *(Mus musculus* L*)* Indicated by Pre-Diabetes Mellitus Type *2* (Pre-Type 2 DM) After Red Rice Yeast Treatment

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***Abstract*—The hepar is an organ that has a complex and vital role, which can be damaged. Hepar damage can be seen from the condition of the cells. His study aimed to provide a histological description of mice hepar (Mus musculus L.) that was indicated by pre-type 2 DM (pre-type 2 DM) after the treatment of red rice yeast was carried out. The study was conducted on male mice weighing 20-24 grams and indicated pre-Type 2 DM. the mice were grouped into six groups based on the test material given, namely: red rice, red rice yeast, Yeast hydrolysate enzymatic (YHE) - red rice, positive control (glibenclamide + CMC-Na), normal control (commercial feed + CMC) -Na), and negative control (pre type 2 DM + CMC-Na). Each group was treated with 1 ml of the test material by oral gavage, then histology of the liver was observed to determine the level of liver cell damage. Based on liver histology results of mice, it was found that the level of cell damage was indicated by the level of hepatocyte damage resulting from the treatment of red rice yeast, YHE red rice, glibenclamide + CMC Na, commercial feed + CMC Na, and pre-type 2 DM + CMC Na respectively -according to 12, 29, 47, 18, and 53%. Red rice yeast has the best ability to regenerate liver cells among the treatments given. This result can be seen from the smallest level of red rice yeast hematocyte damage, which is 12% and the largest is negative control (53%), namely mice with type 2 DM and given CMC Na feed.**

Keywords—hepar histology, Mus Muculus L, pre-type 2 DM, red rice yeast treatment

I. INTRODUCTION

The hepar is one of the vital organs that functions as a center for metabolism and excretion of waste metabolites. Hepar tissue is composed of two types of hepar cells, namely parenchyma cells, and nonparenchym cells. Parenchym cells occupy about 70-85% of liver volume. The hepar parenchyma cells are known as hepatocytes, in the form of one or two nucleated polyhedrates [1]. This cell is constantly undergoing mitosis, therefore it can experience regulation if there is damage.

The hepar has a vital function, including producing bile. The function of bile is to hydrolyze fat. The constituent components of bile are bile salts, cholesterol, bilirubin, electrolytes, and water [2]. Bilirubin is the result of hemoglobin degradation, then this bilirubin will be absorbed and metabolized by the hepar. The result of hemoglobin degradation will also produce iron which is stored in the hepar and bones to form new blood cells [3]. The hepar produces an important compound for blood clotting, including vitamin K, whose formation process is influenced by the availability of bile [4]. The hepar also plays a role in fat metabolism, namely energy metabolism in the hepar[5]. The liver functions as a storage place for carbohydrate metabolism, which is glycogen and the compound will be released back into glucose when the body's cells need energy [6]. Hepar as a place for storing vitamins and minerals. Some vitamins include: vitamins A, D, E, and B12 are mostly stored in the liver [7], also stores iron from the breakdown of hemoglobin in the form of ferritin. Hepar also stores copper, a place of protein metabolism. The hepar as a place for the degradation of amino acids and urea synthesis, the formation of plasma proteins and interconversion between different amino acids [8]. The hepar also filters blood from all over the body. The hepar filters and removes compounds from the body [9], including hormones, such as estrogen, aldosterone, and compounds from outside the body, including alcohol and other drugs. Immunological functions [10]. The hepar is part of the mononuclear phagocyte system. It contains high numbers of cells that are involved in immune activity. These cells destroy any disease-causing agent that might enter the hepar through the gut. Hepar is also the production of albumin [11]. Albumin is the most common protein in blood serum. It transports fatty acids and steroid hormones to help maintain correct pressure and prevent the leaking of blood vessels. The hepar synthesizes angiotensinogen [12]. This hormone raises blood pressure by narrow blood vessels when alerted by the production of an enzyme called renin in the kidneys.

In the hepar can experience fatal consequences, including the presence of fat vacuoles that accumulate in the hepar cells. Such conditions result in the hepar not functioning properly. This disorder is known as fatty liver disease which usually occurs together with obesity. At a threshold level, more than 5 to 10 percent of the hepar weight is fat. If the body produces too much fat, or if the fat is not properly metabolized, it can build up in the hepar. If more fat than this builds up in the hepar, this is known as hepar disease.

Fat hepar disease is often related to obesity, high blood pressure, diabetes mellitus (DM), and high cholesterol. DM is known to have 2 types, namely type 1 and type 2 diabetes mellitus. Type 2 DM is a chronic metabolic disorder caused by the body unable to use effectively produced insulin, a hormone that regulates blood glucose levels. Normal blood

glucose is 100-126 mg / dL, prediabetes> 126 <150 mg / dL Patients with type 2 diabetes are characterized by blood glucose levels ⩾ 150 mg / dL. The results of the study using mice showed that the treatment with the administration of red rice yeast intake and YHE (Yeast Hydrolysate Enzymatic) in mice can reduce blood glucose levels. The decrease in blood glucose levels of mice treated with red rice yeast was 161 mg / dL and YHE was 131 mg / dL. Red rice yeast is yeast grown in red rice, while YHE is a yeast extract from the results of enzymatic hydrolysis. Damaged hepar cells can be regenerated. The only internal organ of mammals capable of natural regeneration of lost tissue is the hepar; 25% of the hepar can regenerate into a whole heart [13]. Hepar regeneration. as growth compensation in mammals[14]. This tissue can regenerate completely with at least 25% of the tissue still present. Research conducted on mice that removed two-thirds of hepar tissue was still able to regenerate again within 5-7 days. In humans, because it has a larger and more complex size, the regeneration process requires a longer time. The process of hepar tissue regeneration requires several compounds. The results showed that red rice yeast of red rice contains good biochemical components for cell regeneration, namely protein, chromium, and anthocyanin. One of the hepar damage can be seen microscopically from hepatocytes or parenchymal cells that experience atrophy (cell wasting), necrosis, necrobiosis, fatty, or apoptosis. Necrosis leads to cell or tissue death, is irreversible, especially regarding the cell nucleus and some are natural (= necrobiosis). Therefore looking at the hepar histology is very important to determine the level of cell damage. Base on the background his study aimed to provide a histological description of mice hepar (Mus musculus L.) that was indicated by pre-type 2 DM (pre-type 2 DM) after the treatment of red rice yeast was carried out.

II. EASE OF USE

The study aimed to describe the hepar histology of mice that was carried out in several stages, including the preparation of test materials, obesity induction, treatment using the test material, and hepar histology of mice.

A. *Preparation of Test Material*

Red rice yeast was the yeast that is grown in a medium of red rice flour. In the initial stage, rice was milled and sieved with a size of 100 mesh sieve, then each rice flour was added with distilled water with a ratio of 5: 1 (b /v). The mixture is heated to boiling and finally, a gel (gelatinization process) will be formed. The gel was allowed to cool then hydrolyzed using the enzyme α-amylase and glucoamylase for 6 hours, room temperature (28 ± 5oC). Hydrolyzate was ready to be used as a yeast growth medium. The yeast used was commercial yeast bakery. Yeast was put into hydrolyzate with a ratio of 5: 1 (v / w), then fermented for 10 days. The fermentation results were then centrifuged at a speed of 6000 rpm for 15 minutes and yeast residues will be obtained which were ready for further processing. In the study use YHE red rice (yeast hydrolysate enzymatic) to compare that it's made by enzymatical hydrolysis. Yeast was hydrolyzed using bromelain. Hydrolysis in this study was carried out at 37°C for 24 hours. The hydrolyzate obtained was YHE which was ready to be used as a test material.

B. *Induction of Obesity*

The initial stage is an adaptation, mice were placed in the cage according to the treatment to be given, then adapted for seven days and fed during adaptation to commercial feed and given drinks were replaced every day. Mice were weighed one by one using a digital scale and then measured their blood glucose levels using a nesco multi check. Obesity induction was done by giving fat and fructose feed. Animal fat was given daily at 0.4 mL, fructose was given at 0.6 mL and commercial feed every day for approximately 1 week, then the next stepwas measuring blood glucose levels and weight.

C. *The Treatment of Mice Use Test Material*

The test material in this study was yeast red rice and yeast which have been enzymatically hydrolyzed (YHE). Positive, negative and normal controls are used as a comparison. Table 1 shows the formulation of the test material used in this study.

TABLE I. FORMULATION OF TEST MATERIAL

Material Test	Formulation
Red rice Yeast	Giving red rice yeast 1 mL / per day
Red rice YHE	Giving YHE red rice 1 mL / per day
Glibenclamide (Positive Control)	Control glibenclamide, made diabetes and given glibenclamide (0.9 mg / 200 g bb mice) in CMC-Na 0.2%
Diabetic Control	Control of diabetes (negative control), made diabetes and only given 0.2% CMC-Na
Normal Control	Normal control, non-diabetes, was given 0.2% CMC-Na

The administration of the test material was carried out on male mice (Mus musculus L.) DDW strains aged six weeks weighing 25-30 grams by using gavage needles as much as 1 mL / mice / day for 1 week.

D. *Surgery and Observation of Hepar Histology*

Mice that were treated for one week were dissected and the hepar was washed in a physiological solution, put into Bouin's solution and made histological preparations. Hepar tissue observed in this study was left lobe slice. Preparation using the paraffin method, then staining using hematoxylin and eosin. Observation of hepar tissue histology using a light microscope with a magnification of 100 X and 400 X, with five different sub-fields of view. Every sub-view counts the total number of hepar cells and damaged day cells (apoptosis and necrosis). Then calculated the percentage of damage that occurs using the following formula. Data were analyzed descriptively quantitatively.

$$Damage\ (\%) = \frac{number\ of\ damaged\ cells}{number\ of\ normal\ cells}$$

III. RESULTS AND DISCUSSION

The results of observations using a light microscope carried out on the hepar of mice by treating yeast and YHE red rice and positive, negative and normal control groups after 1 week found normal hepatocytes and hepatocytes to

change the form of parenchymatic degeneration, hydropic degeneration (apoptosis) and necrosis. Hepatocytes are cells that have a round nucleus with a clear membrane and it has a polyhedral shape. Changes in function and structure due to chemical compounds or due to abnormalities that lead to liver tissue damage can be characterized by biochemical lesions such as inflammation, fibrosis, cell degeneration, or necrosis. This change can be observed using a microscope. Necrosis is the death of cells or tissue in living organisms. The nucleus of the dead cell looks smaller, chromatin and reticular fibers multiply. The nucleus becomes denser and then the cell becomes eosinophilic (cariolisis). The mice hepar tissue is shown in Fig. 1.

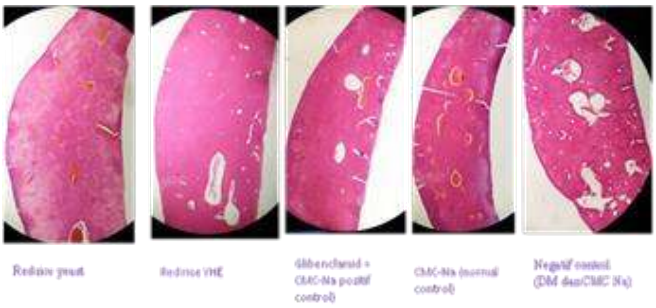

Fig. 1. The hepar mice using light microscope with light microscope magnification of 100 X

Fig. 1 shows that the biggest hepar tissue damage occurs in negative control is DM with CMC Na treatment. Treatment with red rice yeast and red rice YHE showed little tissue damage compared to other treatments. The best treatment is giving red rice yeast.

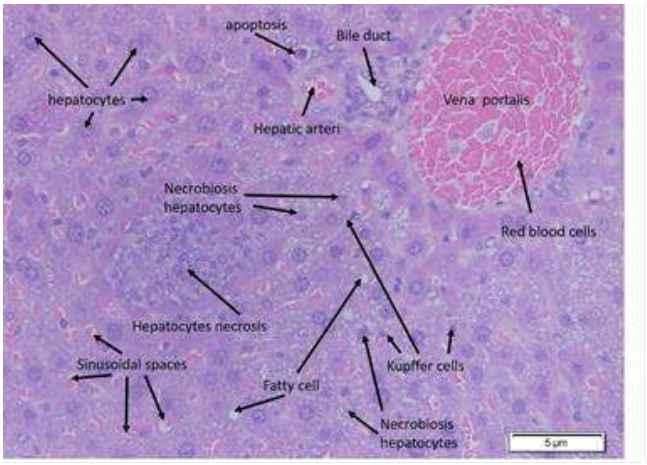

Fig. 2. Histology of mice hepar with the treatment of red yeast rice and its parts at one point of view (light microscope, magnification 400X)

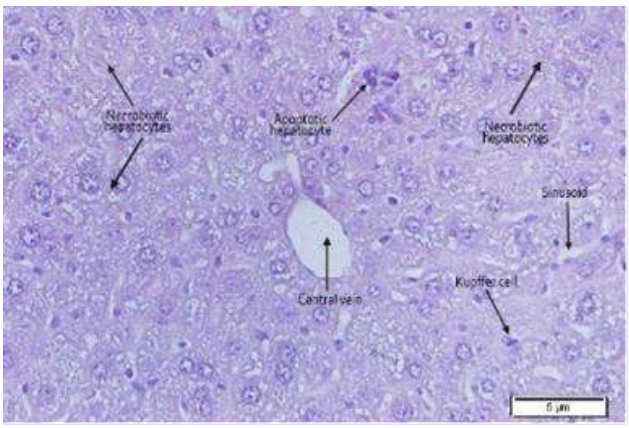

Fig. 3. Histology of mice hepar with the treatment of red rice-YHE and its parts at one point of view (light microscope, magnification 400X).

The hepar is the most frequently damaged organ[15], because the metabolism of various compounds or drugs mainly occurs in the hepar, so the possibility of damage to these organs becomes very large[16]. If the metabolic process does not run normally, it will cause various diseases, one of which is a disease that occurs in the hepar. The cells contained in the hepar will be deposited so that they will experience changes. Consumption of certain drugs or dietary foods can cause hepar damage in a short time or after several weeks or maybe several months. Hepar tissue damage can be in the form of hepatocyte necrosis, cholestasis, or the onset of hepar dysfunction slowly. The hepar histology of mice, parts, and damage to hepatocyte cells in various treatments are shown in Fig. 2-6.

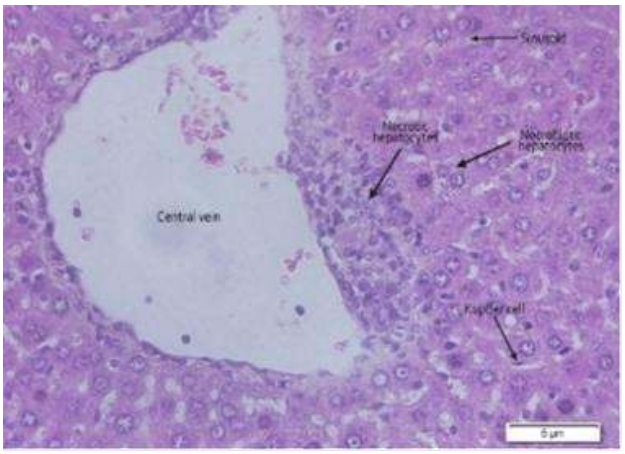

Fig. 4. Histology of mice hepar with the treatment of glibenclamide + CMC-Na (positive control) and its parts at one point of view (light microscope, magnification 400X)

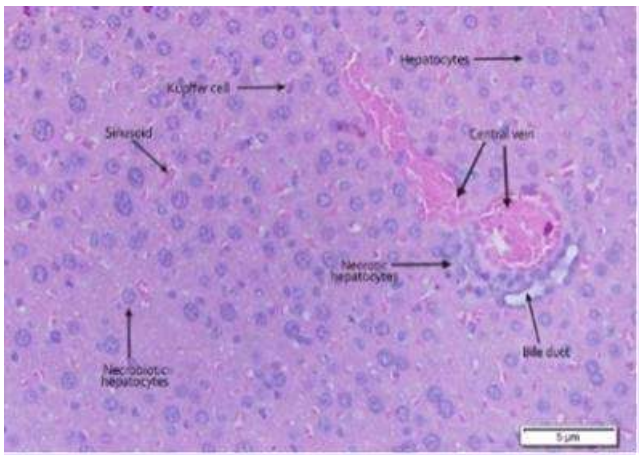

Fig. 5. Histology of mice hepar with the treatment of normal control and its parts at one point of view (light microscope, magnification 400X)

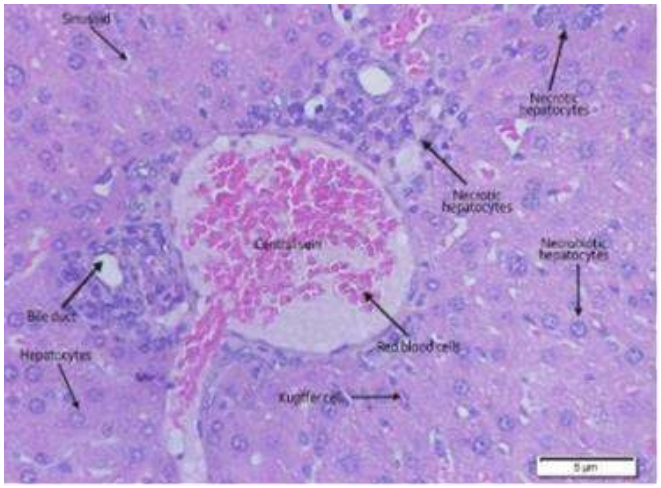

Fig. 6. Histology of mice hepar with the treatment of DM+CMC-Na (negative control) and its parts at one point of view (light microscope, magnification 400 X).

The conditions of hepatocyte cells in mice in various treatments as shown in Table 2.

TABLE II. FORMULATION OF TEST MATERIAL

Treatment	Field of View 1		Field of View 2		Field of View3		Field of View4		Field of View5	
	N	*R*	*N*	*R*	*N*	*R*	*N*	*R*	*N*	*R*
Red rice Yeast	107	7	101	11	112	21	126	16	103	20
Red rice YHE	79	44	87	44	56	28	199	75	233	73
Positive Control	82	114	78	172	118	50	113	60	120	61
Normal Control	191	117	216	29	202	22	209	39	176	17
Negative Control	99	126	104	146	90	145	127	89	120	109

Description: N is a normal cell and R is a damage cell

The level of hepatocyte damage as an illustration of the liver condition of mice in various treatments as shown in Table 3.

TABLE III. LEVELS OF MICE HEPATOCYTE DAMAGE

Treatment	Total Cell		Total cells observed	Damage Level (%)
	N	*R*		
Red rice Yeast	549	75	624	12
Red rice YHE	654	264	918	29
Positive Control	511	457	968	47
Normal Control	994	224	1218	18
Negative Control	540	615	1155	53

Description: N is a normal cell and R is a damage cell

Table 3 shows that the smallest level of hematocyte damage is red rice yeast which is equal to 12% and the largest is negative control (53%), namely mice with type 2 DM and given CMC Na feed. CMC Na is used as a source of mouse fiber. YHE red rice shows a higher level of damage compared to red rice yeast. YHE is the result of enzymatic hydrolysis of red rice yeast which has a higher amount of dissolved amino acid components compared to yeast. This compound is more easily metabolized than protein, but in the process of making YHE is centrifuged during removal of water, so that many anthocyanins and other chemical compounds are suspected of being wasted. Therefore, it is recommended that when making YHE using freeze dryer instead of the centrifuge to get YHE residue. Thus the chemical components present in red rice yeast are thought to have the potential to regenerate hepar cells. Anthocyanins are known compounds that play a role in cell regeneration. Red rice yeast also shows lower levels of hepatocyte damage in hepar cells when compared with treatment with DM drugs (glibenclamide + CMC Na). Glibenclamide is a drug commonly used by sufferer DM and can reduce blood glucose levels. Red rice yeast also showed a smaller level of hematocyte damage (12%) when compared to normal controls (18%). Red rice yeast is yeast grown in red rice, while YHE is a yeast extract from the results of enzymatic hydrolysis. Normal control is mice treated with commercial feed plus CMC Na. In type 2 DM and hepar disease, insulin resistance plays a major role in central pathology. Therefore an understanding of the glucose homeostatic defense is essential for the development of therapies in diabetes and hepar disease. Mammalia hepar is the only organ that can regenerate. Damage or loss of tissue by 25% can be regenerated to produce a complete network [13]. Hepar regeneration. as growth compensation in mammals and although it is an organ whose cells undergo slow regeneration, they have the amazing regenerative ability [14].

IV. CONCLUSION

Based on the histological results of the hepar, we can know the level of hepatocyte damage, respectively red rice, red rice YHE, glibenclamide + CMC Na, commercial feed + CMC Na, and CMC Na + DM are 12, 29, 47, 18 and 53%. Red rice yeast has the best ability to regenerate liver cells compared to other treatments. This result can be seen from the smallest level of red rice yeast damage, which is 12%, while the damage level of type 2 + CMC-Na DM as a negative control is 53%, therefore it is recommended that red rice yeast can be used as an anti pre- type 2 DM.

REFERENCES

[1] G. Pocock, Human Physiology 3rd Ed, Inggris: Oxford University Press, 2006.

[2] M. Hundt, H. Basit and S. John, Physiology, Bile Secretion, StatPearls, 2019.

[3] L. O'Brien, P. Hosick, K. John, D. Stec and T. Hinds, "Biliverdin reductase isozymes in metabolism," *Trends Endocrinol Metab,* vol. 26, no. 4, pp. 212-220, 2015.

[4] L. Amitrano, M. Guardascione, V. Brancaccio and A. Balzano, "2002," *Coagolation Disorders in Liver Disease Semin Liver Dis,* vol. 22, no. 1, pp. 83-96, 2002.

[5] L. Rui, "Compr Physiol," vol. 4, no. 1, pp. 177-197, 2014.

[6] D. Raddatz and G. Ramadori, "Carbohydrate metabolism and the liver : actual aspects from physiology and disease," vol. 45, no. 1, pp. 51-62, 2007.

[7] J. C. Ozougwu, "Physiology of the Liver," *International Journal of Research in Pharmacy and Bioscience,* vol. 4, no. 8, 2017.

[8] Campbell, "Liver: metabolic functions.," *Anaesthesia & Intensive Care Medicine. ,* vol. 7, no. 2, pp. 51-54, 2006.

[9] M. Hoffman, "Picture of Liver," WEBMD LLC, 2014.

[10] B. D.P., B. Gao and G. Gershwin, "2013," vol. 3, no. 2, pp. 567-598, Compr Physiol.

[11] J. L. Throop, M. E. Kerl and 2. C. V. 2. N. 1. Leah A. Cohn, "Compedium," vol. 26, no. 12, 2004.

[12] M. J, B. J, C. E, R. JP and C. P., "Biochemistry and regulation of angiotensinogen," *Clin Exp Hypertens A,* vol. 5, no. 7-8, pp. 1005-1019, 1983.

[13] H. Dieter, Liver Regeneration. as compensatory growth in mammals, 2011.

[14] D. Gruyter, Robbins and Cotran Pathologic Basis of Disease (7th ed), Berlin, 1999.

[15] L. F. C., Basic Toxicology. Second Edition., Jakarta: Indonesia University Press., 1994.

[16] L. W. Powell and D. W. Piper, Basic Gastroenterology of Hepatology, Jakarta: PT. Pharos, 1989.