ANALYSIS OF THE COMPOSITE MEMBRANES SEEDS KELOR (MORINGA OLEIFERA) POLYVYLYDENEFLOURIDE (PVDF) AND IT’S UTILIZATION ON LIQUID COAL WASTE

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Abstract

This research created a seed membrane kelor (moringa oleifera)-PVDF. The making of the membrane begins with preparing the solution blending kelor seed powder 2%. Dissolve 4 g of powder kelor seeds into a solution of 200 mL of acetic acid, then stirred with a magnetic stirrer for 2 hours until homogeneous. PVDF dissolved in N-methyl-2 Pyrrolidone (NMP) and blending along with 17/67/17 comparison kelor powders; 23/67/10; 30/67/3; % (b/b/b). On the research of pull-test done and strain the membrane using the Autograph to know the mechanical properties of the membrane, test Uptake to know the capability of inner membrane absorbs water and surface morphology and membrane pore, performed analysis using a Scanning Electron Microscope (SEM). The membrane with a comparison of 30/67/3% (b/b/b) has the best mechanical strength i.e. amounting to 4.43 N/mm2. Test results of membrane based on SEM average pore size 0.1 µm-10 µm, 3-5, 0.5 µm to 2 µm and 1-6 µm. Is a kind of microfiltration membrane size between 0.1 µm 10 µm and Water Uptake test results are all a membrane produces the ability to absorb water reaches 20%.

Key words: membrane kelor seeds-PVDF, SEM, tensile test, water uptake

INTRODUCTION

The development of the business of coal mining economically have wreaked considerable results, either as a fulfillment of needs in energy and as a source of foreign exchange. Coal mining is one of the country's foreign reserves which currently gets special attention, this is due to coal mining activities in the country certainly had a negative impact for living beings and the surrounding environment. The negative impact of coal mining activity not only causes environmental damage occurs, but there are other dangers that are currently thought to often conceal the maintainer of coal mining in Indonesia. Permanent damage due to the opening of the land, the loss of various types of plants, and a host of other environmental damage turned out to be only part of the potential negative impact that is seen in front of the eyes. The development of membrane technology has attracted great attention in the field of industry and waste water treatment, and has been successfully applied in many sectors such as water desalination, water production ultra-pure, product recycling and wastewater treatment. UF membrane separation performance of micro mainly on some of the research that has been carried out used of UF membrane for processing sewage liquid, oil (Cao, 2006:253), polis sulfa (PSF), which is affiliated with organic such as alumina and titanium dioxide. Technology of membrane polyvylideneflouride (PVDF) membrane is one of the best applications in the system, because UF membrane PVDF has a resistance of antioxidants, good chemical or thermal stability, selectivity which is very organic and mechanical properties and the formation of membrane (Loukidou et al, 2001; 273 and Fu Liu et al, 2011; 375). However the downside of PVDF membrane i.e. membrane surface tend to be hydrophobic in nature, so a separation process involving liquid hydrophilic are lower than you should (Aurora et al, 2015). To get the membrane that has excellent performance in the processing of waste is the largest components of water, to the
modification of the surface and pores of the internal membrane used the technique of blending with seed powder kelor. The seeds of the kelor (*moringa oleifera*) is a natural coagulant to water treatment. Kelor seeds contained in the active compound of 4-α-L-rhamnosyloxy-benzyl-isotiosianat capable of adopting and neutralize metal particles in the waste water and dirt particles that drift in the water (Yusrin et al., 2015). Kelor seed utilization with the skin has a better ability to lower turbidity in water compared to using seed kelor without skin. So with this research with the benefits of supporting development conducted a study of how to utilize the content of the kelor seeds, so coal mining activities are not accused of causing environmental damage. Utilization of seed kelor (*moringa oleifera*) as biokoagulan shows that the seeds of the kelor (*moringa oleifera*) are able to lower the turbidity, the levels of heavy metals in coal mining waste water (Nugeraha et al., 2010). Kelor seed powder (*moringa oleifera*) also has a 99.529% effectiveness to lower levels of Fe ion and 99.355% for Mn and 99.868% turbidity in water (Srawaili, 2009 in Nugeraha et al., Yusrin et al, 2010 and, 2015). Research by Pulungan, 2007 regarding the utilization of seed kelor (*moringa oleifera*) to purify waste water, indicating a decrease of waste turbidities’ know of 72.21%. Based on the results of studies about natural coagulant exploration of herbs and the effect on the bacterial content of Coli, kelor (*moringa oleifera*) can reduce bacteria Coli around 28% (July et al., 1986). Excess seed kelor (*moringa oleifera*) contain active substance rhamnosyloxy-benzyl-isothiocyanate are able to adopt and neutralize a mud particles and metals contained in the waste water and easy to cultivated in an environment about the former mining the coal industry, because the plant seeds kelor (*moringa oleifera*) is a plant that can live in an area with an elevation ranging from sea coast up to the plateau.

**RESEARCH METHODOLOGY**

- **Manufacture of composite membrane kelor seed powder (*moringa oleifera*)-polyvylideneflouride (PVDF)**

  The making of the membrane begins with preparing the solution blending kelor seed powder 2%. Dissolve 4 g of powder kelor seeds into a solution of 200 mL of acetic acid, then stirred with a magnetic stirrer for 2 hours until homogeneous. PVDF dissolved in N-methyl-2-Pyrrolidone (NMP) and blending along with a comparison of the kelor powder 0/67/17 (A), 17/67/17 (B); 23/10/67 (C); 30/67/3 (D); % (b/b/b). The next membrane material mixture is stirred with a magnetic stirrer on temperature 40°C to homogeneous for 15 minutes. The solution is then printed using a Petri dish and then soaked in a tub of coagulation containing mixed squads.

- **Data analysis:** Characteristics of composite membranes seeds kelor (*moringa oleifera*)-PVDF include pull-test and taking the image of a cross section of the membrane by Scanning electron microscopy (SEM). Measurement of pull-test on a sample of the membrane using the autograph in the laboratory Course of mechanical engineering State Polytechnic of Sriwijaya. While the surface membrane using SEM imaging was performed in the laboratory of Geology Bandung using SEM Hitchi Co, S-800, Japan. Test specimens for tensile membrane cut size 50 mm x 15 mm x thickness (mm). Dimension testing tailored to ASTM D882. Test the water uptake ability to know the inner membrane absorbs water. The percentage of water uptake can be calculated with the equation:

\[
W_u = \frac{W_{basah} - W_{kering}}{W_{kering}} \times 100\% 
\]
THE RESULTS OF THE RESEARCH AND THE DISCUSSION

• Results of the SEM Photographs (Scanning Electron Microscopy) Seed Powder Kelor (*Moringa Oleifera*)

![SEM Photographs](image)

a. Membrane A  
b. Membrane B  
c. Membrane C  
d. Membrane D

Figure 1. 1000 x Magnification SEM Photo results

Results morphology of seed membrane kelor (*moringa oleifera*)-PVDF from test *Scanning Electron Microscopy* (SEM) with 1000 x magnification shows the membrane pore structured C that is irregular. According to Fanani *et al*, 2014 form membranes and porous holes at random is a membrane in the process of blending is not homogeneous. While the Membrane pore density seen little D with high density. According to (*Septiani et al*, 2014) high pore density indicates the number of the pore is formed by an extensive surface area, it supports in the process of ion exchange that occurs in the membrane. While the membrane pore sizes A, B, C, D of the SEM test results showed the average diameter 3-5 µm to 2 µm in diameter, 0.5 and 1-6 µm. Based on the classification of the Beker, 2004 the resulting membrane types micro filtrating i.e. the membrane pore diameter between 0.1 µm-10 µm). In this study, the membranes of B, C and D contained powder kelor seeds that can't be perfect, and dissolves dry up along with the membrane. As seen in Figure 1. That there is a vapor, this is because solubility kelor seed powder-PVDF at a solvent NPM is limited. So at a certain concentration cannot dissolve or experiencing Burnout (*Indah et al*, 2012), so its homogeneity dope solution less than perfect.

• **Tensile Test and Water Uptake**
Measurement of mechanical properties needs to be done to find out if the membrane forces are forces that can destroy the membrane. Test the strength of the membrane is done at room temperature with dimensions length 15 cm x width 3 cm using a tool that will be generated Autograph value of Load that is the value of a strong membrane at the moment strained in breaking up and Stroke that is the strength of the strain at the time of the break up owned by the membrane. Strong tensile pull test results shown in Figure 2. Based on the results of the test showed A strong tensile membrane 5.33 tensile strength \( \text{N/mm}^2 \), tensile strength B, membrane 4.09 \( \text{N/mm}^2 \), membrane C 4.21 tensile strength \( \text{N/mm}^2 \) and membrane D 4.43 tensile strength \( \text{N/mm}^2 \).

Figure 2. Strong Tensile Result Test

The higher the kelor added strength tensile test is so large, it is according to Kusumawati et al., 2012 due to the structure of the meeting causes the distance between the molecules in the membrane so that meetings increasingly have great tensile strength. While the test of water uptake of membrane-A, B, C and D reached 20% measured the weight of dried membranes for 24 hours.

The results of all membranes can absorb water very well, so that the hydrophilic nature of the membrane that is easy to carry protons. According to Handayani et al., 2007 if the value of water uptake is too large will result in a drop in the mechanical properties of the membrane.

CONCLUSION
1. Based on the results of the analysis of the composite membrane SEM kelor seed powder (moringa oliefera)-PVDF produced included in the kind of mikrofiltrasi that is between 0.5-5 \( \mu \text{m} \).
2. Based on the results of research more and more seed powder volume kelor membrane D increasingly meeting the pore is formed by pull-test value of 4.43 \( \text{N/mm}^2 \). SEM analysis of D membrane looks evenly do not form such as sponges, with composition 30/67/3\% (b/b/b).
BIBLIOGRAPHY


Juli N., Suriawilis U., Birsyam I., 1986. Studi eksplorasi tentang bahan koagulan alami dari tumbuh-Tumbuhan dan efeknya terhadap kandungan bakteri coli, DEPDIKBUD, ITB. 


DEVELOPMENT OF MATHEMATICS TEST TO INCREASE STUDENTS HIGH ORDER THINKING (HOT) SCALE IN EKASAKTI UNIVERSITI

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Abstract

Students' ability in mathematics have been formed from mathematics learning in elementary school, this ability developed in line with how teachers present math problems in the classroom, at the university level there are students who have good mathematical ability and some who are being. The Mathematics Education Study Program of UNES continues to develop instruments to support the improvement of HOTS students' thinking, one of which develops some questions on the Calculus course. This research is Development Research, the results obtained show that the math problem designed is valid with 73% score.

Keywords: HOT's, ability, mathematics education, calculus

Introduction

HOTS is a wider thinking skill, not just remembering, understanding, and the ability to apply a concept but also the ability to think to analyze a concept, to evaluate and even to create a concept (Syafri 2017). Some students of mathematics education study program of UNES considers abstract mathematics is difficult to understand, one of them is in solving the story in Calculus. So what happens is, the students memorize the technique (the order of ways) answer the problem, not understanding the core issues, materials and how to get the idea to solve the problem. Then, through the results of interviews in obtaining data that students understand the problem, in general can, but cannot be an idea how to answer the question. This is also evident from the low MID exam results.

The ability of students to put mathematical ideas in the answer is also important, because writing a systematic and understandable description is needed when read by the lecturer. Calculus is one of the subjects that must be given to the students as a basis to follow other courses. One of the objectives of Calculus learning is to shape and develop mathematical reasoning. Thus it is necessary to calculate the calculus that provides the challenge of mathematical thinking for students.

Human thinking skills can be classified into two, namely lower order thinking skills (LOTS), and higher order thinking skills (HOTS). In addition, Higher Order thinking skills include critical, logical, reflective, metacognitive, and creative thinking. They are activated when individuals encounter unfamiliar problems, uncertainties, questions, or dilemmas (King, 2017: 1).

Higher order thinking skills is an important aspect in teaching and learning especially at higher education institutions. Thinking skills practices are part of the generic skills that should be infused in all technical subjects. Students with higher order thinking skills are able to learn, improve their performance and reduce their weaknesses. "(Heong, et al, 2012: 99). Therefore HOTS students who study mathematics need to know, so it can be arranged qualified mathematics learning. Newman and Wehlage (in Widodo and Sri, 2013: 162) states that "HOT requires students to manipulate the information and implications, such as when
students combine facts and ideas in order to synthesize, generalize, explain, hypothesize, or arrive at some conclusion or interpretation."

The importance of the role of HOTS in Mathematics learning is also demonstrated by research conducted by Rooney (2012: 99), who uses Inquiry-based learning model to improve student HOTS. Furthermore it is said that in the action research done, the researchers measure the students' HOTS based on the mathematics assigned by the students. HOTS that aims to make students solve problems is a matter that is needed by students, so that when students graduate from an educational level, students are ready to face greater challenges (Layli and Asih, 2015: 38). Hots also stressed that the student to be a better future and problem solver (Kerka in Arase, 2016: 7).

Literature Review

(1) Concepts of Instrument Development

In broad outline Gable (1986: 170) gives 15 steps to develop an instrument: (1) develop conceptual definition, (2) develop operational definition, (3) choose technician scale, (4) revise, (5) preparing the final document, (6) collecting the final data, (10) analyzing the test data using the technique grain analysis and realibility, (11) revising the instrument, (12) performing the final trial, (13) producing the instrument, (14) performing the analysis of validity and additional reliability, and (15) preparing the test manual. The procedures for the preparation and development of instruments proposed by Azwar (2012: 15) are as follows: (1) Identification of measuring purposes, (2) domain measurement restrictions, (3) operational aspects, (4) scaling, (5), (7) qualitative evaluation, (8) quantitative evaluation, (9) grain selection, (10) calculation of realibility coefficient, and (11) instrument validity.

From the opinion of the experts above it appears that experts have almost the same opinion about how to develop a measurement instrument. The process of developing an instrument follows procedures in eight key steps: (1) theory study, (2) development of operational definition, (3) determination of constructs, dimensions and indicators, (4) lattice preparation, (5), (6) analysis of legibility and Social desirability, (7) field trials, and (8) data analysis.

(2) High-Level Thinking Skills

High level thinking skill or Higher Order Thingking Skill (HOTS) is a thinking skill at a higher level than just memorizing. When a person memorizes and reprints information without having to think is referred to as rote. At that level, sous a categorizes it as a remembering ability which is the first level in Bloom's taxonomy not HOTS.

Sukarman (2005: 279), cognitive processes and representations can be divided into two continuous parts: (1) lower order cognition (LOC), ie components located in the initial sequence of cognitive processes and still superficial, perceptions, ingestion of patterns and memories, (2) higher order cognition (HOC), components that lie in the final or higher than the cognitive impairment of human processes, for example pioneering, concept formation, reasoning, language, decision making, problem.

Utami (2012: 164) says that high-level thinking skills, which consist of analysis, evaluation, and creating are part of the cognitive abilities that must be developed in all students. A similar opinion is expressed by Brookhart (2010: 5), that HOTS is the best part of Bloom's taxonomy, which is analysis, evaluation, and creation. Brookhart in this case would like to assert that HOTS is the best man-made skill in the cognitive domain.
similar opinion is expressed by Utami (2012: 163), which states that the analytical ability which is the fourth level in Bloom taxonomy, i.e., the ability to separate a material into components to see the relationship of the parts and suitability of is called the beginning of HOTS, while the synthesis of the ability to combine parts into a new whole is an ability that pleases with creativity. Thus it can be concluded that creativity is one of the variables of HOTS.

Furthermore Wang and Wang (2012: 86) states that the three main components and HOTS are exposed, namely critical thinking skills, design thinking and system thinking. Other thinking skills include creative ideas and planning processes, whereas systems thinking includes organizing factors and dynamic interactions. A similar opinion is expressed by Miri et al. (2007: 335) which states that while there are many opinions about the composite component, HOTS consists of three components, namely critical thinking, system, and creative. Thus, design thinking skills have the same meaning as creative thinking skills, so according to the two opinions there are three components of HOTS, namely critical thinking, creative, and system.

Another opinion states that HOTS is composed of two thinking skills. According to Yee Mei Heong, et al. (2011: 121) HOTS consists of two components: creative and critical thinking skills. When students apply both skills it means students apply HOTS. The same is stated by Rosnawati (2009: 3) which states that critical skills and creative thinking are two important components of HOTS. Furthermore, in the planning of University North Carolina State in order to develop HOTS students, it also uses only two variables, namely critical thinking skills and creative thinking skills. Others argue that HOTS is sufficiently measured using critical thinking skills, as did by Miri (NCSU, 2014: 1-28).

(3) Critical Thinking Skills in Mathematics Learning.

As a skill, critical thinking skills are a taught ability. Such capability is needed by a person when faced with problems in order to obtain a solution. This is confirmed by Sihotang and Febiana (2012: 7-8), which states that in order to develop critical thinking skills, there are 8 steps that need to be done: recognize problems, find ways that can be used to handle problems, collect and arrange information, recognizing unassigned assumptions and values, using appropriate, clear and distinct language in discussing a problem or a thing it's trying to do, evaluating, looking at a logical relationship, and drawing conclusions. Further Faiz (2012: 26) states that critical thinking consists of five types of skills, namely the skills to analyze, synthesize, understand and solve problems, conclude, and evaluate or assess.

In Mathematics is also known the term principle, which need an understanding of the various concepts. This is stated by Hudoyo, that if an idea or idea connects two or more concepts, then the idea is called the principle, Herman (1988: 75). Thus, based on the synthesis results of previous critical thinking skills, describe the characteristics of a person who has critical thinking skills, the cause of critical thinking skills, and how the steps to have critical thinking skills, it can be concluded that the critical thinking skills in learning mathematics is the ability of students to think in producing mathematical knowledge, which includes the use of concepts, principles, and predict the knowledge of mathematics it has, which includes problem solving and decision making.

(4) Creative Thinking Skills in Mathematics Learning

Based on Munandar (2012: 163), there are 10 main characteristics of creative personality: (1) imaginative, (2) having initiative. (4) independent in thinking, (5) elitism, (6) happy adventurous, (7) full of energy, (8) confident, (9) willing to take risks, and (10) brave.
Furthermore, Leo (2008: 7) says that to learn creativity, there are several techniques, among others: (1) serendipity, (2) divergent thinking, (3) belief in ability possessed, and (4) forcing relationship.

More specifically, de Bono (1993: 7) developed a thinking technique called lateral thinking to be a creative person. This developed technique is not scientific and includes a seemingly illogical method of provocation. But in fact this method is very logical in arranging the pattern of the system. According to Moseley et al. (2005: 44) The procedure for creative thinking is (1) redefine problems and objectives, (2) find the analogy, (3) list relevant terms, (4) brainstorm, (5) and use a variety of solutions, (6) list the attributes, (7) list the positive, negative and interesting aspects of the attributes of the various solutions, (8) visualize in various perspectives.

Thus, based on the synthesis results of creative thinking skills in mathematics learning is the ability of a student to generate new ideas / products, through working within the limits of competence, trying new things and producing unusual mindsets, through divergent patterns of think, and patterns lateral thought.

Methodology

This research was conducted in Mathematics Education Study Program of UNES, that is odd semester student. Type of research development (research development). Here are the steps that have been developed based on the theory of theories that have been proposed in the theory study, namely: (1) the study of theory, (2) the development of operational definition, (3) the determination of constructs, dimensions, and indicators, (4) (5) compilation of items, (6) analysis of legibility and Social desirability, (7) field cba test, and (8) data analysis. In accordance with the type of data to be obtained in this study, the research instrument using validation sheet, implementation observation, and questionnaire.

Results and Discussion

This stage is done with two stages of testing are: the validity test and the test of practicality where in each of these trials have been in the validator by the expert concerned. Here are some math problems:

1. Operations * for the set of numbers S = {0, 1, 2, 3, 4, 5, 6} are defined according to the table below:

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If for any integer n greater than 1 is defined $x^n = x^{n-1} \cdot x$, so $5^{2015} = ...$

2. A number is said to be good if there are 2 conditions that have been arranged as follows:
   a. Is the perfect square, the square of a natural number b.Jika most kana digit on the
writing of the decimals moved its position to the leftmost digit, then the number formed is still a perfect squared. For example, 411 is a good number consisting of 3 digits, since 441 = 21^2 and 144 = 12^2. While 144 is not a good number because 144 = 12^2 but 414 is not a perfect squared number. Prove that there are good numbers whose decimal writing consists of exact 2011 digits!

**Validation Problem**

Validation of teaching materials is done based on several aspects, namely the content feasibility aspect, linguistic aspect and scientific aspect. Validation results reviewed from the content feasibility of obtaining an average of 73% with a valid category. This means the developed question has contained appropriate and ongoing content with SAP, the material and the level of student ability. Problems designed to increase students’ critical thinking.

Furthermore, from the validation on the language aspect obtained an average of 3.33 are included into the category valid. This means the language used in the matter has been in accordance with the rules of Indonesian language is good and true and easy to understand students. The next stage in review of the scientific aspect, the problems developed have met the scientific steps such as students are more active in asking and reasoning.

A good question meets the criteria of validity and should also be practical. The practicality of the problem relates to the ease of lecturers and also students in using. This practicality test can be done through questionnaires to lecturers and students as users of the matter. Based on the observation of the implementation of the problem, it is known that the implementation of Calculus lecture by using this designed problem has been going well.

**Conclusion**

Based on the experiments conducted, it is concluded that the mathematical problems designed in this development research have been valid in terms of content and constructs. The Mathematics Education Study Program of UNES continues to develop instruments to support the improvement of HOTS students’ thinking, one of which develops some questions on the Calculus course. The results show that the math problem designed is valid with a score of 73%.

**References**


