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Implementation of Biology Learning Based on Local Culture Science to Improvement of Senior High School Students Learning Outcome in Ciayumajakuning Area

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Abstract. The purposes of this research are to assess: 1) Application of biology learning based on local science culture in Ciayumajakuning region, 2) Improvement of students learning outcome which apply biology learning based on local culture science in Ciayumajakuning region, 3) The difference of students learning outcome which apply biology learning based on localculture science in Ciayumajakuning Region, 4) Students' respond to application of biology learning based on local culture science in Ciayumajakuning Region. This research used in Ciayumajakuning Area (Cirebon district, Kuningan district, Majalengka district, and Indramayu district). This research uses quantitative approach with pre-experimental methods, and the research design called by one group pretest-postestdesign. Population of 10th and 11th grade senior high school students are 1275 persons, 129 persons of 10th and 70 persons of 11th picked as the sample. The Sample chosen by random sampling technique. Written test and questionnaire are used as the instruments. Annova statistical research is used as data analysis techniques. The results of the study showed the average of improvement of Students Learning outcome which apply biology learning based on local culture science in Kuningan district (0,59) is higher than Majalengka district (0,560), Cirebon district (0,49), and Indramayu district (0,28). Based on result Anova test, significance values was obtained 0.040 <0.05. There are significant differences between the improvement students' learning outcome which apply biology learning based on local culture science between district in Ciayumajakuning Region. Biology learning based on local culture science gets positive responses from the students.

Keyword: Local Cultural Science, Learning Outcome

INTRODUCTION

Students in general are less interested to study science because they find science is difficult and hard to understand. Students' opinions are infact inapproproate to the real ideas of science as science can explain any phenomena experienced by the students. Education in schools usually demands students to master the concepts only while in fact students should be able to apply the concepts in their real life. Values held by local people are full of *local genius,* but they have been ignored in education especially in the teaching of science in schools as a result science teaching becomes "dry" and less meaningful [20]. If science teaching in schools does not consider students's local culture the consequence is that students will refuse or only receive some of the concepts in science which are developed in the lesson. Science teaching will tend to strengthen students' point of view of the universe which will create culturation if sub-cultures of modern science taught in schools are in harmony with the subcultures of the students' daily life. If culturation happens, students' scientific thinking skill of daily life also will increase. On the other hand if the sub-cultures of modern science taught in schools are different or even contradictory to the subcultures of the students' daily life about science, as what has happened to the majority of students [1], science teaching will tend to undermine or separate students' view of the universe, until they abandon or put aside their native way to know something and move away from scientific method.

One of the problems faced by some of the local administrations is the degradation of moral, social and cultural values which continually occur in the community. This is because of the waning of cultural values among the younger generation due to globalization. The influx of foreign cultures in the globalization era can threaten the existence of the local culture.Biology is a science that originates from human curiosity about himself, about the environment, and about the continuity of humankind. Biology teaching should balance between the knowledge itself and the environmentor local science and cultures that exist and develop in the community. Students'socio-cultural environment need to be given serious attention in developing biology teaching in schools.The result of preliminary observations which have been conducted in high schools in the area of Ciayumajakuning shows that the learning and teaching process still tends to focus on mastery of concepts only. The ability of students in terms

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of analyzing and critiquing community activities related to science is still very low. Learning only focuses on mastery of concepts. The ability of students to relate concepts learned in everyday life is still far from expectations. As a result, students' understanding of natural phenomena becomes meaningless.

Environment around students has been underutilized as a source of learning thgouh in fact it provides various objects of study that can raise the curiosity of students in the learning process. It is this attitude that needs to be facilitated by the teacher for students to thrive until they reach an understanding by themselves. Selection of appropriate learning approach by a teacher is very important in overcoming problems during the teaching and learning process and is expected to create a maximum general learning approach which facilitate, inspire, strengthen, and underlie theoretical learning methods in a particular concept.

One of the learning activities which is expected to improve students' achievements is by getting students to learn the local culture and science that exist in their environment. The use of local culture in science learning does not mean bringing students to think mystically or mythically, but it is very useful for the interpretation process and develop thinking skills. Students gain contextual learning experience and apperception material from the concept of local culture that exist around them. In addition, a model of cultural integration in learning will enrich the local culture, which in turn can also develop and establish national culture which is made up from the best of the local cultures and ethnic cultures that have developed. Local culture-based learning is a form of learning that blends school teaching with local culture [22]. The process of learning involves local communities by bringing local cultures and adjust the teaching materials in schools. Learning objectives are formulated in accordance with the existing curriculum combining the national curriculum with local content.

Local culture based teaching in biology is a learning that utilizes science in the local culture, either on the aspect of scientific knowledge that has not been proven by western science or knowledge that has been proven by western science and others of which are beneficial to the development of learners' competence. Local culture based teaching strategy in bilogy learning is expected to be able to to tackle various problems encountered in the teaching and learning process. This strategy is expected to provide the students with motivation for learning as this type of learning strategy is very meaningful and is also expected to improve students' achievment. Based on the background above the writer is interested in conducting a research titled " Implementation of Biology Learning Based on Local Culture Science to Improvement of Senior High School Students Learning Outcome in Ciayumajakuning Region".

METHOD

This study was conducted in high schools in the area of Ciayumajakuning (Cirebon, Indramayu, Majalengka, and Kuningan). Research was conducted in the second semester of the school year 2013-2014. Research used pre-experiment design. The population in this study were all high school students of grade X and XI amounted to 1,275 persons. The samples in this study were students of grade X (129 people) and XI (70 people). Samples were taken by random sampling. This research used experimental method. The study used one-group pretest-posttest design. Data were collected with tests and questionnaires, while data analysis techniques used statistical test or ANOVA test.

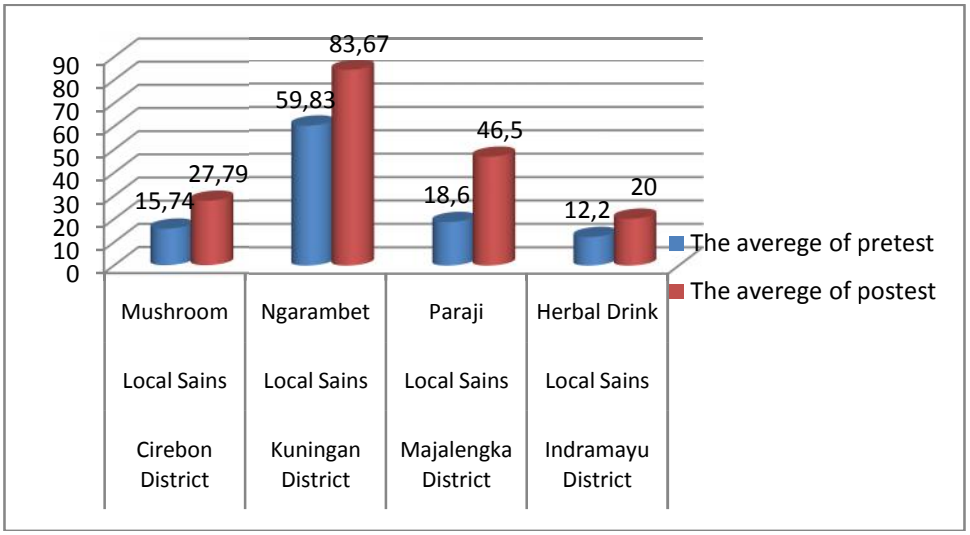
RESULTS

Implementation of Local Culture Based Teaching in Biology. Implementation of local culture based teaching in biology in this research was through the development of the concept of local culture in the process of learning science. Learning is made more emphasis on providing direct experience with the environment. The design of learning activities was through group discussions, observations, presentations, lab, manufacturing of products. Instructional media used were videos, articles and teaching materials that described the activities of the local culture and their relation to the concept of biology. The goal is to improve the quality of teaching to motivate students in learning biology so that students are able to explore the potentials to improve achievements. Application of biology teaching in the concepts of plant tissue is integrated in the local culture of herbal drink, the

concept of ecosystem is integrated in local culture of "Ngarambet", the concept of environmental pollution is integrated into the local culture of mushroom utilization, and the concept of reproductive system is integrated in the local culture of "Paraji".

Average Increase in Students' Achievement after the Application of Local-Culture-Based Teaching in Biology.

Table 3. The average of students' achievements increased after the implementation of Local-culture-based teaching for all concepts in biology in Ciayumajakuning areas



Based on Table 3 it is known that the average of students' achievements increased after the implementation of Local-culture-based teaching for all concepts in biology in Ciayumajakuning areas. Average pretest and posttest score of the students in local-culture-base teaching in biology was highest in the local culture of "Ngarambet" for the concept of ecosystems and the average pretest and posttest was lowest for the local culture of herbal plant in the concept of plant tissue.

Differences in the Average Increase of Students' Achievement After the Implementation of Local Culture BasedTeaching in Biology. Based on Table 4 it is known that the average increase of students' achievement for the local culture "Ngarambet" in Kuningan regency was (0.59) higher than Majalengka (0.56), Cirebon (0.49), and Indramayu (0.28). Increased students'achievement in local-culture based teaching in Cirebon, Kuningan, and Majalengka was at N-gain criteria medium and students'achievement in Indramayu regency was at a low criteria. Differences in students' achievement among regencies in the area of Ciayumajakuning can be seen in Table 5.Based on Table 5, ANOVA test results showed significant value of 0.000 <0.005, meaning that there was a significant difference in students' achievement after the implementation of local-culture-based teaching in biology in Ciayumajakuning area.

Students' Response towards Local Culture Based Teaching in Biology. Based on Table 6.Average students' response to the implementation of local-culture-based biology teaching ranges from strong to very strong. Implementation of local-culture-based teaching in biology received a positive response from students.

DISCUSSION

Average students' achievements increased with the implementation of local-culture-based teaching in biology for all concepts in the area Ciayumajakuning. Average students' pretest and posttest in local-culture-based teaching in biology was highest in local culture "Ngarambet" to the concept of ecosystems while the lowest average of the pretest and posttest score was on the local culture of herbal plant for the concept of plant tissue. Improved

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students' achievement was due to local-culture-based teaching had integrated elements of the environment in the learning and teaching process. Environment where students live are used as a medium to foster the spirit of student learning and to explore the potential of students by analyzing all the activities carried out in the community. Environment here gives a new color in the learning thereby increasing the motivation of students to understand the material presented by the teachers and has implicated in the improvement of students' achievements.

Table 4. Differences in the Average Increase of Students' Achievement After the Implementation of Local Culture Based Teaching in Biology

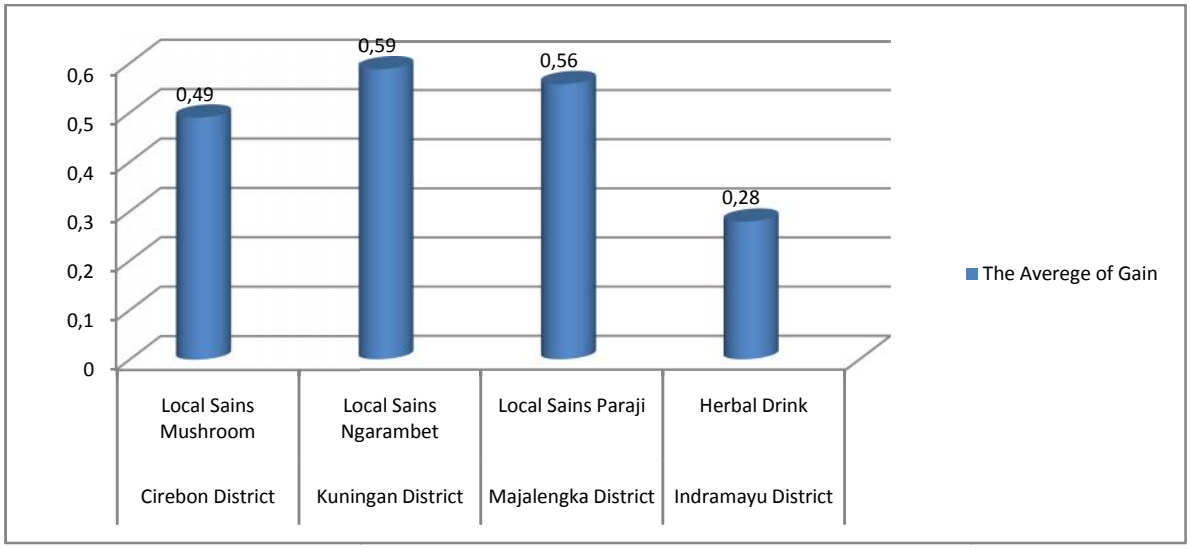

Table 5. ANOVA Test Differences in students' achievementamong regencies in Ciayumajakuning area

F_{hitung}	Df	Signifikansi	Keterangan
52,283	3	0,000	different significant

Table 6. Students' Response towards Local Culture Based Teaching in Biology

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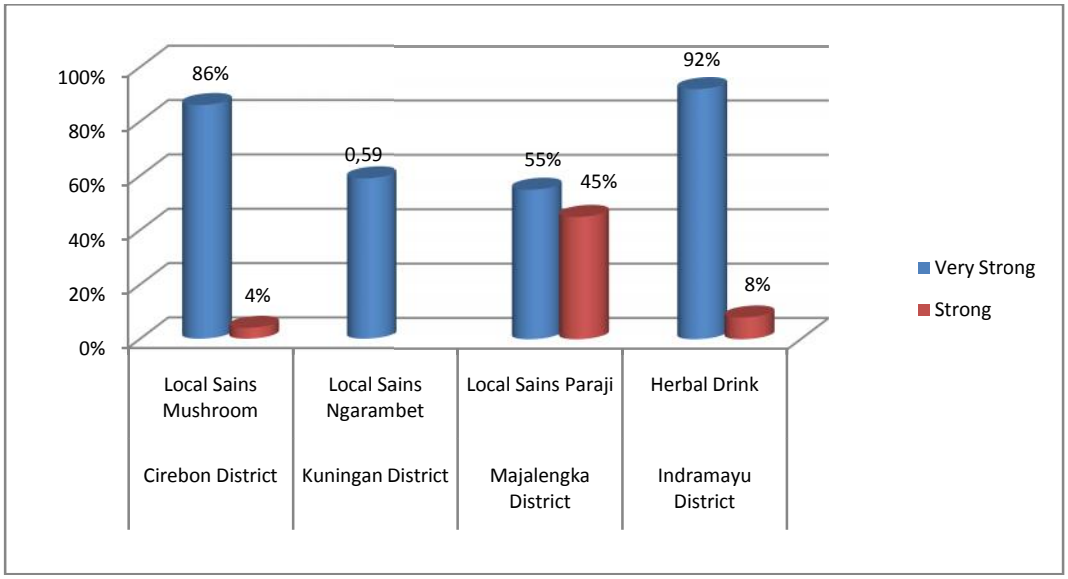

Theoretically, the implementation of local-culture-based teaching model in biology can help students to bridge the gap between theoretical knowledge with cultural knowledge from generation to generation, so that the students' understanding will be better and ultimately achievements will increase. The presence of cultural background on students greatly affect the way students learn, understand and master the concepts taught by teachers at school [22]. Students' achievements in schools are 70% influenced by the ability of students and 30% are influenced by the environment. Implementation of local-culture-based biology teaching has created new ideas in the minds of students which can relate students' previous concepts to the new concepts being studied. Modification of the concepts developed in the minds of students about the local culture will reconstruct the concepts through the interaction during the learning process. Learning biology using local-culture-based teaching model increases students' achievements and this is because: 1) Theoretically, a local-culture-based biology teaching can help students in bridging between theoretical knowledge with practical knowledge, so that students' understanding will be better and in the end achievements will increase, 2) local-culture-based biology learning emphasize on students activism to seek information by jumping directly to the community and apply the existing concepts, 3) local-culture-based biology learning is designed with the principles of contextual learning in which teacher transfer all the knowledge to students by connecting learning materials with the facts in the surrounding environment, so that learning will be more meaningful for the students to understand the biological concepts for the benefit of the environment.

Average increase in students' achievements in Kuningan regency was (0.59) higher than Majalengka (0.56), Cirebon (0.49), and Indramayu (0.28). Increased students' achievements in local-culture-based biology learning in Cirebon, Kuningan, and Majalengka is at medium N-gain criteria and students' achievements in Indramayu regency was at a low criteria. ANOVA test results showed a significant value of 0.000 <0.005, meaning a significant difference in achievements in students who applied local-culture-based biology learning in Ciayumajakuning area. Differences in students' achievements with the application of local-culture-based biology learning in Ciayumajakuning area influenced by factors: 1) the intellectual ability of the students. Intellectual abilities associated with level of intelligence, and intelligence is correlated with the level of thinking skills. The development of thinking skills is correlated with the level of intelligence, 2) teachers' teaching quality. Good quality teaching by teachers will increase students' motivation and achievements. Whatever wasy science is taught it are the teachers who mainly determine what students learn. Thus among the many factors that influence the teaching of science such as teachers, number of students in the classroom, laboratory equipment and administrative staff, it turns out that teacher is a major factor for the success of science learning, 3) learning environment. Learning environment tailored to local cultural conditions able to stimulate the imagination of students, so that students can learn independently and be able to convey his ideas about the concepts being studied. The cultural and environmental approach students are encouraged to understand the concept of science using the environment as a learning

resource [11]. Starting from the care and understanding they can find solutions, make decisions, and most importantly, students can develop the potentials in the neighborhood, 4) Differences.in the characteristics of the concepts in biology can develop students' thinking skills. The concepts have characteristics which are based on attributes and have a hierarchy based on inclusiveness.

The concept of ecosystem, environment pollution, reproductive system, plant tissues have different characteristics. On the concept of ecosystem, including the type of concrete concepts, the concept of environmental pollution is a concept based on the principles, concepts of plant tissue is an abstract concept, and the concept of reproductive system is a kind of abstract concept but a concrete example. The different characteristics of the concept led to the perception of students toward understanding different concepts of Biology. The concept of the ecosystem, environmental pollution and the reproductive system is a concept that is applied in daily life so as to provide a higher perception of student's achievements as compared to the increase of the concept of plant tissue. On the concept of plant tissue increase in students' achievements is the lowest (0.28), this is because the plant tissue is a type of abstract concepts that require high visualization in understanding.

Average students' response to the implementation of local-culture-based teaching model in biology is positive. This shows the success of local-culture-based teaching model in biology. The implementation of local-culture-based teaching model in biology can increase the curiosity of students to study the material in depth, involvement of the student in learning, students' motivation, understanding of learning materials, students' horizons, the ability to retell material that has been learned, and thinking skills.

CONCLUSION

1. Average students' achievements that apply local-culture-based teaching model in biology increased for all concepts in the area of Ciayumajakuning. The average increase of students' achievements that apply in Kuningan regency (0.59) is higher than Majalengka (0.560), Cirebon (0.49), and Indramayu (0.28).
2. There are significant differences in the increase of students' achievements which apply local-culture-based teaching model in biology in the region of Ciayumajakuning.
3. local-culture-based teaching model in biology gets a positive response from students.

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Preliminary Study of Magnetotellurics Measurement on Seulawah Agam Volcano

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Abstract. Magnetotellurics method survey has been used for investigation subsurface structures of geothermal field of SeulawahAgam, District of Aceh Besar, Aceh Province. Transfer function of Magnetotellurics data were collected using MTU Unit instrument. We have recorded 2 components of electric fields and 3 components of magnetic fields in the range of frequency from 10^{-5} to 1 kHz. 5 stations with spacing varied from 2 to 10 km were measured along a profile with length of 30 km. The profile crosses SeulawahAgam volcano in south-north direction. Apparent resistivity and phase data of TE mode were included for 2-D inversion modeling using the MT2DInvMatlab code. The inverted model shows well distribution of electrical conductivity associated as hydrothermal structure. At the depth of 200-800 m there is a conductive layer ($\rho < 10$ Ωm) predicted as cap rock structure and at the depth of 1-4 km there is a hydrothermal reservoir indicated by resistivity values 100-1000 Ωm..

Keywords: Magnetotellurics method, resistivity,2 Dmodelling, Seulawah Agam.

INTRODUCTION

Geothermal energy is energy stored in rocks below the Earth's surface and the fluid contained therein. Most of geothermal systems are found along subduction zones. Indonesia is a country located at triple junction plate tectonic setting where the Eurasian, Pacific, and indo-Australian plates meet. The condition puts Indonesia as a biggest country in the world with geothermal resources (Fig. 1). One of them is found at SeulawahAgam Volcano in Aceh Besar Regency of Aceh Province. Aceh government is going to develop electricity power plant at SeulawahAgam Area in the next couple years. Therefore depth studies on geothermal prospecting are urgently needed in the area. In this paper we present a preliminary result of geophysical method of Magnetotelluric (MT) measurement on SeulawahAgam area.

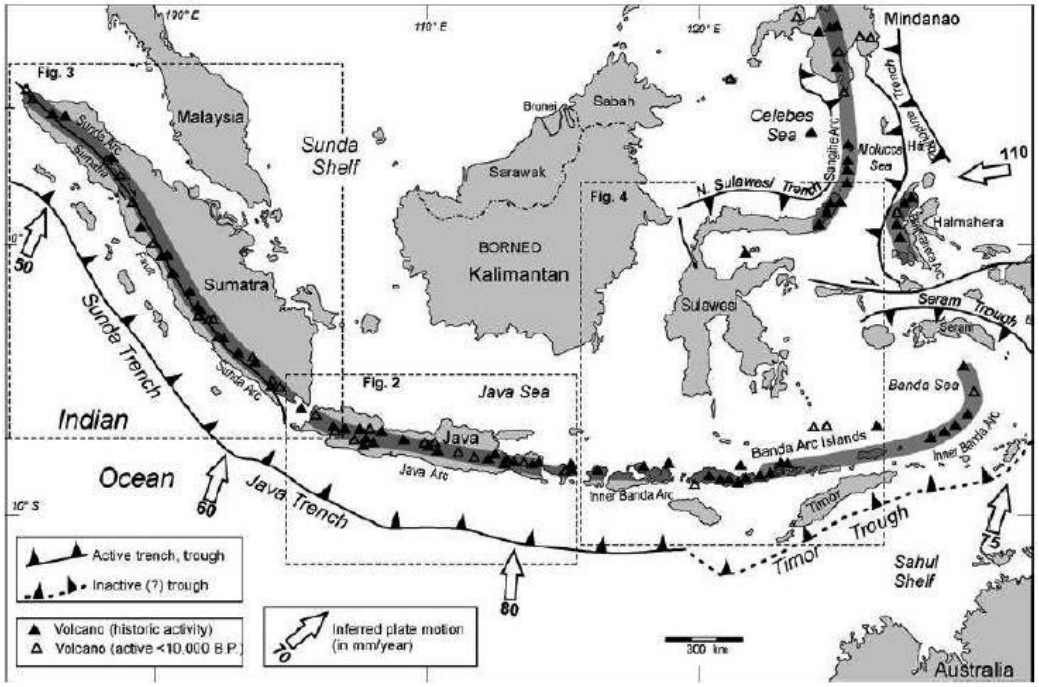

FIGURE 1. Range of volcanic region in based on [2].

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Electromagnetic Method. In terms of the origin of the source of electromagnetic waves are used, the MT measurement is a method of passive electromagnetic (EM) that measure the fluctuations of the electric field (*E*) and the magnetic field (*H*) in the direction of the natural orthogonal to the surface of the Earth as a means to determine structures of Earth conductivity from a depth of dozens of meters to thousands meters [3]. The MT method utilizes a variation of the current telluric in the frequency range 10^{-5} to 10^{4} Hz. Magnetotelluric equipment can detect the terrain through the primary and secondary air (ionosphere), so the field effect of primary and secondary fields can be detected, and there will be different phases and relative amplitude that can be detected at the receiver. Due to the difference of the measured components, the method will reveal the existence of important information about electrical and magnetic parameters arising in a wide range of conductive medium[4]. Information on the electrical conductivity of the medium contained in data magnetotelluric can be obtained from the completion of Maxwell's equations.

Variation of electrical resistivity below subsurface can be calculated based on the formulations introduced by[1]. If it is assumed that electromagnetic waves penetrate the Earth homogeneous isotropic, then apparent resistivity (ρ_{xy}) and phase ($\emptyset_{xy}$) can be calculated based on impedance elements (**Z**), i.e.

$$\rho_{xy} = \frac{1}{\omega\mu_0}\left|Z_{xy}\right|^2 \quad (1)$$

and

$$\square_{xy} = \tan^{-1}\left(\frac{\mathrm{Im}(Z_{xy})}{\mathrm{Re}(Z_{xy})}\right) \quad (2)$$

whereω is frequency and $\mu_0$is magnetic permeability of free space. The subscript of x and y in the equations are indicate direction of electric and magnetic fields measurement, respectively.

METHODS

Magnetotelluric data were performed in four districts in the region of Aceh Besar, i.e. in Jantho (C1 and C2) point, Lembah Seulawah (C3), Seulimum (C4), and Mesjid Raya (C5). The distance between the stations vary where between C1 and C2 is 1.04 km, C2 and C3 is 11.8 km, C3 and C4 is 13.5 km, and C4 and C5 is 3.7 km. The stations are almost formed in strike line crossing the SeulawahAgam volcano in the South to North direction. The data were measured from each stations varied from 6 to 12 hours with frequencies from 320 to 1.03 Hz.

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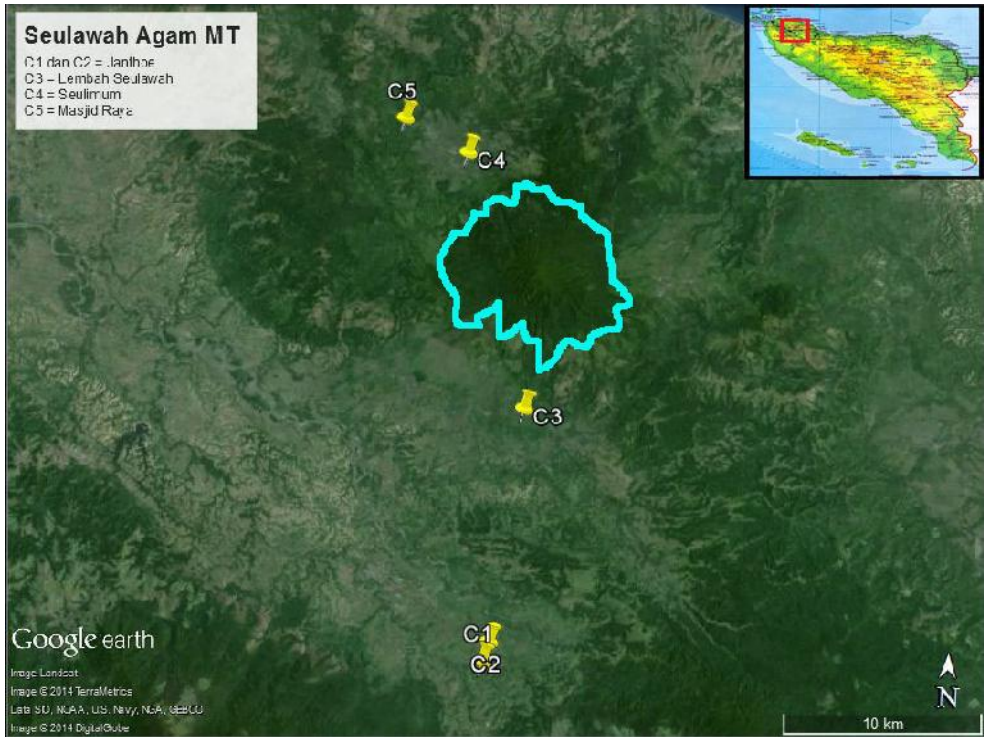

FIGURE 2. The location of research area and MT stations

RESULTS AND DISCUSSION

In order to predict conceptual model of SeulawahAgam volcano we used transverse electric (TE) mode data only. We believe that the targets sought in geothermal exploration are mostly conductors associated as the depth of the reservoir and cap rock. The TE mode data are mostly believed sensitive to the conductors. The TE mode data include apparent resistivity and phase were used for the inversion. The MT2DinvMatlab code developed by SeongKon Lee of Geothermal Resources Group, KIGAM, Korea was used for inversion. The apparent resistivity and phase data as well as the inverted 2D Model of electrical resistivity of SeulawahAgam sub-surface using MT2DInvMatlab shown in Figure 3. The apparent resistivity and phase data indicate the presence of resistive zones at a distance of 10-30 km along the profile. The similarities between the measured and calculated data showed a relatively good inversion process where 0.2 – 0.5 RMS have been reached during the inversion.

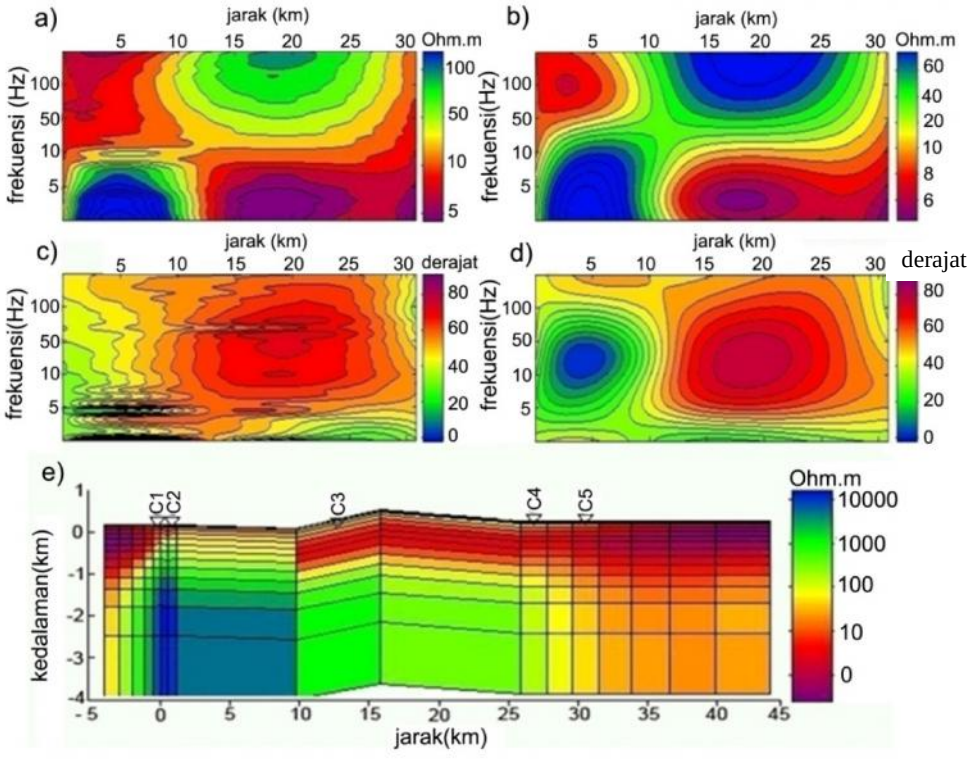

FIGURE 3. Inversion process results that show measured apparent resistivity (a), calculated apparent resistivity (b), measured phase (c), calculated phase (d), and inverted model (e).

Figure 3 shows a comparison between measured and calculated data of apparent resistivity and phases along the profile. The area is dominated by both conductive and resistive zones. The inverted model shows a resistive zone at depth 200 to 800 meters and distance 10-25 km along the profile. The zone is predicted as cap clay layer with electrical resistivity values <10 Ohm-m. Geothermal reservoir is expected at depth of 1 to 4 km with resistivity values vary from 50 to 100 Ohm-m. The inverted model also shows fault area at distance 0 to 10 km along the profile where it indicates by low resistivity values. At the southern part of the profile is expected as recharge area.

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The Application of Experimental Based Guided Inquiry Model in Human Excretion System Material to Improve Students' Science Process Skill

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Abstract. The aim of this research is to find out the improvement of students' science process skill through the application of experimental based guided inquiry model in human excretion system. This research was conducted at SMA Negeri 1 Indrapuri Aceh Besar from April to June 2014. It used experimental based guided inquiry method with class of IPA_2 (n=25 students) as experiment class and IPA_3 (n=25students) as control class. The application of experimental based guided inquiry model was analyzed by using science process skill rubric for the experiment class at the time of experiment and discussion with observationchecklist for control class. The result shows that experimental based guided inquiry model improves science process skill of students of the experiment class. The skill of students of class of IPA_2 (n=25students) has improved from enough to very good, while the skill of class of IPA_3 (n=25students) has not improved from enough category. It can be concluded that students who were taught by using experimental based guided inquiry model has better science process skill than those were taught by discussion.

Keywords: Experimental Based Guided Inquiry Model, Science Process Skill, Excretion System.

INTRODUCTION

The scientific approach is the approach used in the curriculum of 2013. To enhance scientific approach, reasoning in finding is needed. To be called scientific, it has to rely on proofs of objects that are observable, empirical, and measurable with specific reasoning principles [2,4]. One of learning models that goes along with scientific approach is the inquiry model.Guided inquiry model is a model where students are guided to find a conclusion from a series of activity, as if the students acquired the knowledge by themselves [8]. Guided inquiry model is suitable to enhance students' science process skill because it is related to skills they learn in research such as observing, formulating the research question, hypothesis, planning the experiment, conducting the experiment, collecting data, and drawing the conclusion [12]. That way the learning phases in experimental based guided inquiry can train the students' science process skill. This model is well planned, truly instructionally controlled so the students can understand the material taught by teachers more comprehensively [6,1].

Science Process Skill (SPS) is a complex ability used by scientists in conducting scientific research in learning process [3,5]. Science process skill is a series of measurable activities from an experiment. Experiment is the best way to develop process skill [9,7]. Experiment is an important activity in learning process. This activity is done in support of achieving the learning objectives. Some objectives cannot be achieved by the students and it can affect the outcome of their study [11,15]. Biology learning nowadays is still focused on teacher as the main character in teaching-learning process (teacher centered) not student oriented. It is still far from reaching the goal of curriculum 2013, which are to accelerate and motivate students to be smarter, more creative and active in learning.

MATERIALSANDMETHODS

The research was conducted at SMA Negeri 1 Indrapurilocated on Jalan Banda Aceh-Medan Km. 27 Indrapuri Aceh Besar. It was carried out in the even semester of academic year 2013/2014, from April 5th to May 5th 2014. Observation checklist is an instrument used to measure students' science process skill during experiment in experiment class, and discussion observation chek list in control class.Population in this research is 75 students of class XI IPA at SMA Negeri 1 Indrapuri consisting of 3 classes; XI IPA1 (n=25 students), XI IPA2 (n=25) students, and

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XI IPA3 (n=25 students). Sample in this research are students of class XI IPA2 (n=25 students) as experiment class and XI IPA3 (n=25 students) as control class. Sample was chosen through purposive sampling. It is the act of choosing sample based on certain consideration [13]. In this research, the researcher used two classes: experiment class and control class. Experiment classis the class that used experimental based guided inquiry modeling the learning process, while control class used discussion in learning. The experiment design used in this research is based on guided inquiry. Observation form was established to asses science process skill during experiment, which were examining urine pH, glucose in urine, CO_2 and H_2O excretion from lungs, testing body temperature and gall in experiment class. Whereas in control class, the observation sheet was used in assessing science process skill during discussion which were about kidneys, lungs, skin and liver. Assessment scale ranges from 1 to 4. The numbers mean: 1 = poor, 2 = fair, 3 = good, 4 = very good.

$$\text{Result} = \frac{\text{Total Student's Score}}{\text{Maximum Score}} \text{x}100$$

Suwandi: 2011

Table 1. Science Process Skill Observation's Result Criteria

Score Total	Result		Category
	Number	Letter	
28-36	81-100	A	Very Good
19-27	61-80	B	Good
10-18	41-60	C	Fair
0-9	20-40	D	Poor

RESULT AND DISCUSSION

Science Process Skill Result of Experiment Class. Data from analyzing science process skill of students of experiment class has improved during the implementation of guided inquiry while experiment. The improvement occurred in all science process skill observed. It was observed in every experiment.The overall data analyzed from every experiment is shown in (Figure 1).

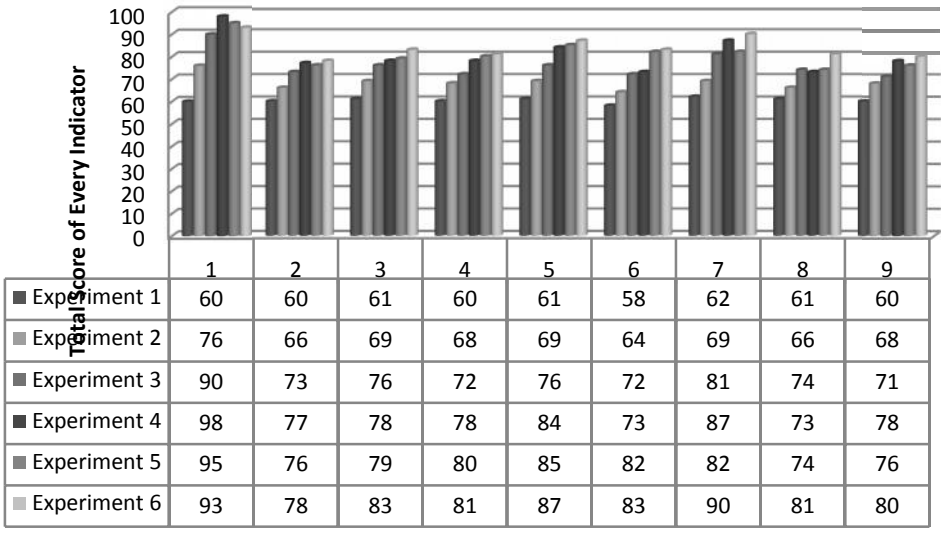

FIGURE 1. The total scores versus the experiment.

1= observing indicator
2= classifying indicator
3= predicting indicator
4= questioning
5= hypothesizing indicator
6= experiment or research planning indicator
7= tool and material usage indicator
8= implementing concept indicator
9= communicating indicator

Experiment 1 = examining urine pH
Experiment 2 = examining glucose in urine
Experiment 3 = examining CO_2 excretion
Experiment 4 = examining H_2O excretion
Experiment 5 = examining body temperature
Experiment 6 = examining gall pH

The Average Improvement of Science Process Skill. Based on the analysis, every indicator of students' science process skill in every experiment has improved. The improvement is shown in (Figure 2).

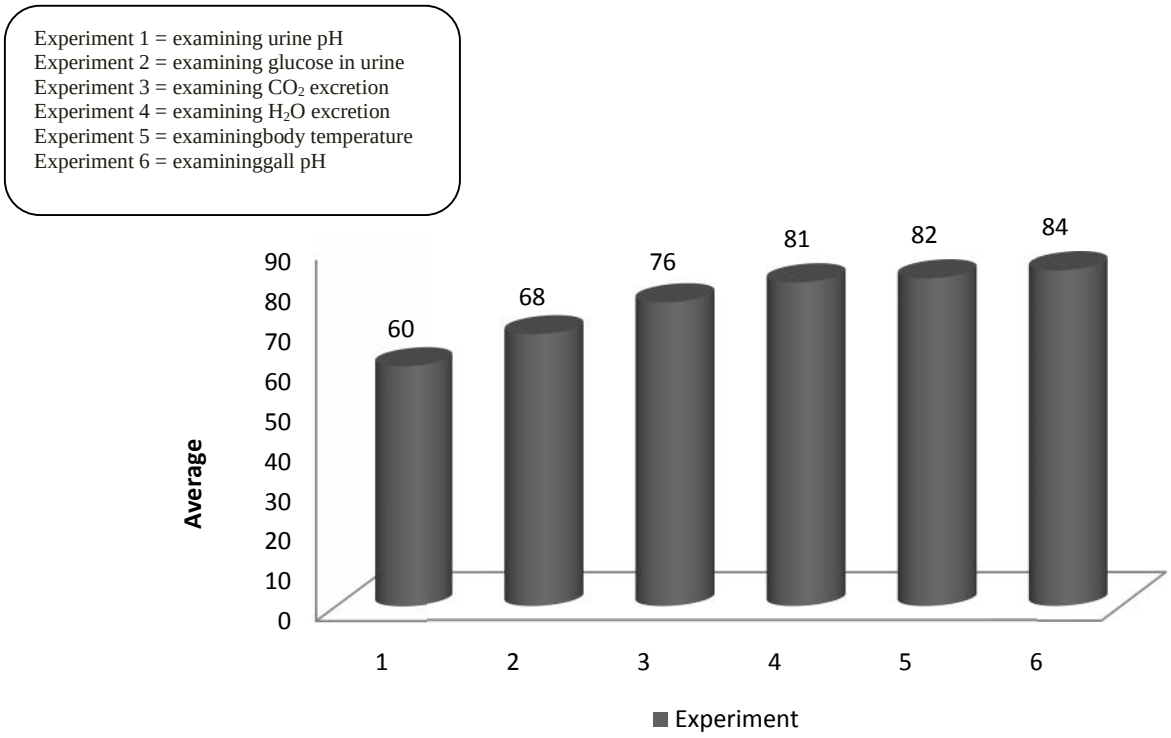

FIGURE 2. The average scoresversus the experiment.

Figure 2 exhibit that the average scores in each experiment has improved. The average score of examining urine pH experiment 60 which is fair, the average score of examining glucose in urine experiment 68 which is, the average score of examining CO_2excretion experiment 76 which is good, the average score of examining H_2O excretion experiment 81 which is very good, the score of examining body temperature experiment 82 which is very good, and the score of examining gall pH experiment 84 which is very good. Thus, experiment is a method that can improve science process skill, since by doing experiment students can develop the basic skills of experiment. It

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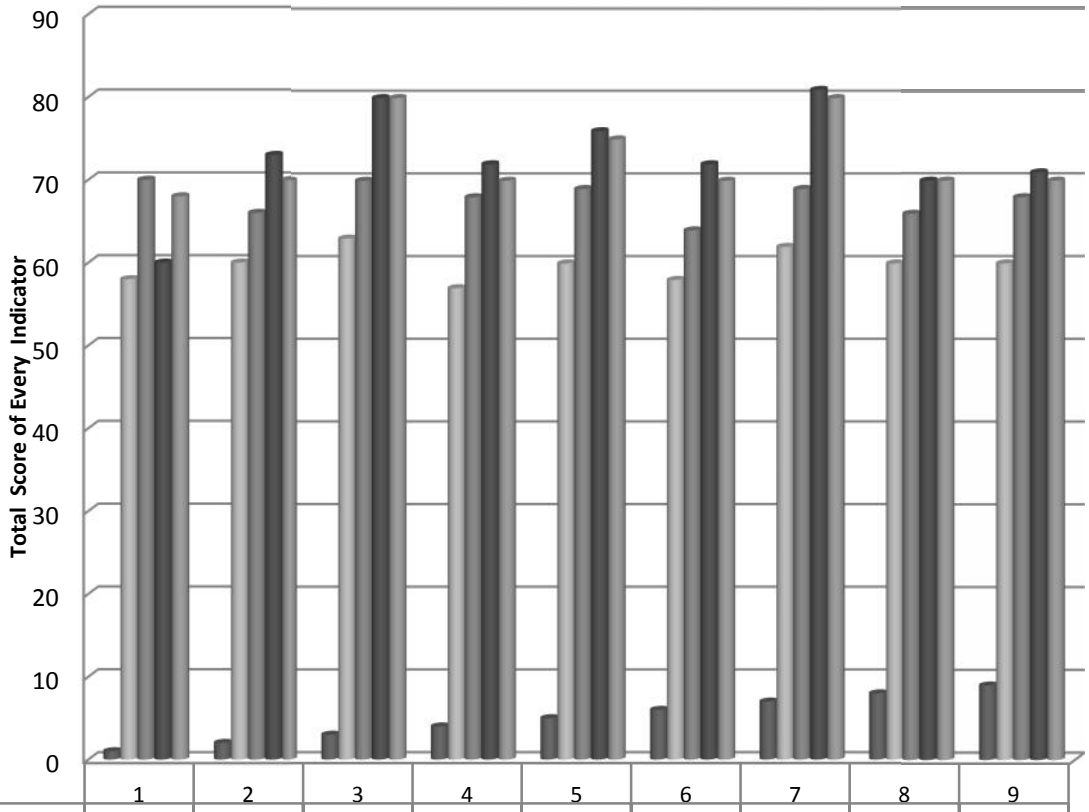
becomes a mean of achieving the goal of science learning, which are process and product oriented. Experiment is the best mean in developing science process skill[10].

Science Process Skill Result of Control Class. Data from analyzing science process skill of students of control class shows no improvement during learning by discussion. Science process skill indicators observed during learning has not improved significantly.The data analyzed from every experiment is shown in (Figure 3).



INDICATOR	1	2	3	4	5	6	7	8	9
Discussion 1	58	60	63	57	60	58	62	60	60
Discussion 2	70	66	70	68	69	64	69	66	68
Discussion 3	60	73	80	72	76	72	81	70	71
Discussion 4	68	70	80	70	75	70	80	70	70

1= observing indicator
2= classifying indicator
3= predicting indicator
4= questioning
5= hypothesizing indicator
6= planning group discussion indicator
7= using theory from various sources indicator
8= implementing concept indicator
9= communicating indicator

Discussion1 = kidneys
Discussion 2 = lungs
Discussion 3 = skin
Discussion 4 = liver

FIGURE 3. .Result Improvement of Every Indicator

Figure 3 shows that science process skill measured during discussion has not improved significantly. However, the indicator which result is about to be significant are predicting and using theory from various sources indicators. The improvement of using theory from various sources indicator was affected by material worksheet used by students during discussion. Based on Figure 4 it is known that, the average score in every discussion has not improved significantly. The average score of discussion about kidneys is 58, which is fair, the average score of discussion aboutlungs is 68, which is good, the average score of discussion about skin is 70 which is good, and the average score of discussion about liver is 60, which is fair.

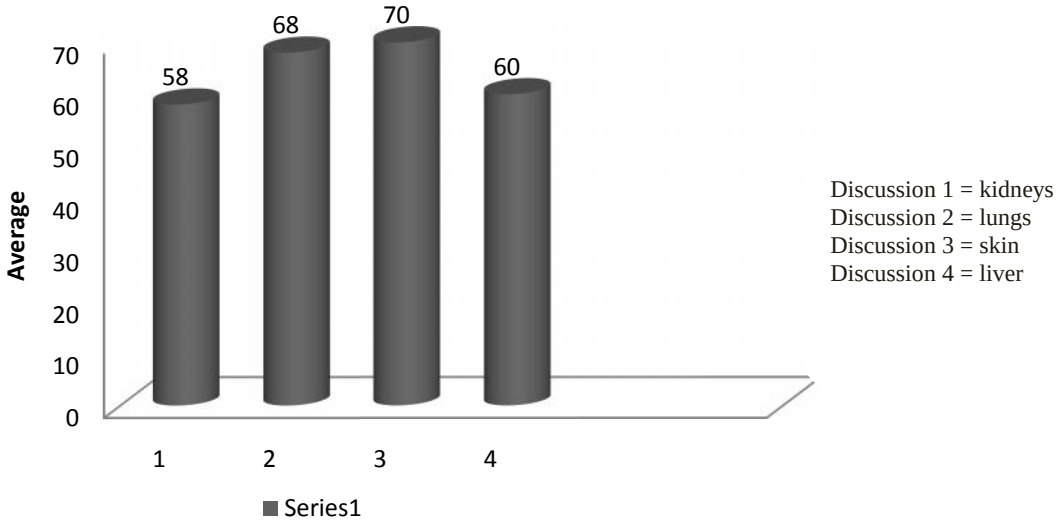


FIGURE 4. The Improvementof Average Score of Science Process Skill in Every Experiment

CONCLUSION

Students who were taught by experimental based guided inquiry model have had very good science process skills, whereas those who were taught by discussion have had fair science process skill.

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Cytotoxic Activity of Ethyl Acetate Extract of *Calotropis gigantea* L. Stem Bark and its Fractions against P388 Cells

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Abstract. The present study deals with the cytotoxic activity of ethyl acetate extract of *Calotropis gigantea* L. stem bark and its fractions such as A, B, C, D and E fractions on murine leukemia cell line P388. Qualitative screening of ethyl acetate extract of stem bark of *Calotropis gigantea* L. for secondary metabolites showed the presence of phenolics, alkaloids, steroids, flavonoids, saponins and coumarins. Cytotoxic activity of the ethyl acetate extract of this plant and A, B, C, D and E fractions was conducted on P388 cells through MTT assay, with IC_{50} value 57.05 µg/mL, 60.37 µg/mL, 55.65 µg/mL, and 58.26 µg/mL respectively, while D and E fractions less active. However the potential of the active fractions as indicated by the results in this study needs to be further investigated.

Keywords: *Calotropis gigantea,* secondary metabolites, cytotoxicity, P388 cells.

INTRODUCTION

Tumors and cancers are classified as diseases those are potentially dangerous to human life. The World Health Organization (WHO) reported deaths from the cancer by about 13% every year [1]. The major causes of cancer are smoking, dietary imbalances, hormones and chronic infections leading to chronic inflammation [2]. According to the International Agency for Research on Cancer (IARC) in 2008 worldwide, it was estimated that there were 12.7 millions new cases, 7.6 million deaths; of these number, 56% of the cases and 64% of the deaths occured in the economically developing countries [3,4]. The success of cancer therapy is still relatively low, this is due to limitations in the use of anticancer associated with safety, because almost all anticancer not only kill the cancer cells, but also cause damage and death in normal cells [5]. The problem is further complicated cancer, because most cases are found at an advanced stage, the survival rate is low, and costly to handle. Therefore it is necessary to do the discovery and development efforts of new cheaper anticancer.

One of the plants that attract attention is *C. gigantea.* It is a plant that originated in India and spread throughout tropical and subtropical regions of Africa and Asia. In ethnobotany leaves of *C. gigantea* believed to treat itching, trachoma, cough, constipation, and scabies; its flower is used as an asthma medication, nausea, and abdominal pain. While the latex is used to cure carbuncle, ekzema, toothache, syphilis, inflammation of the child's ears, dysentery and swelling. The roots of this plant are used to treat gastric cancer. However inventarization of these plants is still low, so that the cytotoxic activity of *C. gigantea* in particular, which grows in the region of Aceh is not known yet. Especially regarding to its chemical content. Previous studies conducted by[6] have isolated an anticancer compound pregnanon that is calotropon of ethanol extract of the roots of *C. gigantea*. *C. gigantea* plants have chemical constituents such as kardenolida, cardiac glycosides, flavonoids, pregnan, gigantisin and non-protein amino acids. During the screening of cytotoxic materials from tropical medicinal plants, the ethanol extract of the roots of *C. gigantea* showed cytotoxic activity against K562 chronic myelogenous leukemia, and human gastric cancer SGC-7901 *in vitro* using the MTT method with IC50 value of 9.7 mg/mL and 6.7 mg/mL. Bioassay-guided fractionation of the ethanol extract of *C. gigantea* roots produces a new compounds pregnanon, namely calotropon (1), with cardiac glycosides compounds (2). The structures of these compounds were determined by using 1D and 2D spectral data of NMR Spectroscopy. Compounds 1 and 2 showed significant cytotoxic activity against K562 cells and SGC-7901.

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Methanol extract of the roots of this plant are used as larvacidal for *Tribolium castaneum* [7]. This plant has the same family with the plant *Calotropis procera* (Asclepiadaceae) which has been studied that the latex at a dose of 1000 mg/mL can kill 100% third instar larvae of *Aedes aegypti* in 24 hours [8], which showed that the latex of this plant is very toxic. The results of screening anticancer of ethyl acetate extracts of stem bark and leaves of *C. gigantea* with Brine Shrimp Lethality Test (BLST) method obtained a strong cytotoxic activity with LC_{50} values of each: 39.73 ppm and 35.86 ppm [9]. Further research has been carried out fractionation of the ethyl acetate extract of the stem bark, phytochemical test and cytotoxicity test of combined fractions with the MTT method against P388 cells.

MATERIALS AND METHODS

Collection of Plant Material

Calotropis gigantea was collected from the wild growing population in Keudee Aceh village, Kecamatan Banda Sakti, Kota Lhokseumawe during March 2014. The plant was identified in the Herbarium Laboratory, Department of Biology, Faculty of Mathematics and Natural Sciences, Syiah Kuala University. The collected plant parts (stem barks) were separated from undesirable materials. The plant parts were sliced into small pieces and dried in open air under shade for one week.

The Extraction Process

The dried stem bark of *C. gigantea* is taken as much as ± 2 kg. Furthermore, the bark is macerated with ethyl acetate solvent for 3x24 hours in order to obtain the extract solution. Maceration is repeated until the extracts obtained were almost clear. Then, the process followed by filtering and the filtrate was concentrated by using a vacuum rotary evaporator to produce concentrated ethyl acetate extract. Then, the weight of the extract is measured.

Fractionation of Concentrated Ethyl Acetate Extract

Concentrated ethyl acetate extract eluent system specified with a suitable solvent comparison using a TLC plate. Subsequently, the sample was drawn as much as 10 grams and its components are separated using a Vacuum Liquid Chromatography (VLC). Stationary phase in the form of silica gel, i.e Silica gel 60 G which is as much as 100 grams and a mobile phase of dichloromethane and methanol with gradient elution (based on the results of analysis by TLC). Accommodated fraction out of each 50 mL in erlenmeyer. The fractions were combined according to similarity of stain patterns after eluted with eluent system obtained and also sprayed with reagent seric sulfate. This is called the combined fractions. Then, the concentrated extracts and combined fractions are tested to identify chemical constituents and MTT assay to P388 cells.

Qualitative phytochemical screening

Chemical tests were performed on the ethyl acetate extract of stem bark of *C. gigantea* and its combined fractions using standard procedure to identify the phytoconstituens [10].

MTT Assay

Cytotoxicity assay was performed as the method that has been reported earlier [11,12]. The cells were harvested (2.5-3.0 x 104 cells/well) and inoculated on plates consisting of 96 wells. The cells were washed with PBS (phosphate buffered saline) and then inoculated cultured with and without sample (1 mg/mL of ethyl acetate extract from the stem bark of *C. gigantea* and combined fractions of ethyl acetate extract). After incubation for 72 h, the medium aspirated. 10 mL solution of MTT (5 mg/mL in PBS pH 7.2) was added to each well and the plate was incubated for 4 h at 37° C. After incubation, 100 mL of DMSO (<0.5%) was added to each well and then homogenized with a shaker for a color formazan stabilize for 15 minutes. Absorbance reading is using microplate reader at λ540 nm and the fraction of surviving cells was calculated. Artonin E (100 mg) was used as a reference drug. Inhibition of the cell is calculated as follows:

$$\% \text{ Cytotoxicity} = (1 - \text{Abs test}/\text{Abs control}) \times 100$$

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RESULT AND DISCUSSION

Maceration of the dried stem bark of *C. gigantea* in ethyl acetate yielded a brownish green extract. Fractionation of the extract by VLC on silica gel gave 14 fractions (FIGURE 1). From TLC analysis, according to similarity of stain patterns, the fractions were combined into five combinations which were fraction A (fraction 1-3), fraction B (fraction 4), fraction C (fraction 5-10), fraction D (fraction 11-12) and fraction E (fraction 13-14).

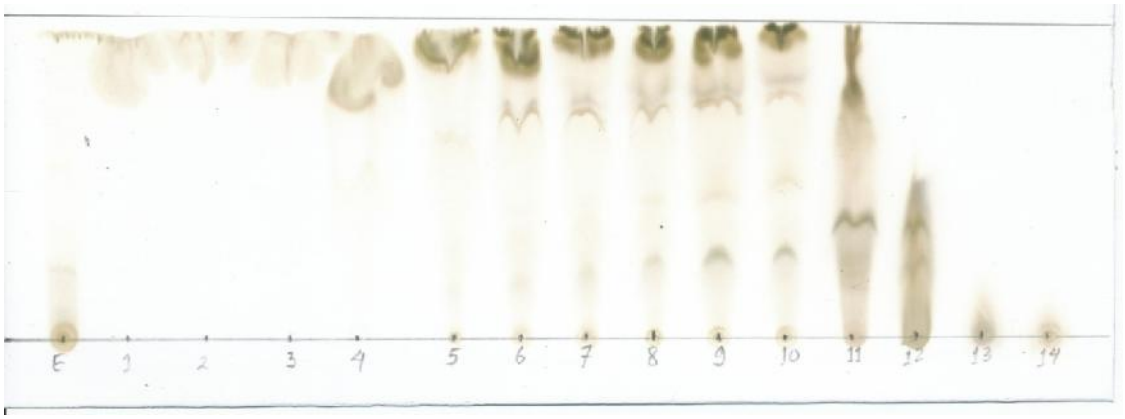

FIGURE 1. The chromatogram of TLC from separated fractions after VLC.

Phytochemical compounds were screened in the ethyl acetate extracts of stem bark of *C. gigantea* and its fractions through qualitative method. The results indicated the presence of alkaloids, saponins, phenols, steroids, flavonoids, coumarins and the absence of terpenoids in the extract. From the fraction A-E showed that the steroid, flavonoids, phenolic, and coumarins were concentrated in the fraction B, while the alkaloids, steroids, saponins and coumarins were found in the fraction C, the coumarins were concentrated in the fraction A. Then, the fraction D contains saponins and significant quantities of steroids, while the fraction E contains only the saponin which was shown in table 1.

TABLE 1. Phytochemical screening of ethyl acetate extract of stem bark of *C. gigantea* and its combined fractions

No.	Secondary Metabolites	Ethyl Acetate Extract	Combined Fractions					Observation Results
			A	B	C	D	E	
	Alkaloids							
1.	Meyer's reagent	-	-	-	-	-	-	-
	Dragendroff's reagent	+	-	-	+	+	-	Red precipitate
	Wagner's reagent	+	-	-	+	+	-	Brown precipitate
2.	Steroids	+	-	+	+	+	-	Green colour
3.	Terpenoids	-	-	-	-	-	-	-
4.	Saponins	+	-	-	+	+	+	Honeycomb froth for a stable 30 minutes
5.	Flavonoids	+	-	+	-	-	-	Pale red /Purple
6.	Coumarins	+	+	+	+	-	-	Flouresenced
7.	Phenols	+	-	+	-	-	-	Pale red

+: presence; - : absence

TABLE (2). MTT assay of ethyl acetate extract of *C. gigantean* stem bark and its combined fractions

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No.	Sample	IC_{50} (µg/mL)
1.	Ethyl acetate extract	57.05
2.	Fraction A	60.37
3.	Fraction B	55.65
4.	Fraction C	58.26
5.	Fraction D	>100
6.	Fraction E	>100
7.	Artonin E (kontrol +)	0.6

The results from MTT assay indicated that the ethyl acetate extract and fraction A, B, and C have cytotoxic activity against murine leukemia P388 cells with value IC_{50} as follow 57.05 µg/mL, 60,37 µg/mL, 55,65 µg/mL, and 58,26 µg/mL which was shown in Table 2, while fractions D and E less active. The Fraction B is most toxic to cancer cells *in vitro* compare to the other fractions, it might be phytochemicals analysis revealed the presence secondary metabolites has the most prominent amount in the fraction B. Phytochemical screening revealed the presence of various chemical constituents, which posses strong antioxidant activities. The antioxidant may prevent and cure cancer and other diseases by protecting the cells from damage caused by free radicals-the highly reactive oxygen compounds [13,14].

CONCLUSION

The phytochemical analysis revealed the bioactive metabolites which are responsible for the cytotoxicity in the ethyl acetate extract of *C. gigantea* stem bark and three fractions A, B and C against P388 cells. MTT assay results from the ethyl acetate extract and five combined fractions against P388 cancer cells is found that the ethyl acetate extract and three fractions combined (A, B and C) have cytotoxic activity with IC_{50} value was 57.05 µg/mL, and fractions A, B , and C are as follows: 60.37, 55.65 and 58.26 µg/mL. Further study is required to isolate the lead compound responsible for this activity and to investigate cytotoxic activity to P388 cell lines for the development of new anticancer drug.

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