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by Erwin Erwin

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The Development of Learning Media of Acid-Base Indicator from Extract of Natural Colorant as an Alternative Media in Learning Chemistry

Mukhamad Nurhadi[1)], Wirhanuddin[1,a)], Erwin[2)], Muflihah[1)], Farah Erika[1)], Iis Intan Widiyowati[1)]

[1]*Chemical education program, Faculty of teacher trainer and education, Mulawarman University, Indonesia*
[2]*Department of chemistry, Faculty of science, Mulawarman University, Indonesia*

a)wirhan.kimmus@gmail.com

Abstract: The development of learning media of acid base indicator from extract of natural colorants as an alternative media in chemistry learning; acid-base solution by using creative problem solving model at SMA N 10 Samarinda has been done. This research aimed to create and develop the learning media from extract of natural colorants, measure its quality and effectiveness, and measure the quality of student learning outcome in acid-base solution topic by using that media. The development process used Analysis, Design, Development, Implementation, and Evaluation (ADDIE) method. The learning media of acid-base indicator was created in the form of box experiment. Its quality was in the range of very good and it was effectively applied in the learning and gave positive impact on the achievement of learning goals.

INTRODUCTION

Learning process in chemistry is a main key to get the goals of its learning. It caused by some aspects i.e. chemistry as a combination of facts, concepts, postulates, and theories. Moreover, learning process in chemistry is a process of scientific process. Further, chemistry gives an understanding of the facts, the ability to identify and solves problems, trains the skills, and gives scientific thinking that can be applied in the life.

Because of the important of learning process in chemistry, the learning process cannot be done by using conventional method only. Trial and experiment is needed to prove the theory. In fact, there are schools that do not have laboratory to do those activities. Some schools have laboratory, but do not have enough tools, glassware and chemicals. Based on the facts above, innovation and creativity are needed by a chemistry teacher to increase the success in learning process.

Experiment gives direct experiences to the student. These experience are the experiences that gotten by student. Edgar said that the success in learning could reach 70% by direct experience. It is the highest rank in the success of students to accept knowledge in learning process.

Students can get the direct experience by using media in learning process. It is things that can be used as tools to deliver messages in learning process, so the messages are easily accepted, easily understood, and easily applied. There are some principles of the usage of learning media i.e. [1] media is used to facilitate student, [2] the media must be in accordance and is directed to get the learning goals, [3] the media must be in accordance with the subject, (4) the media should be in accordance with the interests, needs, and conditions of the students, and [6] the media should be easily operated by the teacher [7]

The topic of acid-base needs verification and one of the ways of the verification is by using acid-base indicator. The common acid-base indicator is indicator synthetics. These indicators are expensive and are not easily found in the border schools. Solutions are needed to solve the problem. One of the solutions is by using acid-base indicator from extract of natural colorants. East Kalimantan has plants that can be used as sources of natural colorants such as

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rosella. Extract of rosella as natural acid-base indicator and the color of the extract was changed by change in pH [8]. To get natural colorant can be done by using extraction process. This process is known as solid-liquid phase extraction, a mass transfer from solid phase to liquid phase [6].

The extraction process to get the natural colorant as acid-base indicator can be done by maceration technique. As an example, extracted the natural colorant from red cabbage by heating the cabbage in 100^{o}C of distilled water for 24 h. Its color was bluish purple with 3.4-6.0 of pH stretch [3]. The extract was insignificantly different with blue bromothymol blue, thus it can be used to detect endpoint of strong acid-strong base titration [2]. Extract of natural indicator from flower of rosella, red rose, shoeblack plant, and red cabbage can be produced in the form of powder, thus these natural indicators can be storage for long time [4].

MATERIALS AND METHODS

Location and Subject of the Research

Subject of this research is 43 students of XI natural science from SMA N 10 Samarinda. Object of this research is the quality of media and the effectiveness of the media in the learning process of acid-base solution topic.

Methods of Research

Research and development method with Analysis, Design, Development, Implementation and Evaluation (ADDIE) approach that has been developed by Robert Maribe Branch was used.

Instrumentations

The instruments were questionnaires, observation sheets, and evaluation sheets. There were 3 categories that have been measured in the development of the media i.e. (1) the quality of media, (2) the effectiveness of media, and (3) the quality of student learning outcome.

Measurement Scale

The measurement of the quality of media was using the criteria quality (%) by Depdikbud. The scale was: very good (90-100%), good (80-90%), enough (65-80%), weak (55-65%), and very weak (0-55%) [5].

RESULTS AND DISCUSSIONS

Acid-Base Indicator from Extract of Natural Colorant

Extract of natural colorant that have been used as natural indicator, one of them is *C. roseus*, *Torenia fournieri* and *Ipomea batatas*. Extract of plants contains anthocyanin that can form its derivate i.e. anthocyanidin, cyanidin, pelargonidin, petunidin, malvidin, and delphinidin. Anthocyanidin is flavonoid compound in the groups of flavon. The common compounds are antocyanidin and cyanidin that constitutes 80% of pigment in plant leaf, 69% in fruits and 50% in flowers [1]. Antocyanin in extract of natural substance will change become the certain color if it react with acid-base solution, thus the extract can be used as acid-base indicator.

TABLE 1. Natural Matter and Degradation of Natural Colorant in the pH.

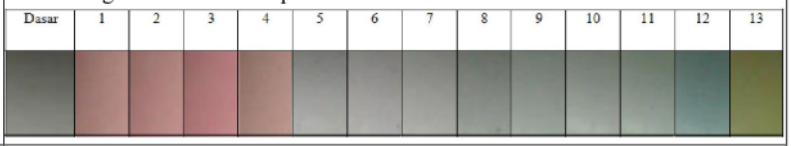
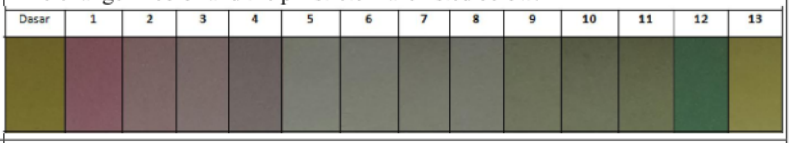
No	Picture	Description
1.		Name : Tapak Dara Species : *C. roseus* The change in color and the pH stretch are listed below. 
2.		Name : Mata Kucing Species : *Torenia fournieri* The change in color and the pH stretch are listed below. 
3.		Name : Ubi Ungu Species : *I. batatas* The change in color and the pH stretch are listed below.

Table 1. above shows that the extract of natural substance from natural resources can be used as acid-base indicator. It can be observe from the change in color of the extract when reacted with acid-base solutions in each pH. For an example, the dark purple of extract of *I. batatas* was pink in color in the solution of acid and greeneish yellow in the solution of base. The extract of natural substance can be used to decide the range of pH of solution by the degradation of the color. The change in the color each pH can be proved by the adsorption *I. batatas* extract with UV-Vis spectrophotometer. It can be shown in Table 2. below.

TABLE 2. Adsorption of extract of natural indicator of *I.batatas* each pH at λ :450

pH	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Absorption	0,287	0,276	0,132	0,125	0,084	0,034	0,029	0,023	0,083	0,098	0,144	0,171	0,280	0,295

Table above shows that the reaction each pH solution with indicator from extract *I. batatas* had degradation in color. This phenomena in accordance with the absorbance resulted. Absorbance is the number of light or energy that absorbed by particles in the solution. Absorbance data shows the conformity with the change in color as shown in Figure 1. It can be concluded that the extract of natural indicator from *I. batatas* is a good class of natural acid-base indicator because it has different changing in color when it reacted with acid-base solution and also had stretch pH of 8-9.

Acid-Based Indicator Media

Based on the natural potential in East Kalimantan, it can be created a learning media of natural acid-base indicator from the extract of natural substance. Development product is acid-base indicator from natural sources that

have been prepared in the box of experiment. The box was completed with support equipment and chemicals that are needed in acid-base solution experiment. The box has been also completed with guide book that contains a short theory, tasks, and procedure. The guide book has been also completed with work sheets of student that can be used to deepen the student knowledge after learning process. The product is shown in the Figure 2 below.

(a) (b)

FIGURE 1. (a) Learning of Media, and (b) Instrument of Media

Analysis the Quality of Media

TABLE 3. The eligibility score of the media by validator and evaluator

Aspects	Score by validator	Category	Score by evaluator	category
Eligibility of content	95	Very good	85	good
Eligibility of language	100	Very good	97	Very good
Eligibility of appearance	97	Very good	90	Very good
Eligibility of technic	95	Very good	90	Very good
Effect of the media on the learning process	97	Very good	93	Very good
Average score (%)	97	Very good	91	Very good

Table 3 above shows the eligibility data from each aspect about the developed learning media. The eligibility of content showed the assessment result of 95% with a very good category to use in learning. The eligibility of language showed the assessment result of 100% with a very good category. It is indicated that the writing and grammar on the guide book was good and easily understood. The eligibility of appearance showed the assessment result of 97% with a very good category. It means that the media has a good in the appearance and easy to use. The eligibility technic showed the assessment result of 95% with a very good category. It can be interpreted that the media has a good physic condition and the quality of the tools was good, thus it can be used in long time. The effect of media in the learning showed the assessment result of 97%. It indicated that the media could increase the motivation and knowledge students. The average of assessment of the media was 97% means that the quality of the media was very good to use in learning process. It is in accordance with the assessment result of 91% by evaluator (chemistry teacher) with very good category.

Effectiveness of Media

TABLE 4. Student scores from the student activity, knowledge and response aspects.

Schools	Scores					
	Psychomotor	affective	Experiment	evaluation	final	response
SMAN 10 SMD	80	95	92	87	88	89

Table 3 above shows the average of student score. The score could be used to measure the effectiveness of the media in learning process. Psychometric and effective scores indicated that the students were ready and gave good response in learning process with the using of the media. It is also in accordance with the ability of the students in the using of the equipment. The ability of the students in using the equipment was good, so the resulted data was good and they could pass the experiment smoothly. The experiment and evaluation scores also showed good score. It means the students could follow the learning process and understand the topic.

The use of media on the learning process was very effective, because the average of final score of the students reached 88 with a very good category. The affectivity of the media was also related to the percentage of student response to the media (89%) with a good category. Those data indicated that the students gave a very good response to the media.

CONCLUSIONS

In short we have create and develop an acid-base indicator media by using the extract of natural colorant with the very good category, very good eligibility. It was effectively used in learning and produced very good quality in the student learning outcomes.

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