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Analysis of the Level of Understanding of Physics Education Students Regarding the Application of Non-Ionizing Radiation in WPC (Wave Pasterutation Control) Technology in Milk Processing Production

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ABSTRACT

WPC (Wave Pasteuration Control) technology is a technology that functions to emit non-ionizing radiation on an object or product for a specific purpose. In the processing of livestock products, this technology has been utilized and its utilization continues to be developed in the processing of dairy products. In developing the use of WPC technology, competent scientists or experts in their fields are needed so that universities hold courses and even study programs in this technology field with the aim of producing competent students, one of which is the University of Jember. This study discusses how the knowledge of physics education students about non-ionizing radiation technology is concentrated in WPC. The purpose of this study is to determine the level of knowledge of physics education students regarding the technology of using non-ionizing radiation in agro-industrial studies on livestock processing. The research method uses descriptive analysis. According to the data obtained.

Key words : Non-ionizing radiation, WPC, Dairy processing

INTRODUCTION

Currently, the development of science and technology is very rapid, various technologies continue to be developed for better and easier human life. One of the science and technology that continues to be developed is technology in the field of animal husbandry. Technology in the livestock industry as well as livestock product processing technology continues to be developed in order to produce better production.

Radiation is energy that travels in the form of waves or high-speed particles. Radiation is divided into two types, namely alpha and beta particles which come from radioactive particles and electromagnetic waves. Electromagnetic waves are energy flows in the form of electric and magnetic fields. Based on the amount of energy produced, electromagnetic wave radiation is divided into ionizing and non-ionizing radiation. Non-ionizing radiation is low-frequency radiation that does not have enough energy to break the bonded electrons together. Examples of non-ionizing radiation are ultraviolet light, infrared light, microwaves and radio waves.

Non-ionizing radiation can be defined as the spread or emission of energy which, if it passes through a medium and an absorption process occurs, the radiation energy beam will not be able to induce an ionization process in the medium. The term non-ionizing radiation physically refers to electromagnetic radiation with an energy of less than 10 eV which includes ultraviolet, visible, infrared, microwave, and radiofrequency

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electromagnetic. In addition, ultrasound is also included in non-ionizing radiation (Lusiyanti, Y. (2001).

This research was conducted to determine the level of knowledge of physics education students at the University of Jember regarding the application of non-ionizing radiation technology in the processing of livestock products, both the concept and its utilization. This research can be useful as a reference for those who need it, especially for the physics education study program at the University of Jember to find out the level of student knowledge regarding non-izonizing radiation technology so that they can improve and increase student knowledge.

RESEARCH METHODS

This research uses a descriptive method, the descriptive method is a method that describes or describes a fact in a phenomenon (Rukajat, 2018). The descriptive method was used in this study with the aim of being able to describe the level of knowledge and comparison of knowledge between Unej physics education students regarding non-ionizing radiation, especially regarding WPC. Data collection was carried out by distributing questionnaires to unej physics education students and unej agricultural technology students. The questionnaire contains 10 questions with 9 multiple choice questions and 1 checkboxes question. In multiple choice questions, the respondent is expected to be able to answer the question according to the situation and knowledge of the respondent by selecting 1 answer from the several choices that have been provided. Meanwhile, in terms of checkboxes, Respondents are expected to be able to answer questions according to their knowledge by choosing more than 1 answer from the several choices provided. The questionnaires distributed contained questions regarding conceptual knowledge and the use of non-ionizing radiation technology in agro-industries. After the data is collected, data analysis will be carried out. The data obtained by giving a true-false score from the respondents' answers then gives the results of the average score of Unej physics education students. From the respondents' answers, the percentage of the results of the answers will be calculated as follows The questionnaires distributed contained questions regarding conceptual knowledge and the use of non-ionizing radiation technology in agro-industries. After the data is collected, data analysis will be carried out. The data obtained by giving a true-false score from the respondents' answers then gives the results of the average score of Unej physics education students. From the respondents' answers, the percentage of the results of the answers will be calculated as follows The questionnaires distributed contained questions regarding conceptual knowledge and the use of non-ionizing radiation technology in agro-industries. After the data is collected, data analysis will be carried out. The data obtained by giving a true-false score from the respondents' answers then gives the results of the average score of Unej physics education students. From the respondents' answers, the percentage of the results of the answers will be calculated as follows

$$x = \frac{skor\ yang\ diperoleh}{jumlah\ skor\ maksimal}\ x\ 100\%$$

RESULTS AND DISCUSSION

In order to find out the level of student understanding, a test item consisting of 10 questions was given to the respondent. The test questions given to the respondents were 9 multiple choice questions and 1 checkbox question which were filled in by Physics Education Students at the University of Jember. The distribution of the results of the respondents' answers to

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each question can be seen in the following table:

No.	x	Number of Students
1	1%-10%	7
2	11%-20%	29
3	21%-30%	30
4	31%-40%	17
5	41%-50%	39
6	51%-60%	31
7	61%-70%	33
8	71%-80%	21
9	81%-90%	42
10	91%-100%	39

From these data it is known that the understanding of Physics Education students is quite good regarding the concept of non-ionizing radiation in industrial technology. Because of the 50 students who were respondents there were only 19 students who got an understanding score below 70%.

First, question number 1 covers the notion of non-ionizing radiation technology. The correct answer to question number 1 is option B, namely "non-ionizing or non-ionizing radiation is radiation that cannot cause ionization." In this question as many as 47 students answered correctly because it was still relatively easy.

Question number 2 covers the types of rays that are included in non-ionizing radiation. This question is used as a checkbox so that students can separate what includes non-ionizing radiation. Which of the following answers is correct include radio waves (which carry information and entertainment via radio and television), microwaves (which are used in microwave ovens and cell phone transmissions), infrared light (which gives off energy in the form of heat), visible light (which we can see), and ultraviolet light (which is emitted by the sun). Among the 50 students who were respondents, there were 36 students who could answer correctly and 14 students who answered incorrectly.

Question number 3 asks whether students already know the picture in the form of a WPC image. It was asked whether the students had ever seen the tool or had not. The results of this question were 11 students who had known it while the other 39 had never seen the tool.

Problem number 4 asks a question derived from a picture of the WPC tool. In the picture, students are asked whether there is a tool that uses non-ionizing radiation in the tool. The answers from 50 students were 46 students who answered that there was the application of non-ionizing radiation in the device. Meanwhile, 4 other students answered none. The correct answer is that there is the application of non-ionizing radiation to the WPC tool used.

Question number 5 asks what type of non-ioniozing radiation is used in the application of the WPC tool in the image provided. Of the 50 student respondents, 39 children answered correctly while 11 other children answered incorrectly.

Question number 6 covers things that do not include the advantages of non-ionizing radiation in WPC tools. The correct answer is option A which is "Can neutralize milk without destroying the good protein". In this question as many as 32 students answered correctly.

Question 7 asks about the purpose of WPC technology in using non-ionizing radiation in milk processing. Among the 50 respondents who answered correctly, 27 students answered by providing a milk pasteurization machine using microwaves

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with an automatic system that can kill bacteria, inactivate enzymes, destroy spores and maintain nutritional value in milk before it is processed and has high time efficiency. in operation.

Question number 8 asks about the concept of non-ionizing radiation in WPC devices, especially regarding microwave waves. Asked why microwave waves are used in the tool. Of the 50 student respondents who could answer correctly as many as 29 students and 21 students had not answered correctly. The correct answer in this case is because microwave radiation can damage bacteria to the bacterial DNA structure so that all pathogenic bacteria will die.

Question number 9 asked about understanding the concept. It was asked why electromagnetic wave radiation is used in neutralization. Of the 50 student respondents, 34 students managed to answer correctly, while 16 others did not answer correctly. The answer to this question is that electromagnetic radiation has long been studied to kill bacteria, inactivate enzymes and destroy spores in milk.

Question number 10 asks whether the radiation causes damage to the nutrients in the milk. Answers are provided yes or no with a reason column. The correct answer is not to affect the reason Microwave radiation can be absorbed by the water content without affecting the nutrients in the milk so as to prevent protein denaturation. In this question there were 33 students who answered correctly.

CONCLUSIONS

Based on the analysis of the results of the answers of Jember University Physics Education students to the questionnaire about non-ionizing radiation technology in the application of the WPC tool, it can be concluded that the student's understanding of the concept is quite good. But it would be better, prospective physics teacher students still need to improve their understanding on a number of things, including the basic knowledge of non-ionizing radiation, the application of non-ionizing radiation in industrial sectors, and the effects of non-ionizing radiation.

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