Gravitasi
Journal available at: https://bestjournal.untad.ac.id/index.php/GravitasiFisika
e-ISSN: 2654-4318 p-ISSN: 1412-2375

The Influence of Eco Enzyme on the Reduction of Electromagnetic Radiation from Mobile Phone

P. Pingki*), A. Nismayanti, S. Sabhan, I. Iqbal, K. Kasman, M. Maskur
Physics Study Department, Faculty of Mathematics and Natural Sciences, Tadulako University, Palu, Indonesia

Information

Article history:

Received: 24 October 2023

Accepted: 27 August 2024
Published: 30 August 2024

Keywords:
Eco Enzyme
Electromagnetic Radiation
Mobile phones

Abstract

Radiation generated by mobile phones can potentially cause health problems to users. This study aims to limit or suppress the effects of electromagnetic wave radiation using multifunctional fluids, namely eco enzymes. There are 2 treatments, namely using eco enzymes measuring 600 ml and 1.2 L with 6 passes with a certain distance and a duration of 0 minutes, 5 minutes, 10 minutes, 15 minutes, 20 minutes, 25 minutes, and 30 minutes. The results of data analysis were carried out using the effectiveness equation. The highest average values of the electric field and magnetic field were found on path A before using the eco enzyme, with measurements of 6 V/m and 0.18 μT. Eco enzyme successfully reduced electromagnetic radiation from mobile phones with an effectiveness of 53%. Therefore, eco enzyme is very useful as an environmentally friendly material that can protect us from exposure to electromagnetic radiation.

*) e-mail: pingki915@gmail.com
DOI: 10.22487/gravitasi.v23i1.16638

1. INTRODUCTION

In the sophisticated and technology-filled era, almost everyone has a mobile phone (HP). Until now mobile phone users continue to increase rapidly, even in modern society mobile phones have become a primary need such as food and drinks but without realizing that in addition to providing the benefits, mobile phones can also cause harmful effects on health because mobile phones emit radiation [1], [2]. Radiation is the spread of elementary particles and radiant energy from a radiation source to a surrounding medium or destination [3], [4]. Radiation emitted by mobile phones is a form of electromagnetic waves where it can penetrate the vacuum of space. Radiation from mobile phones can cumulatively cause various diseases, including brain cancer, brain tumors, Alzheimer's, fatigue and the mildest is that it can cause headaches [5].

In 2001, the US Federal Communication Commission (FCC) tested the level of radiation emitted by several mobile phones [6] where the results showed that the mobile phone that had the lowest radiation was Motorola V3688/8088 with 0.02 W/cm^2 radiation and Philips Genie mobile phones had the highest radiation of 1.52 W/cm^2 [7] Long-term exposure to electromagnetic waves from electrical appliances causes fatigue, tired eyes, stiff neck, headaches, restlessness and others. Electromagnetic waves can also cause immune system weakness, loss of calcium, and many other problems [8].
Therefore, to reduce the negative impact of electromagnetic waves, it can be limited with fluids, namely eco enzymes [9]. Eco enzyme is a multifunctional organic solution produced through a fermentation process derived from the remaining organic matter, sugar, and water [10]. The color of this enzyme eco-liquid is dark brown or light brown and has a strong fresh sour aroma. This eco enzyme is the discovery of Dr. Rosukon Poompanyong from Thailand [11]. He is a researcher and environmentalist and founder of the Organic Agriculture Association of Thailand. From this effort and innovation, he was awarded an award by FAO Regional Thailand in 2003.

The purpose of this study is to determine the amount of electromagnetic wave radiation emitted by mobile phones before and after using eco enzymes and know the influence of eco enzymes in reducing the circulation of electromagnetic waves emitted by mobile phones.

2. MATERIALS AND METHODS

This experimental research was conducted in the Laboratory of Experimental Physics, Department of Physics, Faculty of Mathematics and Natural Sciences, Tadulako University in September 16-30, 2022. Before conducting research, the researchers prepared tools and materials such as eco enzymes, electromagnetic radiation tester measuring instruments, samsumg brand mobile phones, rulers, stopwatches, laptops and multi-parameter testers. Electromagnetic radiation measurements on mobile phones are carried out when watching online videos. In this study, 24 measurement points were used which were divided into 6 passes, namely trajectory A (front), trajectory B (rear), trajectory C (right side), trajectory D (left side), trajectory E (top) and trajectory F (bottom) using before / after eco enzymes. The size of the eco

enzyme is divided into two sizes, namely the 600 ml eco enzyme and 1.2 L eco enzyme with each size spaced 4 cm, 8 cm, 12 cm and 16 cm with a duration of 5 minutes, 10 minutes, 15 minutes, 20 minutes, 25 minutes and 30 minutes.

Mobile phone radiation measurement is done by positioning the mobile phone horizontally and vertically. Mobile radiation measurement techniques using eco enzyme can be seen in the following picture:

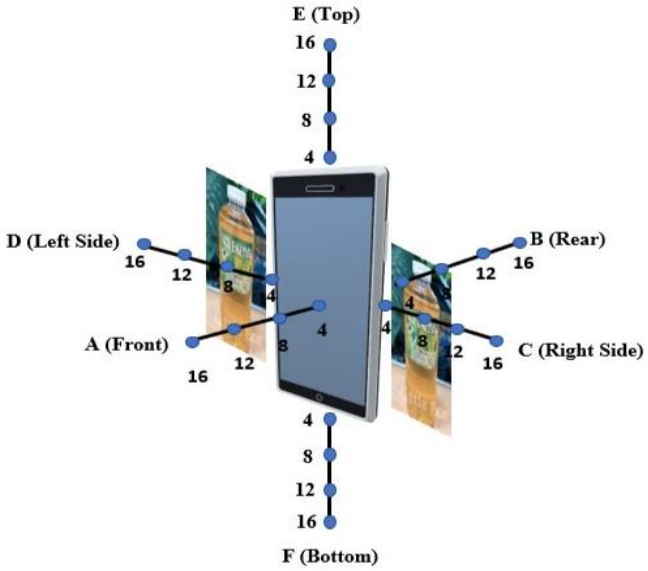

Figure 1. Measurement point design

Measurement of electromagnetic radiation on mobile phones is done when watching online videos. The value of radiation exposure obtained at the measurement point (Figure 1). Each measurement point measured the amount of radiation exposure as much as 7 times the time variation each with the provision of duration of 0 minutes, 5 minutes, 10 minutes, 15 minutes, 20 minutes, 25 minutes and 30 minutes and distance variations of 4 cm, 8 cm, 12 cm and 16 cm. The measurement results were divided into 2 groups, namely radiation measurement without using Eco Enzyme and radiation measurement using 600 ml and 1.2 L eco enzymes. Data obtained from the results of measuring electromagnetic radiation on mobile phones using electromagnetic radiation tester measuring instruments with variations in distance and time where the data is presented in graphic form. And to find out the effectiveness of eco enzyme 600 ml and 1.2 L can use the following equation.

$$E_E = \frac{E_{TEE} - E_{EE}}{E_{TEE}} \times 100\% \quad (1)$$

$$E_B = \frac{B_{TEE} - B_{EE}}{B_{TEE}} \times 100\% \quad (2)$$

where:

E_E = Electric field effectiveness (%)
E_B = Magnetic field effectiveness (%)
E_{TEE} = Electric field without eco enzyme
E_E = Electric field using eco enzymes
B_{TEE} = Magnetic field without enzyme eco
B_{EE} = Magnetic field using eco enzymes

3. RESULTS AND DISCUSSION

The resulting radiation consists of an electric field (V/m) and a magnetic field (μT). Changes in exposure to electromagnetic radiation with variations in distance and time can be seen in Figure 2 and Figure 3. The results of the analysis of the physical and chemical properties of eco enzyme.

Table 1. Measurement results of pH, EC and TDS eco enzyme

Acidity Degree (pH)	Conductivity (EC)	Total Dissolved Solid (TDS)
3	3	1728

From Table 1 can be seen the value of acidity (pH) eco enzyme 3, conductivity (EC) 3 μS/cm and total dissolved (TDS) 1728 mg/L. The results of measuring the electric field without using eco enzyme can be seen in Figure 2. Based on Figure 2.a, it shows that in conditions without eco enzyme juxtaposing. The track that has the highest average electric field is track A (front) at a distance of 4 cm of 6 V/m, a distance of 8 cm of 4 V/m, a distance of 12 cm of 3 V/m, a distance of 16 cm of 3 V / m. While the lowest electric field is the E (top) and F (bottom) trajectories¬ at a distance of 4 cm of 2 V/m, a distance of 8 cm of 2 V/m, a distance of 12 cm 1 V/m, a distance of 16 cm of 1 V/m. It can be seen that radiation exposure undergoes changes. This happens because it is influenced by the distance from the radiation source, where the longer the distance from radiation exposure, the smaller the dose received.

Based on Figure 2.b, it shows that under conditions of 600 ml eco enzyme juxtaposed. The trajectory that has the highest average electric field is trajectory A (front) at a distance of 4 cm of 3 V/m, a distance of 8 cm of 2 V/m, a distance of 12 cm of 1 V/m, a distance of 16 cm of 1 V/m., while the lowest electric field is the path of E (top) and F (bottom)¬ at a distance of 4 cm of 2 V/m, distance 8 cm by 2 V/m, distance 12 cm by 1 V/m, distance 16 cm by 1 V/m. It can be seen that radiation exposure undergoes changes. This happens because it is influenced by the distance from the radiation source, in which the longer the distance from radiation exposure, the smaller the dose received.

Based on Figure 2.c, it shows that under conditions of eco enzyme juxtaposed 1.2 L. The trajectory that has the highest average electric field is trajectory A (front) at a distance of 4 cm of 3 V/m, a distance of 8 cm of 2 V/m, a distance of 12 cm of 1 V/m, a distance of 16 cm of 1 V/m. while the lowest electric field is the path E (top) and F (bottom)¬ at a distance of 4 cm of 2 V/m, distance 8 cm by 2 V/m, distance 12 cm by 1 V/m, distance 16 cm by 1 V/m. It can be seen that radiation exposure undergoes changes. This happens because it is influenced by the distance from the radiation source suggesting that the longer the distance from radiation exposure, the smaller the dose received. The results of magnetic field measurements without using eco enzyme can be seen in Figure 3.

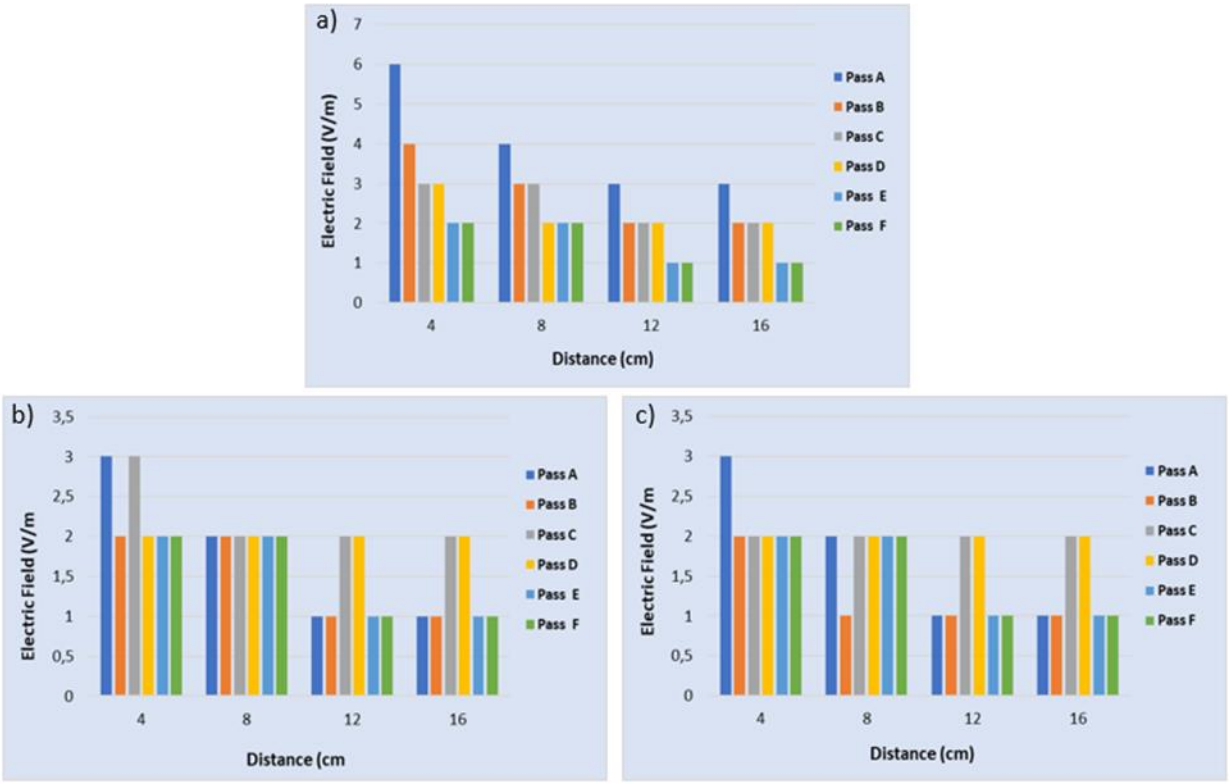

Figure 2. Electric field values on the mobile phone: a. without using eco enzyme, b. using 600 mL of eco enzyme, and c. using 1.2 L of eco enzyme

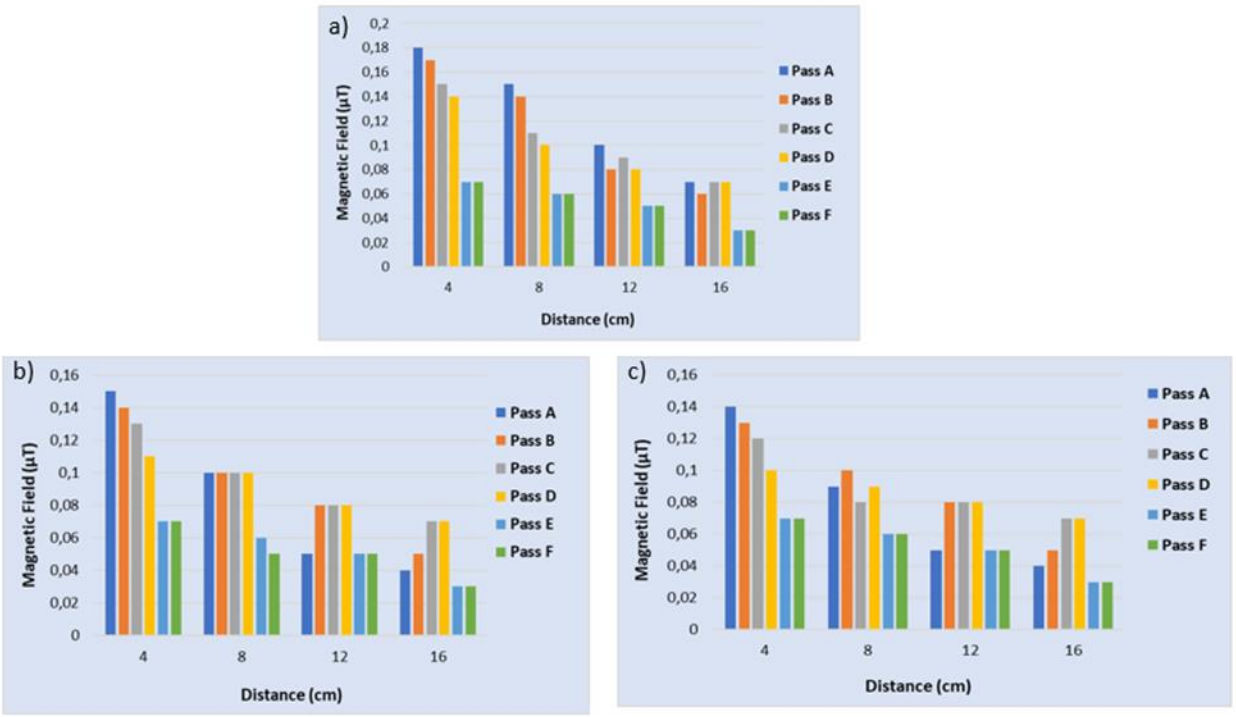

Figure 3. Magnetic field values on the mobile phone: a. without using eco enzyme, b. using 600 mL of eco enzyme, and c. using 1.2 L of eco enzyme

Based on Figure 3.a, it shows that in conditions without eco enzyme juxtaposing. The trajectory that has the highest average magnetic field is trajectory A (front) at a distance of 4 cm of 0.18 μT, a distance of 8 cm of 0.15 μT, a distance of 12 cm of 0.1 μT, a distance of 16 cm of 0.07 μT. While the lowest magnetic field is the trajectory E (top) and F (bottom)¬ at a distance of 4 cm of 0.07 μT, a distance of 8 cm of 0.07 μT, a distance of 12 cm of 0.05 μT, a distance of 16 cm of 0.05 μT. It can be seen that radiation exposure undergoes changes. This happens because it is influenced by the distance from the radiation source. Where the longer the distance from radiation exposure, the smaller the dose received.

Based on Figure 3.b, it shows that under conditions of 600 ml eco enzyme juxtaposed. The trajectory that has the highest average magnetic field is trajectory A (front) at a distance of 4 cm of 0.15 μT, a distance of 8 cm of 0.1 μT, a distance of 12 cm of 0.05 μT, a distance of 16 cm of 0.04 μT. While the lowest magnetic field is the trajectory E (top) and F (bottom)¬ at a distance of 4 cm of 0.07 μT, a distance of 8 cm of 0.06 and 0.05 μT, a distance of 12 cm 0.05 μT, a distance of 16 cm of 0.03 μT. It can be seen that radiation exposure undergoes changes. This happens because it is influenced by the distance from the radiation source. Where the longer the distance from radiation exposure, the smaller the dose received.

Based on Figure 3.c, it shows that under conditions of eco enzyme juxtaposed 1.2 L. The trajectory that has the highest average magnetic field is trajectory A (front) at a distance of 4 cm of 0.15 μT, a distance of 8 cm of 0.09 μT, a distance of 12 cm of 0.05 μT, a distance of 16 cm of 0.04 μT. While the lowest magnetic field is the trajectory E (top) and F (bottom)¬ at a distance of 4 cm of 0.07 μT, a distance of 8 cm of 0.06 and 0.05 μT, a distance of 12 cm 0.05 μT, a distance of 16 cm of 0.03 μT. It can be seen that radiation exposure undergoes changes. This happens because it is influenced by the distance from the radiation source. Where the longer the distance from radiation exposure, the smaller the dose received. The determination of the effectiveness value of eco enzyme 600 ml and 1.2 L can be calculated using equations 1 and 2. The following is a table of effectiveness using eco enzymes. (Table 2 and Table 3)

Table 2. Analysis of the effectiveness of electromagnetic radiation in all trajectories using eco enzyme 600 ml

Track Name	Average Electric Field Effectiveness (V/m)	Average Magnetic Field Effectiveness (μT)
Pass A	52%	36%
Pass B	42%	15%
Pass C	19%	11%
Pass D	12%	8%
Pass E	0	1%
Pass F	0	1%

Table 3. Analysis of the effectiveness of electromagnetic radiation in all trajectories using eco enzyme 1,2 L

Track Name	Average Electric Field Effectiveness (V/m)	Average Magnetic Field Effectiveness (μT)
Pass A	53%	39%
Pass B	46%	15%
Pass C	25%	18%
Pass D	22%	8%
Pass E	0	1%
Pass F	0	2%

Table 2 and Table 3 show the effectiveness of using eco enzymes with sizes of 600 ml and 1.2 L. In trajectory A, the average effectiveness of eco enzyme electric fields measuring 600 ml and 1.2 L is 52% and 53%. The average effectiveness of magnetic fields measuring eco enzyme 600 ml and 1.2 L is 36% and 39%. Pathway B the average effectiveness of the electric field of eco enzyme size 600 ml and 1.2 L is 42% and 46%. The average effectiveness of magnetic fields measuring eco enzyme 600 ml and 1.2 L is 15%. In trajectory C the average effectiveness of the electric field of eco enzyme size 600 ml and 1.2 L is 19% and 25%. The average effectiveness of magnetic fields measuring eco enzyme 600 ml and 1.2 L is 11% and 18%. Pass D the average effectiveness of the eco enzyme electric field size of 600 ml and 1.2 L is 12% and 22%. The average effectiveness of magnetic fields measuring eco enzyme 600 ml and 1.2 L is 8%. Trajectory E the average effectiveness of the eco enzyme electric field size 600 ml and 1.2 L is 0.. The average effectiveness of magnetic fields of eco enzyme size 600 ml and 1.2 L is 1%. Path F the average effectiveness of the eco enzyme electric field size 600 ml and 1.2 L is 0. The average effectiveness of magnetic fields measuring eco enzyme 600 ml and 1.2 L is 1% and 2%.

If the results of measuring electromagnetic radiation without eco enzyme are compared using eco enzyme, then eco enzyme 600 ml and 1.2 L can reduce the radiation contained in the A-D pathway. While the lowest electromagnetic radiation measurement results in trajectories E and F when juxtaposed with eco enzyme did not decrease. The potential of eco enzyme multifunctional liquid in reducing mobile phone electromagnetic radiation is influenced by the source of hydroxyl radicals (OH) contained in eco enzyme will react with pollutants through radicalization reactions that take place continuously until finally free radicals will meet with other free radicals so that a termination reaction occurs that forms oxygen (O_2). High levels of oxygen can improve the environmental quality of electromagnetic radiation. OH radicals become chemical compounds that play an important role in the chemical reaction of ozone in the atmosphere. These radical compounds include free radicals that are reactive so that they act as ozone-depleting agents in the atmosphere. OH radicals also play a role in the process of producing and decomposing ozone in the atmosphere.

In the study, it was found that the variation in distance significantly affected the dose of radiation exposure. This is evidenced in the graph of the results obtained showing that distance variations have different doses. The closer the distance to the radiation source, the exposure received will be large. However, on the contrary, if the longer the distance from the radiation source, the dose of radiation exposure received is smaller.

Based on the results of measurements that have been made, the magnetic field produced by several mobile phones as research objects is still below the safe limit set by WHO. The World Health Organization (WHO) recommends that the threshold values for exposure to electric fields and magnetic fields of 50/60 Hz are 5kV/M and 100 μT for the general group, 10kV/M and 500 μT for the working group (WHO, 1990). In this study, the largest electric and magnetic fields produced were 6 V / m and 0.20 μT, the value of which is still far compared to the limits of WHO. Although it is still at a safe limit, it does not rule out the possibility of side effects of magnetic field accumulation in the user's body, for that further study is needed on exposure to electric fields and magnetic fields in the long term [3].

4. CONCLUSION

The highest average values of the electric field and magnetic field were found on path A before using the eco enzyme, with measurements of 6 V/m and 0.18 μT. When using 600 ml of eco enzyme, the electric field and magnetic field were measured at 4 V/m and 0.17 μT, respectively. When using 1.2

L of eco enzyme, the electric field was measured at 3 V/m, and the magnetic field at 0.15 μT. Eco enzyme successfully reduced electromagnetic radiation from mobile phones with an effectiveness of 53%. Therefore, eco enzyme is very useful as an environmentally friendly material that can protect us from exposure to electromagnetic radiation.

REFERENCES

[1] C. A. Teodorescu, A.-N. Ciucu Durnoi, and V. M. Vargas, "The Rise of the Mobile Internet: Tracing the Evolution of Portable Devices," Proceedings of the International Conference on Business Excellence, vol. 17, no. 1, pp. 1645–1654, Jul. 2023, doi: 10.2478/picbe-2023-0147.

[2] T. Rahim Soomro and M. Sarwar, "Impact of Smartphone's on Society," 2013. [Online]. Available: http://www.europeanjournalofscientificresearch.com

[3] Nanda Karmaker et al., "Fundamental characteristics and application of radiation," GSC Advanced Research and Reviews, vol. 7, no. 1, pp. 064–072, Apr. 2021, doi: 10.30574/gscarr.2021.7.1.0043.

[4] S. Abdul Azeem, Q. Fatema, and S. Kumar Sharma, "Ether & Radiant Energy: A vital source of energy & allied resources," – International Journal of Computer Networks and Wireless Communications (IJCNWC), ISSN: 2250-3501 Vol.9, No.2, Mar-April , vol. 9, no. 2, pp. 2250–3501, 2019, [Online]. Available: https://www.researchgate.net/publication/335911116

[5] Anil R. Saradva, "Radiation impact from Cell Phones and Towers on Human Health and Environment - A Review," Int J Sci Res Sci Technol, pp. 537–541, Feb. 2023, doi: 10.32628/ijsrst2310176.

[6] Federal Communications Commission, "Resolution Of Notice Of Inquiry, Second Report And Order, Notice Of Proposed Rulemaking, And Memorandum Opinion And Order," Washington, D.C. 20554, 2019. [Online]. Available: https://www.fda.gov/Radiation-

[7] S. Rathee and M. Duhan, "Comparative study of mobile phone emitted EM waves on human brain at different charging levels," Int J Biomed Eng Technol, vol. 22, no. 2, pp. 178–188, 2016, doi: 10.1504/IJBET.2016.079147.

[8] O. Austin, O. A. Osahenvemwen, and O. Omorogiuwa, "The Effects of Radiation Emitted from Base Stations and Mobile Phones on Human Beings," IEEE 3rd International Conference on Electro-Technology for National Development (NIGERCON) , pp. 113–2017, 2017, [Online]. Available: https://www.researchgate.net/publication/341353933

[9] A. Nismayanti, S. Rugayya, and M. Syahrul Ulum, "Effect of Eco Enzyme on Television Electromagnetic Radiation," Tadulako Science and Technology Journal, vol. 5, no. 1, 2024.

[10] A. Novianti and I. Nengah Muliarta, "Eco-Enzym Based on Household Organic Waste as Multi-Purpose Liquid," AGRIWAR JOURNAL, vol. 1, no. 1, pp. 12–17, 2021, doi: 10.22225/aj.1.1.3655.12-17.

[11] N. Kamaluddin et al., "Eco enzyme sustainable living product based halal lifestyle in Ternate," in AIP Conference Proceedings, American Institute of Physics Inc., Mar. 2023. doi: 10.1063/5.0118752.