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Development of E-Supplements of Biomordan from Cengkodok *(Melastoma malabathricum)* Leaves For Learning Green Chemistry

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Abstract: *Green chemistry is one of the elective courses in the Chemistry Education Study Program of FKIP Untan, which focuses on methods to reduce or eliminate the use of chemicals. Learning media has an important role in the learning process as a learning resource to support the learning process. This study aims to determine the feasibility of E-Supplement Biomordan from Cengkodok Leaf (Melastoma malabathricum). The method used in this research is Research and Development (R&D) with the ADDIE development model. The data collection technique used was an indirect communication technique which was carried out by giving an assessment sheet in the form of a checklist to two experts. The assessment contains certain indicators that are assessed using a Likert scale assessment score. The results of the Green Chemistry e-supplement feasibility test obtained a result of 98% with a very feasible category so that it can be used in Green Chemistry courses.*

Keywords: *development; e-supplement; melastoma malabathricum; green chemistry*

INTRODUCTION

The utilization of information technology in the learning process is a necessity nowadays to achieve effective and efficient learning objectives (Tekege, 2017). Learning is a process that requires interaction between learners, educators, and learning resources in an educational environment. This learning aims to make the process of acquiring knowledge and knowledge, mastering skills, and forming attitudes and beliefs in students (Josephine et al., 2016). Learning media plays a crucial role in the educational process as a tool to aid learning, ensuring clarity in conveying materials and facilitating the effective and efficient achievement of learning objectives (Muhson, 2010).

Green chemistry is one of the elective courses in the Chemistry Education Study Program of FKIP Untan, which focuses on methods to reduce or eliminate the use of chemicals. As a relatively new field of study in chemistry, Green Chemistry emphasizes the application of chemical principles in the design, use, or production of chemicals with the aim of reducing the impact of the use or production of hazardous materials that can harm the environment and human health (Nurbaity, 2011).

The main guide in the Tanjungpura University Chemistry Education Study Program for Green Chemistry learning is the Semester Learning Plan (RPS). The learning objectives in this course are that students can explain the role of local plants in increasing environmental awareness of the impact of chemical activities on the environment and human health. One of the plants that can be used in developing this principle is the use of biomordants from cengkodok *(Melastoma malabathricum)* leaves. Research by (Parawansa et al., 2023) who explored biomordants from plants stated that cengkodok leaves have the potential as biomordants for textile fibers so as to reduce dependence on synthetic dyes that have the potential to damage the environment.

Based on the results of interviews conducted with Green Chemistry Lecturers, it is known that the learning process only uses PowerPoint and has not used other learning media so that learning tends to be boring. The restriction arises from the absence of teaching materials during the learning process and the insufficient implementation of learning methodologies. Therefore, it is necessary to use learning media that can arouse the interest of students to achieve learning objectives. The use of media in the learning process will affect students' understanding of the material presented by educators. This is because the media used can describe the material more realistically (Fashiri & Susanti, 2020). One of the learning tools or media that can be used is supplements.

LITERATURE REVIEW

Learning media is defined as a tool or component that contains information used by educators to convey messages to students in the form of videos, photos, books, and so on (Hafiza et al., 2022). According to the Big Indonesian Dictionary (KBBI) (2011) supplements are additions given to complement newspapers, magazines, and the like, as well as complementary attachments. Supplement is also defined as an addition or complement to something that has existed before with the aim that the learning material is presented in more detail. In the context of learning, learning supplements can be interpreted as additional tools that support the learning process in the classroom (Rahmi & Syamsurizal, 2021).

E-supplements are learning media that do not use paper raw materials, but digital files that can be accessed on various electronic media. The advantages of electronic supplement teaching materials are that they are more practical to use because they can be easily accessed anywhere and anytime through electronic devices such as gadgets and computers (Nukila et al., 2022). According to Sukoco et al., 2021 e-supplements have several advantages and disadvantages. The advantages of e-supplements include a simple appearance, can facilitate student understanding, can be used repeatedly, is not easily damaged, and is more efficient. In addition, the disadvantage of e-supplements is that there must be an internet network to access them.

Research by Sinaga et al., 2023 who conducted a feasibility test of learning media in the form of e-booklets with an average percentage of 91.23% with a very feasible category to use and proved an increase in student learning outcomes after being given the e-booklet. The assessment results of Siburian & Sahputra, 2021 stated that the elemental chemistry's pedia e-supplement based on multirepresentation obtained a percentage of material feasibility of 95.6% with very feasible criteria. The assessment of the language aspect obtained a score of 94.4%, indicating very feasible feasibility. Similarly, the assessment of the design aspect resulted in a score of 95.5%, also indicating very feasible feasibility. The results of the response test in the large group obtained a percentage of 85.5% with very good criteria. Based on the results of the study, it can be concluded that the Elemental Chemistry's Pedia e-supplement is declared very feasible and the response obtained can be declared very good.

METHODS

The method used in this research is Research and Development (R&D). R&D is a process to develop a new product or improve an existing product. The resulting product can be hardware or software (Donasari & Silaban, 2021). Mulyatiningsih (2014) states that development research (R&D) aims to produce new products through a development process (Bahtiar & Julianto, 2022). The development model used in this research is the ADDIE development model which consists of analysis, design, development, implementation, and evaluation (Arief et al., 2021). However, this research is limited to the analysis, design, and development stages. This study aims to determine the feasibility level of the media that has been developed, namely the Green Chemistry E-Supplement. The subject of this research is E-Supplement Green Chemistry Biomordan from Cengkodok Leaf *(Melastoma malabathricum).* The development procedure with the ADDIE model can be seen in Figure 1 below (Sugihartini & Yudiana, 2018).

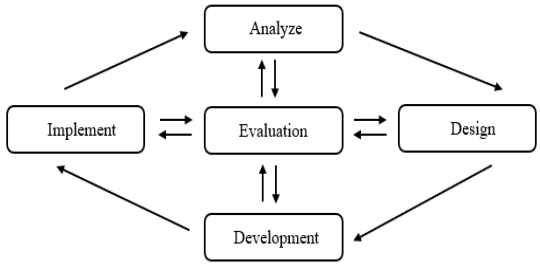

Figure 1. ADDIE development model

In the analysis stage, the method used is qualitative analysis, namely analysis conducted by interview and observation (Junaid, 2016). Interviews were conducted with lecturers teaching Green Chemistry courses. Moreover, the design phase involves creating the storyboard for the media to be produced. The development phase entails actualizing the media and conducting a feasibility evaluation of the completed media (Kurnia et al., 2022). The media made will be tested for feasibility based on aspects of material, media, and language by two experts.

The data collection method employed is an indirect communication technique, accomplished by distributing an assessment sheet in the form of a checklist to experts. The assessment contains certain indicators that are assessed using a Likert scale assessment score. The Likert scale used in this study can be seen in Table 1.

Table 1. Criteria for feasibility rating sheet with likert scale

Criteria	Description	Statement Score
SS	Strongly agree	4
S	Agree	3
TS	Disagree	2
STS	Strongly disagree	1

Furthermore, the results of the feasibility assessment score are calculated using the percentage with the formula:

$$RSP = \frac{n}{N} \; x \; 100\%$$

Description:
RSP = Average assessment score
n = Number of scores obtained
N = Maximum number of scores
(Riza et al., 2021).

The results of the average percentage of the total assessment score are categorized using a Likert scale which can be seen in Table 2.

Table 2. Interpretation criteria for feasibility assessment score

Feasibility Interval	Eligibility Criteria
76% < × ≤ 100%	Very Feasible
51% < × ≤ 75%	Feasible
26% < × ≤ 50%	Not feasible
0% < × ≤ 25%	Very unfeasible

(Nurdiana et al., 2023)

RESULT AND DISCUSSION

The first stage begins with conducting an analysis, namely direct interviews with lecturers teaching Green Chemistry courses. The interview was conducted to obtain information about the resources needed in the learning process and the preparation of the project plan. Based on the analysis conducted, it is known that the learning process only uses PowerPoint and

has not used other learning media so that learning tends to be boring. This constraint arises from the absence of teaching materials during the learning process and the inadequate implementation of learning methods, leading to unmet learning objectives. The learning objective is "Students can explain the role of local plants in increasing environmental awareness of the impact of chemical activities on the environment and human health".

The design phase involves creating a media design in the form of a storyboard and assembling a feasibility assessment sheet. A storyboard is a comprehensive outline of an application arranged in sequence, accompanied by explanations and specifications for each design element (Suparni, 2016). The storyboard serves as a guide that will be used in the system implementation process. The main purpose of making a storyboard is to explain the narrative flow of a story or scenario that will be produced (Ariyana et al., 2022).

The next stage in this research is development, namely making learning media in accordance with the plans that have been made previously. Learning media made in the form of A4-sized e-supplements designed using Canva through the website. The e-supplement contains cengkodok plants *(M. malabathricum)*, synthetic dyes, natural dyes, mordants, determination of cengkodok leaf levels, application of biomordants from plants, and evaluation questions to increase students' understanding. This learning media is expected to help students develop skills in utilizing local plants. The e-supplement display can be seen in Figure 2 below.

Figure 2. Display of green chemistry e-supplement

The Green Chemistry e-supplement learning media made was then revised by experts before being assessed for feasibility. This stage was carried out to obtain criticism from experts and used as input. Based on the evaluation from the experts, there are several things that need to be improved in the aspects of material, media, and language.

Based on the material aspect, the feasibility assessment of the Green Chemistry e-supplement was reviewed from various indicators conducted by 2 experts. In the material presentation indicator, there are several sub-materials that need to be added, namely tannin compounds. This sub-material explains the structure of tannins, the properties of tannins, and tannin groups, and the biomordant reaction between cellulose and dyes. In addition, there is also an improvement in the indicator of the validity of the material in the e-supplement, namely the chemical structure presented is a tannin derivative, causing a wrong interpretation.

Based on the evaluation of this indicator expert, the chemical structure was replaced with the general chemical structure of tannin compounds. Image presentation must be in accordance with the material presented and consistency so that the material can be understood without causing multiple interpretations (Basyari et al., 2012). The revised results of adding sub-materials and general chemical structures of tannin compounds can be seen in Figure 3.

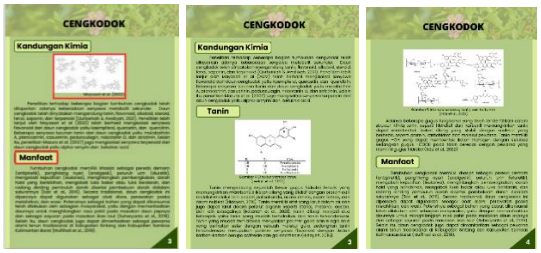

Figure 3. Revision of the material aspect feasibility assessment

Furthermore, the feasibility assessment of the media aspect. In the indicator of the visual appearance of teaching materials, there are several things that need to be added, namely a description of each picture and table and the addition of numbering in the

sub-material types of mordants (Figure 4). In addition, each image also needs to include the source of the image to ensure the validity of the image used in the e-supplement. Then the addition of numbering to the types of mordants, namely metal mordants, oil mordants, and natural mordants, aims to provide clarity and order of explanation in the content of e-supplements so that improvements are needed to produce effective sentences. This is in accordance with the view of Indrastuti (2020), straightforward language is characterized by effectiveness, unambiguity, and clarity.

Figure 4. Revision of media aspect feasibility assessment

In terms of language, the assessment of the feasibility of Green Chemistry e-supplements is carried out through a number of indicators, one of which is straightforward. In the analysis, there are several sentences in the e-supplement that are considered less effective, as shown in Figure 5 below.

Figure 5. Revision of language aspect feasibility assessment

Furthermore, this e-supplement was tested for feasibility by experts with certain indicators. The feasibility assessment is carried out based on aspects of material, media, and language to determine the level of feasibility of e-supplements based on percentage criteria so that they can be used. The feasibility assessment of Green Chemistry e-supplement instruments and products was carried out by two experts who acted as validators. The results of the feasibility assessment of the three aspects can be seen in Table 3 below.

Table 3. Data on feasibility assessment results of green chemistry e-supplemen

Aspects	Indicator	Score obtained	
		Validator 1	Validator 2
Material	Suitability of material with learning objectives	8	8
	Sophistication of the material in the e-supplement	8	8
	Presentation of material in e-supplements	4	4
Media	Visual appearance of teaching materials	8	7
	Use of letters	8	8
Language	Straightforward	8	7
	Communicative	4	4
	Language rules	4	4
	Total percentage	100%	96%

In terms of various aspects based on the feasibility assessment from experts, the Green Chemistry e-supplement learning media with the material "Biomordan from Cengkodok Leaf *(Melastoma malabathricum)"* obtained an overall average result of 98% with very feasible criteria to use. This is in line with the research of (Siregar et al., 2024) who conducted a feasibility test of learning media in the form of a chemical module on hydrocarbons based on contextual compound materials with a percentage of 91.23% which was stated as very feasible to be used as teaching materials. Then Sembiring & Susanti, 2024 stated that the results of the validation of materials and media by several validators showed an average overall percentage of 90.04% with the criteria of very feasible to use. Sutiani & Maisyarah, 2021 also conducted a feasibility test on guided inquiry-based modules, namely the material reached an average percentage of 83.10% and the media averaged 83.09% with a very feasible category and can be used as a supporting medium in learning.

The advantage of this e-supplement is that it is easily accessible anywhere and anytime through electronic devices such as devices or computers and can be used repeatedly. This e-supplement also has the disadvantage that it only contains text and images without audio visual and there must be an internet network to access it.

CONCLUSION

Based on the research conducted, the Green Chemistry e-supplement with the material "Biomordan from Cengkodok Leaves *(Melastoma malabathricum)*" obtained a result of 98% with a very feasible category so that it can be used in Green Chemistry courses. This developed e-supplement aims to make the learning process more interesting and can increase students' motivation in learning.

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REFERENCE

Arief, M. D., Auliah, A., & Hardin, H. (2021). Pengembangan E-Magazine Reaksi Reduksi dan Oksidasi Sebagai Media Pembelajaran Kimia Kelas X SMA/MA. *Jurnal Inovasi Pembelajaran Kimia (Journal Of Innovation in Chemistry Education)*, *3*(2), 148–163. https://doi.org/10.24114/jipk.v3i2.28111

Ariyana, R. Y., Susanti, E., & Haryani, P. (2022). Rancangan Storyboard Aplikasi Pengenalan Isen-Isen Batik Berbasis Multimedia Interaktif. *INSOLOGI: Jurnal Sains Dan Teknologi*, *1*(3), 321–331. https://doi.org/10.55123/insologi.v1i3.375

Bahtiar, R. D. A. A., & Julianto, J. (2022). Pengembangan media video interaktif berorientasi pendekatan CTL untuk meningkatkan hasil belajar siswa dalam pembelajaran IPA materi hubungan ekosistem dengan makhluk hidup pada siswa kelas 5 SD. *Jurnal Pendidikan Guru Sekolah Dasar*, *10*(06), 1236–1247.

Basyari, A., Sunaryo, S., & Iswanto, B. H. (2012). Pengembangan Media Pembelajaran Fisika Berbasis Adobe Flash untuk Menjelaskan Fisika Inti dan Radioaktivitas untuk SMA Kelas XII. *Seminar Nasional Fisika*, 116–120.

Donasari, A., & Silaban, R. (2021). Pengembangan Media Pembelajaran Kimia Berbasis Android Pada Materi Termokimia Kelas XI SMA. *Jurnal Inovasi Pembelajaran Kimia (Journal Of Innovation in Chemistry*

Education), *3*(1), 86–95. https://doi.org/10.24114/jipk.v3i1.23056

Fashiri, F., & Susanti, N. (2020). Pengembangan Bahan Ajar Interaktif Berbasis Website Pada Topik Larutan Elektrolit dan Non Elektrolit. *Jurnal Inovasi Pembelajaran Kimia (Journal Of Innovation in Chemistry Education)*, *2*(2), 104–109. https://doi.org/10.24114/jipk.v2i2.19789

Hafiza, M., Marlina, L., & Astuti, R. T. (2022). Pengembangan Media Pembelajaran Whiteboard Animation pada Materi Hidrokarbon sebagai Media Alternatif Pembelajaran Daring. *Jurnal Inovasi Pembelajaran Kimia (Journal Of Innovation in Chemistry Education)*, *4*(1), 82–91. https://doi.org/10.24114/jipk.v4i1.33661

Josephine, A., Sawiji, H., & Susantiningrum, S. (2016). Penerapan Model Pembelajaran Discovery Learning untuk Meningkatkan Keaktifan dan Prestasi belajar Peserta Didik pada Matapelajaran Pengantar Administrasi Perkantoran Kelas X Administrasi Perkantoran 3 SMK Negeri 6 Surakarta Tahun Pelajaran 2014/2015. *Jurnal Informasi Dan Komunikasi Administrasi Perkantoran*, *1*(1), 14–35. https://doi.org/10.20961/jikap.v1i1.19132

Junaid, I. (2016). Analisis Data Kualitatif dalam Penelitian Pariwisata. *Jurnal Kepariwisataan*, *10*(1), 59–74. https://doi.org/10.31219/osf.io/npvqu

Kurnia, M. R. A., Haryanto, H., Sanova, A., & Dewi, C. A. (2022). Studi Respon Siswa Terhadap Pengembangan Multimedia Interaktif Berbasis Chemo-Entrepreneurship Berbentuk Aplikasi Android. *Jurnal Kependidikan Kimia*, *10*(1), 10–20. https://doi.org/10.33394/hjkk.v10i1.4954

Muhson, A. (2010). Pengembangan Media Pembelajaran Berbasis Teknologi Informasi. *Jurnal Pendidikan Akuntansi Indonesia*, *8*(2), 1–10. https://doi.org/10.21831/jpai.v8i2.949

Nukila, M., Muharini, R., Sartika, R. P., & Lestari, I. (2022). Pengembangan E-Suplemen Berbasis Multirepresentasi pada Materi Hidrokarbon. *Jurnal Ilmu Pendidikan*, *4*(4), 5970–5987. https://doi.org/10.31004/edukatif.v4i4.3071

Nurbaity, N. (2011). Pendekatan Green Chemistry Suatu Inovasi Dalam Pembelajaran Kimia Berwawasan Lingkungan. *Jurnal Riset Pendidikan Kimia*, *1*(1), 13–21. https://doi.org/10.21009/JRPK.011.02

Nurdiana, N., Dwiyanti, S., Pritasari, O. K., & Wilujeng, B. Y. (2023). Pengembangan Media Pembelajaran Berbasis Website Kompetensi Dasar Gizi Untuk Kecantikan Di Smk Labschool Unesa 1 Surabaya. *Journal UNESA*, *12*(2), 186–194.

Parawansa, K. A., Masriani, M., Sasri, R., Sapar, A., Erlina, E., & Ersando, E. (2023). The Effect of Different Solvents on Total Tannin Content of Cengkodok (Melastoma malabathricum) Leaf Extracts. *Hydrogen: Jurnal Kependidikan Kimia*, *11*(6), 821–834. https://doi.org/10.33394/hjkk.v11i6.9774

Rahmi, R., & Syamsurizal, S. (2021). Meta-Analisis Validitas Booklet Materi Ekosistem Sebagai Suplemen Bahan Ajar Biologi Kelas X SMA. *Journal of Science Education*, *1*(2), 51–57.

https://doi.org/10.52562/biochephy.v1i2.255

Riza, F. Y., Antosa, Z., & Witri, G. (2021). Pengembangan Lembar Kerja Peserta Didik Berbasis Multikultural Pada Pembelajaran Seni Budaya dan Prakarya Kelas V Sekolah Dasar. *Jurnal Inovasi Pendidikan Dan Pembelajaran Sekolah Dasar*, *4*(2), 21–32. https://doi.org/10.24036/jippsd.v4i2.112327

Sembiring, D., & Susanti, N. (2024). Development of PowToon-Based Audio-Visual Media in Chemical Bonding Materials. *Jurnal Inovasi Pembelajaran Kimia (Journal Of Innovation in Chemistry Education)*, *5*(2), 94–101. https://jurnal.unimed.ac.id/2012/index.php/jipk

Siburian, K., & Sahputra, R. (2021). Pengembangan E-Suplemen Elemental Chemistry's Pedia Berbasis Multirepresentasi Untuk Mahasiswa Pendidikan Kimia Universitas Tanjungpura. *Jurnal Education and Development*, *9*(4), 235–246. https://doi.org/10.37081/ed.v9i4.2951

Sinaga, H., Silalahi, M. V., & Situmorang, M. V. (2023). Pengembangan Media Pembelajaran E-Booklet pada Materi Keanekaragaman Hayati terhadap Hasil Belajar Siswa Kelas X SMA Negeri 4 Pematang Siantar. *Journal Of Social Science Research*, *3*(5), 7116–7130. https://doi.org/10.31004/innovative.v3i5.5702

Siregar, T., Yawan, S. F., & Panggabean, F. T. M. (2024). Development of Contextual-Based Chemistry Modules on Hydrocarbon Compound Materials. *Jurnal Inovasi Pembelajaran Kimia (Journal Of Innovation in Chemistry Education)*, *6*(1), 20–29. https://jurnal.unimed.ac.id/2012/index.php/jipk

Sugihartini, N., & Yudiana, K. (2018). Addie Sebagai Model Pengembangan Media Instruksional Edukatif (MIE) Mata Kuliah Kurikulum Dan Pengajaran. *Jurnal Pendidikan Teknologi Dan Kejuruan*, *15*(2), 277–286. https://doi.org/10.23887/jptk-undiksha.v15i2.14892

Sukoco, G. F., Sapto, A., & Ridhoi, M. R. (2021). Pengembangan Buku Suplemen Elektronik Materi: Sejarah Banjir dan Pembangunan Saluran Air di Tulungagung Tahun 1939-1986 Untuk Pembelajaran Sejarah Kelas X IIS 3 SMA Katolik ST. Thomas Aquino Tulungagung. *Journal of Islamic Civilization History and Humanities*, *2*(1), 41–48. https://doi.org/10.22515/isnad.v2i1.4905

Suparni, S. (2016). Metode Pembelajaran Membaca Doa Berbasis Multimedia Untuk Anak Usia Dini. *Indonesian Journal on Software Engineering*, *2*(1), 57–63. https://doi.org/10.31294/ijse.v2i1.668

Sutiani, A., & Maisyarah, D. (2021). Pengembangan Modul Berbasis Guided Inquiry Pada Pokok Bahasan Laju Reaksi. *Jurnal Inovasi Pembelajaran Kimia (Journal Of Innovation in Chemistry Education)*, *3*(1), 96–105. https://doi.org/10.24114/jipk.v3i1.24100

Tekege, M. (2017). Pemanfaatan teknologi informasi dan komunikasi dalam pembelajaran SMA YPPGI Nabire. *Jurnal Teknologi Dan Rekayasa*, *2*(1), 40–52.