Teaching Coagulation Using Bio Coagulant from Mango Skin Against Cement Wastewater to Vocational School Students through Experimental Demonstrations

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Abstract: The purpose of this study was to determine the effect of video learning on the coagulation process using a mango peel-based bio-coagulant on cement wastewater for vocational school students. The bio-coagulant fabrication is done by drying the mango peel in an oven at 60 degrees Celsius, mashing it in a blender, then uniforming the powder particle size using a 200 mesh sieve. The mango peel bio-coagulant powder was then applied to cement wastewater that had been conditioned to an acidic atmosphere with variations of 100, 150, 200, 250, and 300 mg/L. Cement wastewater was tested through pH, temperature, and total dissolved solids (TDS) tests before and after adding the bio-coagulant powder to determine the effect of the bio-coagulant application. This research was also conducted by providing pretest questions, learning videos, and posttest questions to vocational students. The results showed that giving bio-coagulants to cement wastewater could increase the pH value, had no effect on temperature changes, and could decrease the TDS value. Then, the learning outcomes for vocational students show that the use of video learning media has a low effect on students' understanding of the coagulation process.

Keywords: bio-coagulant, coagulation, mango peel, teaching, students

1. Introduction

Coagulation is the process of adding a coagulant or chemical substance to a solution to condition suspensions, colloids, and suspended matter in preparation for further processes, namely, flocculation. Flocculation is the process of collecting particles with unstable charges which then collide with each other to form a collection of particles of a larger size, known as flocculant particles or floc (Rusydi et al., 2017). With the presence of larger particles, the separation between solute and solute particles can be done more easily. In the application process, coagulation uses a substance called a coagulant.

Coagulants are chemical substances that cause the destabilization of the negative charge of particles in suspension. This substance is a positive charge donor which is used to destabilize the negative charge of the particles. In water treatment, aluminum salts, Al (III) or iron (II), and iron (III) salts are often used (Mayasari & Hastarina, 2018). However, the use of these chemicals is not good because they can pollute the environment and pose a health risk. Thus, the use of coagulants derived from natural ingredients is required. The use of natural coagulants is expected to reduce processing costs and also minimize the environmental impact caused by the use of chemical substances or synthetic materials which produce side effects in their use.

Bio-coagulant is a natural coagulant that acts to bind impurities in the waste (Bija et al., 2020). Based on the source, natural coagulants can be classified into animal, vegetable, and microbial-based bio-coagulants, while based on the active ingredients, they can be classified as proteins, polyphenols, and polysaccharides. Polysaccharides are natural substances that are abundant and are often found in plants and animals (Kristianto et al., 2020). Various materials have been used in the synthesis of bio-coagulants. The report of the bio-coagulant synthesis is shown in Table 1. However, the use of mango peel as the main ingredient of bio-coagulant is rarely found. The use of mango peel in the process of making bio-coagulants is because it contains the

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active ingredient of polysaccharides in the form of pectins (Mardhatilla et al., 2021).

Learning media provide an important role in the success of the learning process (Hernawati & Nandiyanto, 2021; Winarni & Rasiban, 2021; Maryanti & Nandiyanto, 2023). The development of technology today encourages various changes in aspects of life, as well as in the aspects of education, including learning media. Instructional videos are a type of media that prioritizes the power of sound and images in their delivery (Pamungkas et al., 2018; Judiasri et al., 2019). The advantages of audio-visual media in the form of instructional videos can bridge the limitations of student experience with the material taught by the teacher and provide contextual experiences to students (Haerullah & Hadi, 2020). Examples of the use of learning media in the form of video are video learning material tangents to circles (Putri & Dewi, 2020), Social Science learning videos (IPS) for elementary school students (Yuanta, 2020), and Natural Science learning videos for students. primary school (Jatmiko et al., 2017). However, there is no learning video about the coagulation process using bio-coagulant made from mango peel against cement wastewater for vocational high school students (SMK) does not exist.

Therefore, the novelty of this study is the use of mango peel as a bio-coagulant base material and the evaluation of the learning outcomes of vocational school students about the bio-coagulation process with bio-coagulants from mango peel to cement wastewater. This study was supported by several analyses, including pH, temperature, and total dissolved solids (TDS) tests before and after adding the bio-coagulant powder to determine the effect of the bio-coagulant application.

Based on our previous studies for applying experiments to vocational schools (Nandiyanto et al., 2018; Nandiyanto et al., 2020a; Nandiyanto, 2020b; Nandiyanto, 2020c; Nandiyanto et al., 2020d; Nandiyanto et al., 2020e; Nandiyanto et al., 2020f; Hidayat et al., 2020), the main objective of this study was to determine the effect of the instructional video on the coagulation process using bio-coagulant made from mango peel on cement wastewater for vocational high school students (SMK). In addition, this study aims to determine the effect of bio-coagulant made from mango peel on the quality of cement wastewater. For teaching and learning process to students, this study also did experimental demonstration supported with online learning. Although this online learning is good to solve barrier in ths covid pandemic condition, there are some limitations, making teacher must add some strategies. Detailed strategies for facing covid pandemic are reported in elsewhere (Mulyanti et al., 2020; Hashim et al., 2020; Sangsawang, 2020; Hernawati & Nandiyanto, 2021; Nasution & Nandiyanto, 2021; Huwaidi et al., 2021; Maryanti, 2021; Ganesha et al., 2021; Ramdhani & Nandiyanto, 2021; Sukmawati & Maryanti, 2022).

2. Materials and Methods

2.1. Materials

The ingredients used in the manufacture of bio-coagulants are mango (obtained from the market in Cianjur) and acetic acid / CH_3COOH (obtained from PT SIDOLA, Sumedang). The tools used are an oven, blender, digital scale, container, mesh, stopwatch, and thermometer.

2.2. Bio-coagulant fabrication process

Figure 1 shows the fabrication process of a bio-coagulant with mango peel as a base. The first process in making a bio-coagulant is peeling the mango peel. The peeled mango skin is then washed using water. After the washing process, the mango peels are dried in the sun before being oven-dried at 60 degrees Celsius to ensure the loss of moisture. The dried mango peel is then mashed and sieved using a 200 mesh sieve.

2.3. Bio-coagulant ability testing

Testing the bio-coagulant ability is carried out with the first step, namely the cement wastewater sample is put into a 100 ml beaker, then the wastewater sample is conditioned so that it has an acidic pH, then put the bio-coagulant powder into a beaker that is already contains 100 ml of waste. The dosage variations used were 100, 150, 200, 250, and 300 mg/L. After that, the stirring was carried out for approximately 4 minutes followed by a 60 minutes precipitation process for each sample.

2.4. pH testing

The pH test is carried out to determine the acidity level contained in cement wastewater. In addition, the basic ingredients for cement manufacturing, namely CaO, Fe_2O_3, Al_2O_3, and SiO_2 were tested to determine the comparison the quality of water containing these materials. The higher the pH value, the higher the alkalinity value and the lower free carbon dioxide levels. The activity of hydrogen ions in water is indicated by the pH value or the degree of acidity. The pH value ranges from 1-to 14. This pH test is carried out using a pH meter.

2.5. Temperature test

The temperature test is a test carried out to measure the water temperature in the five variations of the sample before and after the coagulation process with bio-coagulants. In this study, the temperature test was carried out by testing the five variations of the sample using a thermometer. The temperature test is carried out by immersing the thermometer directly into the water and leaving it for 2-5 minutes until the thermometer shows a stable value, then note the scale of the thermometer without lifting.

2.6. TDS test

TDS is are a parameter of the number of particles, both organic and non-organic in the water. The unit of measure for TDS is ppm (parts per million) which is calculated in milligrams per liter (mg/L). The TDS test is carried out using a TDS meter.

Table 1. Bio-coagulant Synthesis Report

Active Materials	Main Materials	Results	Reference
Calcium Carbonate ($CaCO_3$)	Clamshells	The addition of $CaCO_3$ did not have a significant effect on water purification. Meanwhile, after the addition of CaO, there was a change in the value of TDS, pH, electrical conductivity, and color change. The more mass used, the clearer the water will be.	(Evi et al., 2020)
Polysaccharides	Moringa seeds (Moringa oleifera L.)	Giving Moringa seed powder as much as 0.05 grams has not been able to inhibit bacteria with the total MPN value still reaching> 2400/100 ml of water while 0.1 gram is able to reduce the number of bacteria by about 460/100 ml of water and 0.15 gram around 210/100 ml water.	(Muthmainna et al., 2021)
Polysaccharides (Pectin)	Ladle cactus (Opuntia cochenillifera)	The results showed that fresh cactus extract with 0.075 N HCl solvent and cactus powder extract with 0.1 N HCl solvent was the most effective as a base material in river water treatment.	(Chayani, 2019)

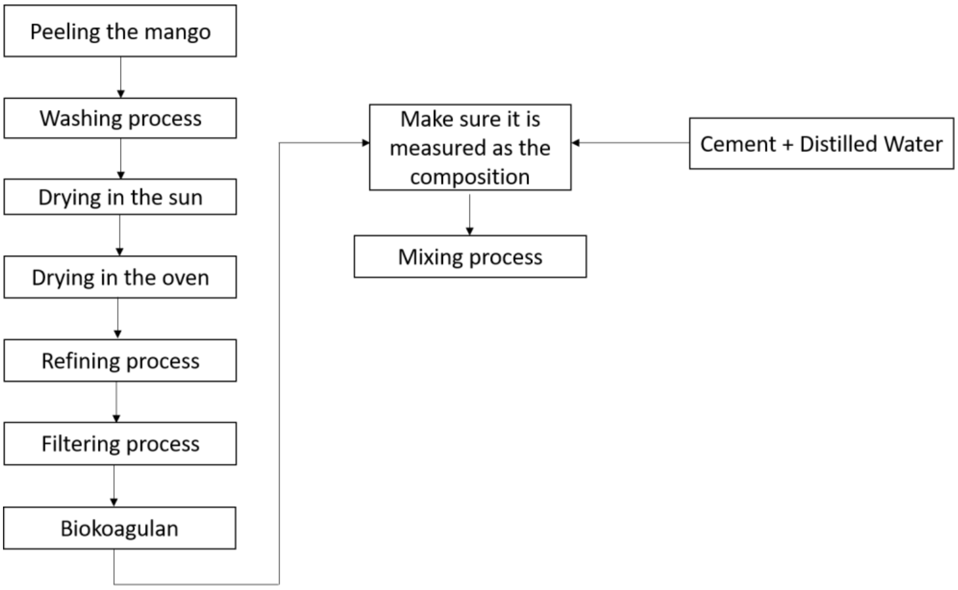

Fig. 1 Bio-coagulant Fabrication Process

2.7. Teaching methods

The method of teaching the coagulation process using bio-coagulants made from mango peel against cement wastewater was carried out on vocational high school students (SMK) in Indonesia. The method used is divided into three stages. The first stage is giving a pre-test which consists of filling in student identities, testing IQ, and giving questions about coagulation. The second stage is providing learning videos about the coagulation process. The last stage is a post-test which consists of filling in student identities and giving questions about coagulation.

3. Results and Discussion

The results of the bio-coagulant fabrication show the black powder is slightly brownish. Filtering using a 200 mesh sieve causes the bio-coagulant powder to have a very small and fine size.

Figure 2 shows the observation results of the addition of bio-coagulants to the pH value of the five variations. Previously, sample A had an average pH of 5.2, sample B had an average pH of 6, sample C had an average pH of 5.1, sample D had an average pH of 5.5, and sample E had an average pH of 5. After the coagulation process in the sample, the average pH of sample A became 8.7, the average sample B became 9, the average sample C became 8.8, the average sample D became 9.1, and the average sample E became 9.2. Based on the data in Fig. 2, the pH test results have increased. This is because the pectin pH tends to be unstable. After all, the glycoside bonds of the pectin poly galacturonic chain will be hydrolyzed so that the protopectin molecules are hydrolyzed less.

Then, based on the results of the temperature test observations shown in Fig. 3, it shows the average sample temperature before and after the addition of bio-coagulants. Before the addition of bio-coagulants, sample A has an average temperature of 27.7 ° C, sample B has an average temperature of 27.2 ° C, sample C has an average temperature of 27.3 ° C, sample D has an average temperature of 27.3 ° C, and sample E has an average of 27.4 ° C. After adding the bio-coagulant to the sample, sample A has an average of 27.1 ° C, sample B has an average of 26.8 ° C, sample C has an average of 26.8 ° C, sample D has an average of 28 ° C, and sample E has an average of 27.1 ° C.

From Fig. 3 it can be seen that there is no significant temperature change in the cement water sample before and after the coagulation process with coagulants, that is, the temperature is still in the range of 26 and 27 ° C. This is because the coagulation-flocculation process will not affect temperature changes (Sudarno & Hadiwidodo., 2014).

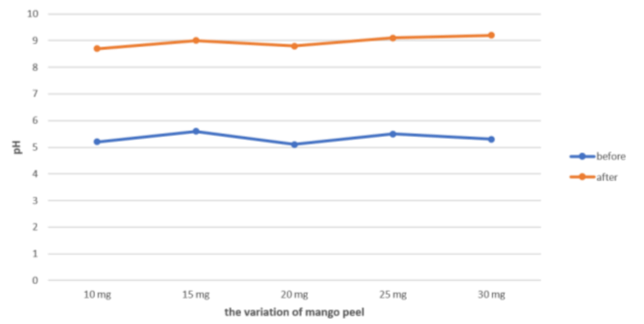

Fig. 2 Bio-coagulant effect on pH

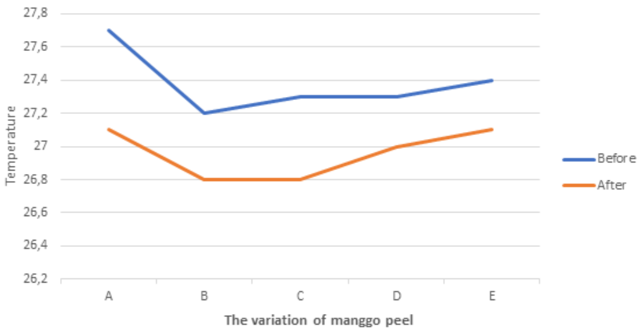

Fig. 3 Effect of bio-coagulants on temperature

Figure 4 shows that the overall TDS yield has decreased. This occurs because the coagulation process can reduce the TDS value. Although in general the addition of coagulants decreases the TDS value of cement wastewater, one variation in the dosage of bio-coagulants increases the TDS value. However, the increase was only slightly. This can occur because the coagulation process is not optimal.

Figure 5 shows the results of the IQ score of SMK students. The respondents' IQ scores were divided into 7 categories, namely mentally retarded (<69), borderline (10-79), below average (80-89), average (90-109), above average (110-119), superior (120-129).), and very superior (> 130) (Marusiak & Janzen, 2008).

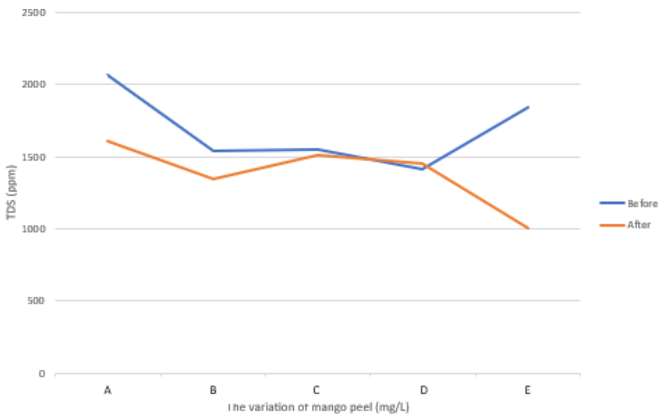

Fig. 4 Influence mango peel concentration on TDS

Based on the data in Fig. 5, it is shown that the number of students with the mentally retarded IQ category is 0 students, borderline 0 students, below average is 4 students, the average is 4 students, above average is 7 students, superior is 2 students, and very superior is 4. students.

Table 2 shows the results of the pretest and posttest that were processed to determine the student's normalized gain. The pretest and post-test questions consisted of 15 true-false questions as parameters for the progress of vocational school students' learning progress towards the coagulation process using a bio-coagulant made from mango peel to cement wastewater.

Table 2 shows the questions given to SMK students to see the level of understanding of students during the learning process through video learning media. Based on the results of the normalized gain shown in Table 2. Figure 6 is presented to make it easier to see the N gain score acquisition criteria.

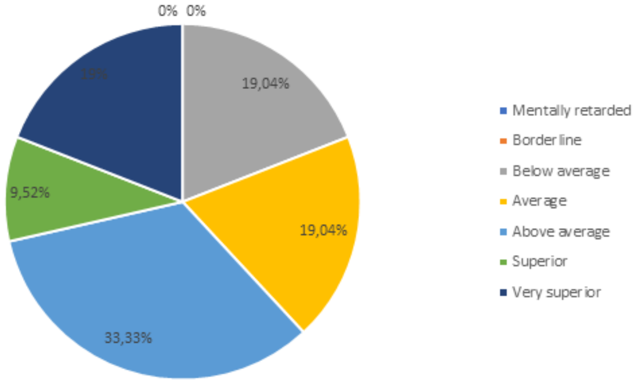

Fig. 5 Student IQ data

Table 2. Pre-test and Post-test Result

No.	Score (%)		N gain
	Pretest	Post-test	
1.	8	11	0.42
2.	10	10	0.00
3.	11	8	-0.75
4.	7	8	0.12
5.	10	11	0.20
6.	8	8	0.00
7.	8	9	0.14
8.	10	11	0.20
9.	8	11	0.42
10.	7	8	0.12
11.	7	10	0.37
12.	8	10	0.28
13.	10	11	0.20
14.	8	12	0.57
15.	10	12	0.40
16.	8	10	0.28
17.	7	11	0.5
18.	7	10	0.37
19.	7	9	0.25
20.	8	8	0.00
21.	9	11	0.33

Based on Fig. 6, two categories of normalized gain results are obtained. As many as 61.90% of students obtained normalized gain values which were in the low category and as many as 38.10% of students obtained normalized gain values that were included in the moderate category. Overall, the normalized gain average value obtained is 0.21, less than 0.3 which is in the low category.

In addition, the limitations of this study need to be considered because this research was conducted when the COVID-19 outbreak occurred online or from home studies that need additional strategies for enhancing students' comprehension (Mulyanti et al., 2020; Hashim et al., 2020; Sangsawang, 2020; Hernawati & Nandiyanto, 2021; Nasution & Nandiyanto, 2021; Huwaidi et al., 2021; Maryanti, 2021; Ganesha et al., 2021; Ramdhani & Nandiyanto, 2021; Sukmawati & Maryanti, 2022).

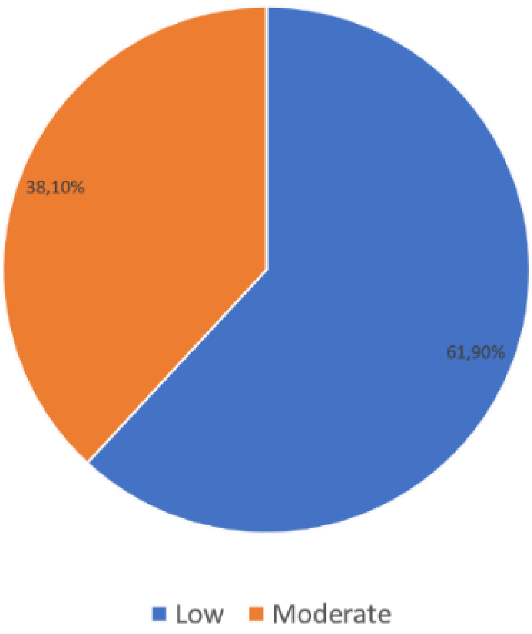

Fig. 6 Normalized gain pie chart

4. Conclusion

Based on the results of this study, the effect of providing video learning media on the coagulation process using bio-coagulants made from mango peel has a low impact on the understanding of vocational students. The provision of bio-coagulant powder to cement wastewater has been tested for its effect through pH, temperature, and TDS tests. The test results showed that overall, the application of bio-coagulant powder caused an increase in pH, had no effect on temperature, and caused a decrease in the TDS value in cement wastewater. Based on this study, the provision of bio-coagulants from mango peels to cement wastewater was able to affect improving water quality as evidenced by the resulting efficiency in decreasing the TDS value.

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References

Bija, S., Yulma, Y., Imra, I., Aldian, A., Maulana, A., and Rozi, A. (2020). Sintesis biokoagulan berbasis kitosan limbah sisik ikan bandeng dan aplikasinya terhadap nilai BOD dan COD limbah tahu di kota Tarakan. Jurnal Pengolahan Hasil Perikanan Indonesia, 23(1), 86-92.

Chayani, M. (2019). Penggunaan ekstrak kaktus centong (opuntia cochenillifera) sebagai koagulan alami pada air Sungai Kota Palu Jembatan III (Doctoral dissertation, Universitas Tadulako).

Evi, J., Mustari, M., Afriani, F., Rafsanjani, R. A., and Tiandho, Y. (2020). Pemanfaatan limbah cangkang kerang darah sebagai bio-koagulan untuk penjernihan air tanah terpolusi (Studi Kasus: Selindung). Proceedings of National Colloquium Research and Community Service, 4, 92-94.

Ganesha, P., Nandiyanto, A.B.D., and Razon, B.C. (2021). Application of online learning during the Covid-19 pandemic through zoom meeting at karya mekar elementary school. Indonesian Journal of Teaching in Science, 1(1), 1-8.

Haerullah, A., and Hadi, D. (2020). Video pembelajaran ipa sd/mi berbasis sumber daya alam lokal kota Ternate. Humano: Jurnal Penelitian, 11(2), 93-102.

Hashim, S., Masek, A., Abdullah, N. S., Paimin, A. N., and Muda, W. H. N. W. (2020). Students' intention to share information via social media: A case study of COVID-19 pandemic. Indonesian Journal of Science and Technology, 5(2), 236-245.

Hernawati, D., and Nandiyanto, A. B. D. (2021). The use of learning videos in order to increase student motivation and learning outcomes during the COVID-19 pandemic. ASEAN Journal of Science and Engineering Education, 1(2), 77-80.

Hidayat, D. S., Rahmat, C., Fattah, N., Rochyadi, E., Nandiyanto, A., and Maryanti, R. (2020). Understanding archimedes law: What the best teaching strategies for vocational high school students with hearing impairment. Journal of Technical Education and Training, 12(1), 229-237.

Huwaidi, F., Nandiyanto, A. B. D., and Muhammad, N. (2021). The urgency of online learning media during the Covid-19 pandemic at the vocational school in Indonesia. Indonesian Journal of Educational Research and Technology, 1(2), 35-40.

Jatmiko, P. D., Wijayantin, A., and Susilaningsih, S. (2017). Pengaruh pemanfaatan video pembelajaran terhadap hasil belajar IPA kelas IV sekolah dasar. Edcomtech Jurnal Kajian Teknologi Pendidikan, 1(2), 153-156.

Judiasri, M. D., Aneros, N., and Herniwati, H. (2019). Using vlog in shokyu kaiwa's course to improve students' speaking ability. *JAPANEDU: Jurnal Pendidikan dan Pengajaran Bahasa Jepang*, *4*(2), 115-125.

Kristianto, H., Jennifer, A., Sugih, A. K., and Prasetyo, S. (2020). Potensi polisakarida dari limbah buah-buahan sebagai koagulan alami dalam pengolahan air dan limbah cair. Jurnal Rekayasa Proses, 14(2), 108-127.

Mardhatilla, F., Hartono, E., and Hidayat, F. (2021). Pemanfaatan limbah kulit mangga di kota Cirebon. ABDIMAS: Jurnal Pengabdian Masyarakat, 4(1), 446-450.

Marusiak, C., and Janzen, H. (2008). Ability and achievement variables in average, low average, and borderline students and the roles of the school psychologist. The Alberta Journal of Educational Research, 54(4), 432-447.

Maryanti, R. (2021). Assessment of mathematical abilities of students with intellectual disabilities during the COVID-19 pandemic. Indonesian Journal of Community and Special Needs Education, 1(2), 47-52.

Maryanti, R., and Nandiyanto, A. B. D. (2023). Curriculum development in science education in vocational school. ASEAN Journal of Science and Engineering Education, 1(3), 151-156.

Mayasari, R., and Hastarina, M. (2018). Optimalisasi dosis koagulan aluminium sulfat dan poli aluminium klorida (Pac) (studi kasus pdam Tirta Musi Palembang). Integrasi: Jurnal Ilmiah Teknik Industri, 3(2), 28-36.

Mulyanti, B., Purnama, W., and Pawinanto, R. E. (2020). Distance learning in vocational high schools during the covid-19 pandemic in West Java province, Indonesia. Indonesian Journal of Science and Technology, 5(2), 271-282.

Muthmainna, N., Hafsan, H., and Hala, Y. (2021). Potensi biji kelor (Moringa oleifera Lamk.) sebagai biokoagulan alami air sumur. Filogeni: Jurnal Mahasiswa Biologi, 1(1), 7-11.

Nandiyanto, A. B. D., Asyahidda, F. N., Danuwijaya, A. A., Abdullah, A. G., Amelia, N. I. A., Hudha, M. N., and Aziz, M. (2018). Teaching "nanotechnology" for elementary students with deaf and hard of hearing. Journal of Engineering Science and Technology, 13(5), 1352-1363.

Nandiyanto, A. B. D., Rohman, E., Handayani, M. N., and Putri, S. R. (2020a). E-Module in producing briquettes from melinjo (gnetum gnemon) shell with various particle sizes and binder concentrations for vocational school students. Journal of Engineering Education Transformations, 34, 57-64.

Nandiyanto, A. B. D., Tiyana, R., Azizah, D. N., and Hofifah, S. N. (2020b). Demonstrating the biobriquettes production using variations in particle size and binder concentration using audio-visual to vocational students. Journal of Engineering Education Transformations, 34, 87-94.

Nandiyanto, A. B. D., Widiaputri, S. I., Maharani, S., and Ragadhita, R. (2020c). Job sheet learning media on briquette production from coffee grounds and soybean peel with various compositions and particle sizes for vocational high school students. Journal of Engineering Education Transformations, 34, 139-146.

Nandiyanto, A. B. D., Bustomi, A. T. A., Sugiarti, Y., and Santiuly, G. C. (2020d). The effect of electronic module utilization for biomass briquettes experiment using cocoa shells and sea mango to vocational school students. Journal of Engineering Education Transformations, 34, 115-123.

Nandiyanto, A. B. D., Rachmat, L. A., Rahayu, D. L., Azizah, N. N., and Al, D. F. (2020e). Development of job sheet application in making biobriquette based on coconut (cocos nucifera) coir with variation of particle size and banana (musa paradisica) peels for vocational students. Journal of Engineering Education Transformations, 34, 132-138.

Nandiyanto, A. B. D., Raziqi, G. Y., Dallyono, R., & Sumardi, K. (2020f). Experimental demonstration for enhancing vocational students' comprehension on heat transfer through conduction and radiation of light bulb. Journal of Technical Education and Training, 12(3), 189-195.

Nasution, A. R., and Nandiyanto, A. B. D. (2021). Utilization of the google meet and quiziz applications in the assistance and strengthening process of online learning during the COVID-19 pandemic. Indonesian Journal of Educational Research and Technology, 1(1), 31-34

Pamungkas, A. S., Ihsanudin, I., Novaliyosi, N., and Yandari, I. A. V. (2018). Video pembelajaran berbasis sparkol videoscribe: Inovasi pada perkuliahan sejarah matematika. Prima: Jurnal Pendidikan Matematika, 2(2), 127-135.

Putri, L. A., and Dewi, P. S. (2020). Media pembelajaran menggunakan video atraktif pada materi garis singgung lingkaran. Mathema: Jurnal Pendidikan Matematika, 2(1), 32-39.

Ramdhani, T., Nandiyanto, A.B.D. (2021). The use of Whatsapp social media as reinforcement online learning during the COVID-19 pandemic. Indonesian Journal of Multidisciplinary Research, 1(1), 107-112.

Rusydi, A. F., Suherman, D., and Sumawijaya, N. (2017). Pengolahan air limbah tekstil melalui proses koagulasi–flokulasi dengan menggunakan lempung sebagai penyumbang partikel tersuspensi (Studi kasus: Banaran, Sukoharjo dan Lawean, Kerto Suro, Jawa Tengah). Arena Tekstil, 31(2), 105-114.

Sangsawang, T. (2020). An instructional design for online learning in vocational education according to a self-regulated learning framework for problem solving during the

Covid-19 crisis. Indonesian Journal of Science and Technology, 5(2), 283-198.

Sudarno, D. T. N., and Hadiwidodo, M. (2014). Cangkang udang sebagai biokoagulan untuk penyisihan turbidity, tss, bod, dan cod pada pengolahan air limbah farmasi PT. Phapros Tbk, Semarang. Jurnal Teknik Lingkungan, 3(4), 1-10.

Sukmawati, D., Maryanti, R. (2022). Development of education and economic circulation in supporting local potential as community empowerment efforts amid the Covid-19 pandemic. Indonesian Journal of Multidiciplinary Research, 1(2), 235-250.

Winarni, R. S., and Rasiban, L. M. (2021). Perception of Japanese students in using online video as a learning media. Indonesian Journal of Educational Research and Technology, 1(1), 15-16.

Yuanta, F. (2020). Pengembangan media video pembelajaran ilmu pengetahuan sosial pada siswa sekolah dasar. Trapsila: Jurnal Pendidikan Dasar, 1(2), 91-100.