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Local Wisdom of Making Alcohol in Natural Science Learning in Elementary Schools

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ABSTRAK

Kurikulum 2013 berorientasi untuk menghasilkan peserta didik berkualitas yang berakar pada budaya bangsa dan dikembangkan berwawasan global. Proses pembuatan minuman beralkohol, merupakan salah satu contoh integrasi unsur ilmu pengetahuan alam dan kearifan lokal sebagai bentuk pelestarian budaya. Namun pihak sekolah masih kurang memiliki referensi dan kepekaan terhadap upaya penggalian aktivitas kearifan lokal masyarakat, khususnya dalam proses pembuatan miras. Penelitian ini bertujuan untuk menganalisis kajian etnosains pada proses pembuatan alkohol dalam pembelajaran IPA di sekolah dasar. Penelitian ini menggunakan pendekatan kualitatif dan termasuk dalam jenis penelitian etno science. Sumber data dalam penelitian ini ditentukan melalui teknik purposive sampling, dengan dua orang pembuat alkohol sebagai subjeknya. Objek penelitian ini meliputi proses pembuatan alkohol dan kajian etnosains dalam proses pembuatan alkohol pada pembelajaran IPA di sekolah dasar yang diperoleh melalui wawancara, observasi, dan dokumentasi. Teknik analisis yang digunakan adalah model Miles dan Huberman (reduksi data, penyajian, dan verifikasi). Hasil penelitian menunjukkan bahwa proses pembuatan alkohol dikaitkan dengan materi pembelajaran IPA di sekolah dasar, terkait dengan peralihan fasa, konveksi (perpindahan kalor), konduktor, dan sumber energi., dan sumber energi.

ABSTRACT

The 2013 curriculum is oriented towards producing quality students who are rooted in the nation's culture and are developed based on a global perspective. The process of making alcoholic beverages, is one example of integration elements of natural science and local wisdom as a form of cultural preservation. However the school still have lack of references and sensitivity to efforts to explore the local wisdom activities of the community, especially in the alcohol-making process. This research aims to analyse the ethno science study on the alcohol-making process in natural science learning in elementary schools. This study used a qualitative approach and is included in the ethno science research type. The data source in this study was determined through a purposive sampling technique, with two alcohol makers as the subjects. These research's objects consisted of the alcohol-making process and ethnoscience studies in alcohol making process in natural science learning in elementary schools, which were obtained through interviews, observations, and documentation. The analysis technique employed was the Miles and Huberman model (data reduction, presentation, and verification). The results uncovered that the alcohol-making process it is associated with natural science learning materials in elementary schools, it relates to phase transition, convection (heat transfer), conductors, and energy sources.

1. INTRODUCTION

Indonesia has thousands of islands from Sabang to Merauke, rich in cultural diversity, art, customs, ethnicity, race, language, values, and environmental management. In this case, local wisdom can be generally interpreted as a form of wisdom based on the values believed by the local community. However, the science and wisdom of TFs are not thoroughly understood by local people in their historical context (Jia et al., 2023; Sudarmin, 2015). The use of local wisdom in the teaching and learning process is also needed by the community. Communities must be involved to solve problems by applying wisdom and experience. Local wisdom needs to be developed so that it can imply cultural identity in an area in order to develop prosperity in accordance with local needs. Therefore, to encourage the development of education and

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learning processes schools can use local resources and capabilities (Kumala & Setiawan, 2019; Pornpimon et al., 2014).

The study activity between indigenous science and traditional society that comes from hereditary beliefs and still contains myths is called ethnoscience. The correlation between the original knowledge in the community and scientific knowledge in the literature was analyzed to integrate this indigenous knowledge into education (Rahayu & Sudarmin, 2015; Sumarni et al., 2022). Ethnoscience is also considered a system of knowledge and cognition typical of a given culture (Sudarmin, 2015; Sudarmin & Samini, 2015). By combining scientific science knowledge in schools with genuine science knowledge in the community (Gondwe & Longnecker, 2015; Dewi et al., 2017), students will care more about the surrounding environment. The application of learning like this can increase students' understanding of scientific science concepts, and learning becomes more meaningful. One of the obstacles in natural science learning was the learning companion book used by students with no presentation of the connection between natural science learning and the environment around students in the form of local culture or wisdom (Najib, 2018; Seroto, 2017). Science refers to daily activities so students can think scientifically about the surrounding situation. For this reason, educational staff must instill character education in students by integrating the science concepts learned with local wisdom in the area where students live.

On the other hand, the quality of natural science learning in Indonesia is deemed low, due to lack of attention to the socio-cultural environment as a source of learning. The concepts contained in natural science learning tend to be abstract, so students' ability to integrate the learning obtained at school into everyday life is still minimal (Ely, 2015; Setiawan et al., 2017). Meanwhile, the 2013 curriculum aims to produce quality students who are rooted in the nation's culture, and it was developed using the philosophy that "education is rooted in the nation's culture to build the nation's present and future." Thus, it is vital to create study materials that form an understanding of the potential in the area where students live so that students are more familiar with the natural and cultural environment. In this regard, ethnoscience-based natural science learning is only applied to specific materials that can be associated with an ethnoscience approach. This is in line with the results that the learning process is done not only in the classroom, but also in the environment and society. Hence, ethnoscience-based natural science learning is learning with the culture/customs of the local area/environment (Nurcahyani et al., 2021; Sudarmin et al., 2017).

Moreover, many students still do not know the connection between the concept of natural science and the process of making products in the community, which students often encounter daily. Several other researchers have also investigated the relationship between indigenous knowledge and natural science learning. As in Merauke, in the Malind tribal community, community knowledge is passed down from ancestors regarding the making of *sagu sep* (Supriyadi & Nurvitasari, 2020), and herbal medicine is a traditional medicine whose raw materials come from nature (plants and animals) (Septiani & Listiyani, 2021). In addition, in Indonesia, research related to constructing community knowledge based on local wisdom into scientific knowledge has been carried out, including ethnoscience studies in the process of making Madura shrimp paste in natural science learning (Hadi et al., 2019). Besides, the process of smoking fish can be used as a source of natural science learning (Perwitasari et al., 2016). Another study was also conducted regarding an ethnoscience study of the process of making Balinese wine in Tri Eka Buana Village as a supplement to natural science material for junior high school (N. L. P. P. P. Dewi et al., 2022). Thus, learning natural science concepts can be done by reviewing concepts and showing their application to people's daily lives, which have been carried out for generations and have even become an income source.

This fact is due to the lack of references and sensitivity to efforts to explore the local wisdom activities of the community, especially in the alcohol-making process in Bekonang Village, which can be studied into scientific knowledge. Thus, it causes a lack of student interest in natural science learning, which is considered challenging and difficult to understand, resulting in students not understanding the concept of natural science learning and low student learning outcomes. Therefore, efforts are needed to increase references for teachers and students to make it easier to carry out learning activities so that student learning outcomes improve and it is easy to understand natural science material by connecting natural science concepts with local wisdom in the community and providing additional knowledge for the community in Bekonang Village, particularly. Based on the background of the problems and solutions described, it is crucial to conduct this ethnoscience research to analyze the technoscientific study of the alcohol-making process in Bekonang Village. Later, it can be used in natural science learning in elementary schools. Thus, teachers can link natural science learning with local wisdom in the community to support previous research.

2. METHOD

This research method used a descriptive qualitative approach. A qualitative approach is research that prioritizes data presented in a narrative. In addition, the type of research employed in this study was ethnoscience. Ethnoscience research is the study of scientific knowledge through the nature-related culture that develops in society (Supriyadi & Nurvitasari, 2020). In this qualitative research is using ethnographic design. The definition of ethnographic design is a qualitative research procedure for describing, analyzing, and interpreting patterns of behavior, beliefs, and language shared by groups that share cultures over time (Jumrah, 2022). This study was conducted in Bekonang Village, Mojolaban, Sukoharjo, Central Java. This location was chosen because, according to information, the Bekonang people work as alcohol makers. The subjects in this study were several alcohol makers in Bekonang village. Meanwhile, this research's object consisted of making and studying ethnoscience in the alcohol-making process in natural science learning in elementary schools. Aspect of observation is show is show Table 1.

Table 1. Aspects Observed/Interviewed

Informant	Aspects Observed/Interviewed
SR	Materials needed
	Initial process
	A hereditary business as a form of local wisdom
SP	Making process
AZP	Making process
	Results
AR	Results
	Marketing

The sampling technique used was purposive sampling. Specific considerations determined by the researchers were seen from the quality of understanding of the problems studied regarding the information on the alcohol-making process and constructing local wisdom into natural science learning in elementary schools. Then, the data sample grew according to the information obtained using the snowball sampling technique, so the data were saturated. The instruments used in this study were interview guidelines and observation guidelines to collect data regarding the benefits of alcohol and the process of making alcohol. Once the manufacturing process is known, then identification is carried out to find out the relationship between the process of making alcohol and the content of natural science in elementary schools. Data was collected through observation, interviews and documentation. To test the validity of the data, data triangulation, extended observations, and informant reviews were used. Data analysis techniques used in this study were data analysis before going to the field, data analysis in the field using the Miles and Huberman models (data reduction, data presentation, and data verification), source triangulation, and technical triangulation.

3. RESULT AND DISCUSSION

Result

In Bekonang, the home industry for making alcohol began with the process of making ciu first. Ciu is a semi-finished product of alcohol, which is usually used by the public as a body-warm drink but is misused by certain people to become an intoxicating drink. This ciu is widely consumed by men. The difference between ciu and alcohol is that ciu is only processed once, whereas alcohol is processed twice. Ciu can also be called semi-finished alcohol. The end product of the process is alcohol. Mixing by four components as the pre-stage is show in Figure 1.

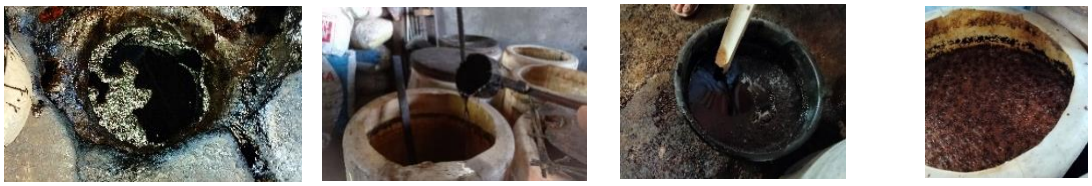

Figure 1. Pre-Stage of Making Alcohol

Base on Figure 1 show the early process of making alcohol. At first waste from the leftover stew (sediment from expansion)/*badeg* has a more liquid texture that has been left for ten days in the amount of

five small buckets. It will produce sugarcane juice has a thick texture of five small buckets. And plain water amounts to five small buckets. After that bacem water from sugarcane molasses is left for five days, and there are two small buckets of foam. These four ingredients are mixed evenly with materials from bamboo. The next process is fermentation as show in Figure 2.

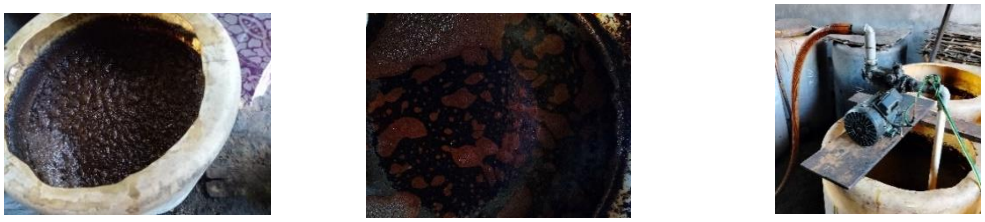

Figure 2. Main Stage Alcoholic Fermentation Process

Base on Figure 2 show the next process of making alcohol. These four ingredients are mixed evenly with materials from bamboo. After all mixed, let it stands for one day until there is a soda with much foam. After letting it sit for eight days, it becomes caustic soda, and foam is reduced and is then transferred from the holding drum to the boiling drum using a diesel. Then the solution transferred to an iron drum is ready to be boiled using firewood on a pawon. And the last step is show in Figure 3.

Figure 3. Last Steps of Making Alchohol

Base on Figure 3 show the final process of making alcohol. The solution is heated to a boil, producing steam. The boiling process is from 5 a.m. to 9 a.m. (four hours). The boiling steam becomes dew and will be channelled through a thick plastic hose to a drum filled with water, and there is a copper hose set in a circle immersed in water. Water is flowed periodically using Sanyo water. The water is allowed to overflow when it is fed from below (hot water can be replaced by plain water). Hot water then flows with normal temperature water so that the temperature is stable to cool the ciu water so that the temperature is not too hot. Then the results are stored in the conductor. By looking at the alcohol-making process, the relevance of natural science content material in elementary schools can be seen in Table 3.

Table 3. The Relationship Between Natural Science Materials And the Alcohol-Making Process

No	Materials	Description of the alcohol-making process
1	Conductor	Iron drum used for containing and boiling
2	Convection (Heat Transfer)	Heat transfer during the boiling process
3	Phase transition (Evaporation)	Boiling produces water vapor.
4	Energy sources	Firewood

Discussion

Alcohol has agreed-upon medical benefits. Some benefits of alcohol include stimulating brain activity, lowering blood sugar levels on an ongoing basis, and is proven to be a powerful antiseptic that kills bacteria. One of these types of alcohol is ethanol (Akbar & Riyanto, 2020; Juwita, 2012). Ethanol in the medical world is used as an ingredient for making disinfectants and antiseptics (Lukmanudin, 2015; Zuhri & Dona, 2021). In the medical world, the primary use of alcohol is as auxiliary material in drug formulation or production. Thus, alcohol in drugs is not the central part intended for "medicine" but instead as a "helper" ingredient. In addition, the use of alcohol in drugs is usually in liquid form, intended to dissolve drug substances that are difficult to dissolve in water (Anggraini et al., 2017; Wardani & Pertiwi, 2013). Yet, this function of alcohol has been replaced by many emulsifiers or suspending agents. For example, alcohol with a concentration of 70% is generally used as an antiseptic liquid that can be used to clean wounds or medical devices. This concentration is much higher than the alcohol concentration, so alcohol used in the medical field should not be used for daily consumption because of the risk of causing life-threatening poisoning

(Saputra et al., 2018; Yuan et al., 2017; Zuhri & Dona, 2021). Therefore, the use of alcohol in the medical world is intended for external use, such as antiseptics and disinfectants.

Hand sanitizer or hand sanitizer is an agent used to kill germs that cause disease in the hands, such as bacteria and viruses because the content in alcohol is useful as a bacteria killer because alcohol itself is hot and flammable and alcohol can denature proteins by dehydration and dissolve fat (Firdausi et al., 2022; Kiswandono et al., 2020; Mallarangang & Haddade, 2022). Alcohol can denature proteins found in bacteria and viruses, causing metabolic disturbances that cause bacterial and viral cell death (Firdausi et al., 2022; Sianipar et al., 2021). The ethanol contained in the hand sanitizer will break down fat which is the main component of a microorganism. Ethanol will react by denaturing proteins by dehydration and dissolving fat as a result of which cell membranes are damaged and enzymes are inactivated by ethanol (Fibonacci, 2019; Irianto et al., 2018; Rezki, 2016). Antiseptics are substances that can inhibit or destroy microorganisms on living tissue; this antiseptic alcohol is relatively safe for the skin. The type used is usually ethyl alcohol or ethanol, with a 60-90% concentration. Other types of alcohol are 1-propanol (60–70%) and 2-propanol/isopropanol (70–80%), or it can be a mixture of these types of alcohol (Astawa, 2012; Pancawati & Ami, 2015; Sari et al., 2021). Meanwhile, disinfectants are generally used for inanimate objects and are usually utilized to sterilize medical instruments (Rezki, 2016; Susatyo, 2016).The most effective method of killing bacteria is basting and soaking in 70% alcohol for 2 minutes. The greater the concentration of alcohol, the greater the ability to interfere with bacterial metabolic processes and cause greater inhibition of germ growth ((Srikartika et al., 2016; Zuhri & Dona, 2021).

The Bekonang alcohol industry located in Mojolaban Sub-district, Sukoharjo Regency is large since most communities are Bekonang alcohol artisans, which have been established or existed since the Dutch colonial era (some say it has existed since 1925, and some say it has existed since 1930) and has only been distilled since 1981. It is made using leftover sugarcane molasses from a sugar factory, in which, at first, the alcohol production, known as ethanol, was 35%, and people often referred to it as *"ciu."* Then, it developed through the distillation process, and the alcohol content increased to 70% alcohol and then to 90% alcohol. Research found that 30% alcohol content is commonly called *ciu*. At that time, people did not know that *ciu* could be reprocessed to produce alcohol. *Ciu,* made from sugarcane molasses, had an alcohol content of 30%. Sugarcane molasses must go through a process of fermentation, heated, and distilled to become *ciu* (Hardiyati & Dianingrum, 2021; Osvaldo et al., 2012; Rosyadi et al., 2014). The process takes approximately five days. In ancient times, artisans still used traditional tools made of clay. The tradition of *ciu* management in Bekonang still persists to this day.

Learning science in schools will be easier to understand if teachers pay attention to the culture of students (Khusniati et al., 2017; Sudarmin et al., 2017; Ramdani et al., 2020). Teachers' understanding of wisdom learning can make science learning occur meaningfully so that teachers need understanding and combine actual knowledge in society with scientific knowledge in schools (Ika Nurani Dewi et al., 2020; Sudarmin et al., 2017). Integrating culture into learning is an essential effort because school learning is suitable for the 21st century, namely science learning with a multicultural approach. The integration of local wisdom in the learning process supports good science learning (Kumala & Setiawan, 2019; Sofyan et al., 2019). This statement follows research results by previous study that state science teaching materials based on local wisdom can increase the effectiveness of learning and student achievement (Nurcahyani et al., 2021; Uge et al., 2019). Ethnic-based science learning guides students in finding and building their knowledge (Hairida, 2017; Hartini et al., 2018). Furthermore, learning based on local wisdom produces more meaningful learning because the objects observed are in the environment (Susilawati et al., 2016; Yuan et al., 2017).

The implications of this research offer the right solution to the problem with the ethnoscience study of the process of making alcohol in Bekonang Village in science learning for teachers, students, and the community. This solution is in accordance with the research that the community's original knowledge in the process of making shrimp paste can be constructed into scientific knowledge, which can be a source of learning to foster students' local wisdom values in their environment. Furthermore, the results of the analysis of ethno scientific studies on the manufacture of alcohol can be used in learning natural sciences in elementary schools. The limitations of this research are that the research location is only in one place on the island of Java and it discusses the process of making alcohol related to elementary school material. Recommendations for further research are expected to be able to examine areas other than the island of Java and can discuss the process of making alcohol related to materials junior high school, high school.

4. CONCLUSION

Based on the study results and discussion, it can be concluded that the alcohol-making process began with fermenting sugarcane juice, *badeg* waste, plain water, and sugarcane molasses *bacem* water. The

fermented product was then heated until it boiled and evaporated so that a distillation and evaporation process occurred, which then flowed into the cooler using plain water, and the steam would turn into *ciu*. The alcohol took two processes to make. In addition, ethnoscience studies are the production process that still used bamboo when mixing raw materials, *pawon* as a tool for boiling, and firewood utilized for boiling.

5. REFERENCES

Akbar, I., & Riyanto, B. (2020). Komunikasi Getok Tular (Word ff Mouth) sebagai Pemasaran Produk Ciu di Desa Bekonang Kecamatan Mojolaban Kabupaten Sukoharjo. *Solidaritas*, *4*(3). http://ejurnal.unisri.ac.id/index.php/sldrts/article/view/5530.

Anggraini, A., Yuningsih, S., & Sota, M. M. (2017). Pengaruh pH Terhadap Kualitas Produk Etanol Dari Molasses Melalui Proses Fermentasi. *Jurnal Reka Buana*, *2*(2), 99–105. https://doi.org/https://doi.org/10.33366/rekabuana.v2i2.725.

Astawa, I. G. (2012). *Konsep Dasar IPA 2: Bermuatan Peta Pikiran dan Model Perubahan Konseptual*. Singaraja: Universitas Pendidikan Ganesha.

Dewi, I.N, Poedjiastoeti, S., & Prahani, B. (2017). ElSII Learning Model Based Local Wisdom To Improve Students' Problem Solving Skills and Scientific Communication. *International Journal of Education and Research*, *5*(1), : 107-118. https://doi.org/http://www.ijern.com/journal/2017/January-2017/09.pdf.

Dewi, Ika Nurani, Utami, S. D., Effendi, I., Ramdani, A., & Rohyani, I. S. (2020). The Effectiveness of Biology Learning-Local Genius Program of Mount Rinjani Area to Improve the Generic Skills. *International Journal of Instruction*, *14*(1), 265–282. https://doi.org/10.29333/IJI.2021.14116A.

Dewi, N. L. P. P. P., Suardana, I. N., & Priyanka, L. M. (2022). Kajian Etnosains Proses Pembuatan Arak Bali di Desa Tri Eka Buana sebagai Suplemen Materi IPA SMP. *Jurnal Pendidikan Dan Pembelajaran Sains Indonesia*, *5*(1), 1–11. https://repo.undiksha.ac.id/8023/.

Ely. (2015). *Peran Budaya Lokal dalam Pembentukan Sains: Studi Naturalistik Pembentukan Sains Siswa Kelompok Budaya Sunda Tentang Fotosintesis dan Respirasi Tumbuhan dalam Konteks Sekolah dan Lingkungan Pertanian*. Bandung: Universitas Pendidikan Indonesia.

Fibonacci, A. (2019). Sintesis Alkohol Dari Limbah Nangka (Artocarpus heterophyllus) sebagai Campuran Bahan Bakar Minyak (Biofuel). *Walisongo Journal of Chemistry*, *2*(1), 17–25. https://doi.org/https://doi.org/10.21580/wjc.v2i1.4043.

Firdausi, F. F., Puspitasari, E., & Fajriyah, N. H. (2022). Tinjauan saintifik dan fikih terhadap penggunaan alkohol dalam produk hand sanitizer. *Konferensi Integrasi Interkoneksi Islam Dan Sains*, *4*(1), 155–159. https://ejournal.uin-suka.ac.id/saintek/kiiis/article/view/3227.

Gondwe, M., & Longnecker, N. (2015). Scientific and Cultural Knowledge in Intercultural Science Education: Student Perceptions of Common Ground. *Research in Science Education*, *45*(1), 117–147. https://doi.org/10.1007/s11165-014-9416-z.

Hadi, W. P., Sari, F. P., Sugiarto, A., & Mawaddah, W. (2019). Terasi Madura : Kajian Etnosains dalam Pembelajaran IPA untuk Menumbuhkan Nilai Kearifan Lokal dan Karakter Siswa Madura Shrimp Paste : Study of Ethnoscience in Science Learning to Improve Student ' s Local Wisdom and Character. *Quantum*, *10*(1), 45–55. https://scholar.archive.org/work/adbyuj3t4fbapanbc564e4oio4/access/wayback/https://ppjp.ulm.ac.id/journal/index.php/quantum/article/download/5877/pdf.

Hairida, H. (2017). Using Learning Science, Environment, Technology and Society (SETS) Local Wisdom and based Colloids Teaching Material. *JETL (Journal Of Education, Teaching and Learning)*, *2*(1), 84–89. https://doi.org/10.26737/jetl.v2i1.146.

Hardiyati, & Dianingrum, A. (2021). Pawon pada rumah tinggal jawa. *Jurnal Ilmiah Mahasiswa Arsitektur*, *4*(1), 390–399. https://jurnal.ft.uns.ac.id/index.php/senthong/article/view/1328.

Hartini, S., Firdausi, S., Misbah, & Sulaeman, N. F. (2018). The development of physics teaching materials based on local wisdom to train Saraba Kawa characters. *Jurnal Pendidikan IPA Indonesia*, *7*(2), 130–137. https://doi.org/10.15294/jpii.v7i2.14249.

Irianto, H. C., Singgih, H., & Dewatama, D. (2018). Aplikasi Logika Fuzzy pada Penurunan Kadar Air dalam Susu dengan Metode Evaporasi Hamdan. *Jurnal Elkolind*, *5*(2), 1–6. https://doi.org/10.33795/elk.v5i2.129.

Jia, Z., Zhang, B., Sharma, A., Kim, N. S., Purohit, S. M., Green, M. M., Roche, M. R., Holliday, E., & Chen, H. (2023). Revelation of the sciences of traditional foods. *Food Control*, *145*. https://doi.org/https://doi.org/10.1016/j.foodcont.2022.109392.

Jumrah, J. (2022). Improving Students'vocabulary Through Pictures to Learn English. *Journal of Social Sciences*, *3*(2), 139–146. https://doi.org/10.47323/ujss.v3i2.205.

Juwita, R. (2012). *Studi produksi alkohol dari tetes tebu (Saccharum officinarum L) selama Proses Fermentasi*. Skripsi Universitas Hasanudin Makassar.

Khusniati, M., Parmin, & Sudarmin. (2017). Local wisdom-based science learning model through reconstruction of indigenous science to improve student's conservationist character. *Journal of Turkish Science Education*, *14*(3), 16–23. https://doi.org/https://doi.org/10.12973/tused.10202a.

Kiswandono, A. A., Nauli, P., & Prabowo, R. (2020). Pendampingan Pembuatan Produk Handsanitizer Berbasis Alkohol Pada Kelompok PKK Desa Fajar Baru. *Prosiding Konferensi Nasional Pengabdian Kepada Masyarakat Dan Corporate Social Responsibility (PKM-CSR)*, *2*(3), 446–451. https://doi.org/https://doi.org/10.37695/pkmcsr.v3i0.1009.

Kumala, F. N., & Setiawan, D. A. (2019). Local wisdom-based e-encyclopedia as a science learning medium in elementary school. *Journal of Physics: Conference Series*, *1402*(6), 2–9. https://doi.org/10.1088/1742-6596/1402/6/066061.

Lukmanudin, M. I. (2015). Legitimasi Hadis Pelarangan Penggunaan Alkohol dalam Pengobatan. *Quran and Hadith Studies*, *4*(1), 79–101. https://core.ac.uk/download/pdf/295172452.pdf.

Mallarangang, A., & Haddade, A. W. (2022). Penggunaan Alkohol dalam Upaya Pencegahan Covid-19 Analisis Maslahah Mursalah. *Shautuna: Jurnal Ilmiah Mahasiswa Perbandingan Mazhab Dan Hukum*, *3*(1), 41–52. https://doi.org/https://doi.org/10.24252/shautuna.vi.24319.

Najib, K. (2018). Kajian Etnosains Proses Pembuatan Genteng sebagai Bahan Ajar Tambahan Pelajaran IPA Terpadu. *Jurnal Penelitian Pembelajaran Fisika*, *9*(2), 98–103. https://doi.org/10.26877/jp2f.v9i2.3107.

Nurcahyani, D., Yuberti, Irwandani, Rahmayanti, H., Ichsan, I. Z., & Rahman, M. M. (2021). Ethnoscience learning on science literacy of physics material to support environment: A meta-analysis research. *Journal of Physics: Conference Series*, *1796*(1). https://doi.org/https://doi.org/10.1088/1742-6596/1796/1/012094.

Osvaldo, Z. S., Putra, P. S., & Faizal, M. (2012). Pengaruh Konsentrasi Asam dan Waktu Pada Proses Hidrolisis dan Fermentasi Pembuatan Bioetanol dari Alang-Alang. *Jurnal Teknik Kimia*, *18*(2), 52–62. https://doi.org/http://jtk.unsri.ac.id/index.php/jtk/article/view/18/20.

Pancawati, D., & Ami, A. (2015). Segmentation of Hearth (Pawon) Space In Tenggerese House. *ArchNet-IJAR: International Journal of Architectural Research*, *9*(1), 144–157. https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=b75a78685ae8522d5559386953d8a8e929b1b0cd.

Perwitasari, T., Linuwih, S., Kimia, J. P., Semarang, U. N., Fisika, J. P., & Semarang, U. N. (2016). Peningkatan literasi sains melalui pembelajaran energi dan perubahannnya bermuatan etnosains pada pengasapan ikan. *Jurnal Penelitian Pendidikan IPA*, *1*(2), 62–70. https://doi.org/10.26740/jppipa.v1n2.p62-70.

Pornpimon, C., Wallapha, A., & Prayuth, C. (2014). Strategy Challenges the Local Wisdom Applications Sustainability in Schools. *Procedia - Social and Behavioral Sciences*, *112*, 626–634. https://doi.org/10.1016/j.sbspro.2014.01.1210.

Rahayu, W. E., & Sudarmin, S. (2015). Pengembangan modul IPA terpadu berbasis etnosains tema energi dalam kehidupan untuk menanamkan jiwa konservasi siswa. *Unnes Science Education Journal*, *4*(2). https://doi.org/10.15294/USEJ.V4I2.7943.

Ramdani, A., Utami, S. D., Efendi, I., Dewi, I. N., & Rohyani, I. S. (2020). Local wisdom integrated biology learning program as an alternative to increase generic science skills. *Journal of Physics: Conference Series*, *1521*(4). https://doi.org/10.1088/1742-6596/1521/4/042027.

Rezki, A. N. (2016). *Perbandingan Daya Bunuh Produk Handsanitizer Gel Berbasis Alkohol Dan Triclosan Terhadap Bakteri Tangan*. Doctoral dissertation, FKIP UNPAS.

Rosyadi, F. A., Prasavitri, K. P., & Widjaja, T. (2014). Optimasi Proses Produksi Etanol Dari Molases Menggunakan Teknik Fermentasi-Ekstraktif. *Jurnal Teknik ITS*, *3*(2), 134–136. https://doi.org/http://dx.doi.org/10.12962/j23373539.v3i2.6459.

Saputra, M., Irawan, D., & Mafruddin, M. (2018). Pengaruh Temperatur Hidrolisis Asam Dan Waktu Fermentasi Terhadap Kadar Bioetanol Tetes Tebu. *Turbo : Jurnal Program Studi Teknik Mesin*, *7*(1), 87–92. https://doi.org/http://dx.doi.org/10.24127/trb.v7i1.716.

Sari, F. I. P., Wibowo, B. S., Irwanto, R., & Sarfita, S. (2021). Distillation-Adsorption of Bioethanol Using Natural Kaolin. *IOP Conference Series: Earth and Environmental Science*, *926*(1). https://doi.org/10.1088/1755-1315/926/1/012021.

Septiani, D., & Listiyani, L. R. (2021). Inovasi Modul Etnosains: Jamu Tradisional sebagai Pembelajaran Berbudaya dan Melek Sains. *Edukatif: Jurnal Ilmu Pendidikan*, *3*(2), 288–297. https://doi.org/10.31004/edukatif.v3i2.292.

Seroto, J. (2017). Student Teachers ' Presentations of Science Lessons in South African Primary Schools :

Ideal and Practice Student Teachers ' Presentations of Science Lessons in South African Primary Schools : Ideal and Practice. *International Journal of Educational Sciences*, *4*(2), 107–115. https://doi.org/10.1080/09751122.2012.11890033.

Setiawan, Innatesari, D. K., Sabtiawan, W. B., & Sudarmin, S. (2017). The development of local wisdom-based natural science module to improve science literation of students. *Jurnal Pendidikan IPA Indonesia*, *6*(1), 49–54. https://doi.org/10.15294/jpii.v6i1.9595.

Sianipar, H. F., Siahaan, T. M., Mangapul, M., & Saragih, M. (2021). Diseminasi Hand Sanitizer Mampu Mengurangi Pertumbuhan Mikroba di Siantar Estate. *Mitra Mahajana: Jurnal Pengabdian Masyarakat*, *2*(1), 56–63. https://doi.org/https://doi.org/10.37478/mahajana.v2i1.803.

Sofyan, H., Anggereini, E., & Saadiah, J. (2019). Development of E-Modules Based on Local Wisdom in Central Learning Model at Kindergartens in Jambi City. *European Journal of Educational Research*, *8*(4), 1137–1143. https://doi.org/10.12973/eu-jer.8.4.1137.

Srikartika, P., Suharti, N., & Anas, E. (2016). Kemampuan Daya Hambat Bahan Aktif Beberapa Merek Dagang Hand sanitizer terhadap Pertumbuhan Staphylococcus aureus. *Jurnal Kesehatan Andalas*, *5*(3), 540–545. https://doi.org/https://doi.org/10.25077/jka.v5i3.613.

Sudarmin. (2015). *Pendidikan Karakter, Etnosains dan Kearifan Lokal (Konsep dan Penerapannya dalam Penelitian dan Pembelajaran Sains).* Semarang : Swadaya Manunggal.

Sudarmin, S., Febu, R., Nuswowati, M., & Sumarni, W. (2017). Development of Ethnoscience approach in the module theme substance additives to improve the cognitive learning outcome and student's entrepreneurship. *In Journal of Physics: Conference Series*, *824*(1), 12–24. https://doi.org/10.1088/1742-6596/824/1/012024.

Sudarmin, S., & Samini, S. (2015). Efektivitas Penggunaan Modul Terintegrasi Etnosains dalam Pembelajaran Berbasis Masalah untuk Meningkatkan Literasi Sains Siswa. *USEJ - Unnes Science Education Journal*, *4*(3), 1049–1056. https://doi.org/https://doi.org/10.15294/USEJ.V4I3.8860.

Sumarni, W., Sudarmin, S., Sumarti, S. S., & Kadarwati, S. (2022). Indigenous knowledge of Indonesian traditional medicines in science teaching and learning using a science–technology–engineering–mathematics (STEM) approach. In *Cultural Studies of Science Education* (Vol. 17, Issue 2). Springer Netherlands. https://doi.org/10.1007/s11422-021-10067-3.

Supriyadi, & Nurvitasari, E. (2020). Investasi Sains Asli Suku Malind: Upaya Dalam Pengembangan Kurikulum IPA Kontekstual Papua Berbasis Etnosains. *Jurnal Sains Dan Matematika*, *7*(1), 10–21. https://doi.org/10.23971/eds.v7i1.1081.

Susatyo, J. H. (2016). Perbedaan pengaruh pengolesan dan perendaman alkohol 70% terhadap penurunan angka hitung kuman pada alat kedokteran gigi. *Jurnal Vokasi Kesehatan*, *2*(2), 160–164. https://doi.org/https://doi.org/10.30602/jvk.v2i2.72.

Susilawati, S., Fikriyah, F., & Saefudin, A. (2016). Science Education Based on Cirebon Local Culinary Food. *UMRAN - International Journal of Islamic and Civilizational Studies*, *3*(3–1), 42–49. https://doi.org/https://doi.org/10.11113/umran2016.3n3-1.147.

Uge, S., Neolaka, A., & Yasin, M. (2019). Development of Social Studies Learning Model Based on Local Wisdom in Improving Students' Knowledge and Social Attitude. *International Journal of Instruction*, *12*(3), 375–388. https://eric.ed.gov/?id=EJ1220191.

Wardani, A. K., & Pertiwi, F. N. E. (2013). Produksi Etanol dari Tetes Tebu oleh Saccharomyces cerevisiae Pembentuk Flok (NRRL – Y 265). *Agritech*, *33*(2), 131–139. https://doi.org/https://doi.org/10.22146/agritech.9810.

Yuan, Z., Zhao, W., Liu, Z., & Xu, B. (2017). NaOH alone can be a homogeneous catalyst for selective aerobic oxidation of alcohols in water. *Journal of Catalysis*, *353*, 37–43. https://doi.org/10.1016/j.jcat.2017.05.006.

Zuhri, M. Al, & Dona, F. (2021). Penggunaan Alkohol untuk Kepentingan Medis Tinjauan Istihsan. *Journal of Law, Society, and Islamic Civilization*, *9*(1), 40–49. https://scholar.archive.org/work/exqot5gxnvbxxeocqnaew7vud4/access/wayback/https://jurnal.uns.ac.id/JoLSIC/article/download/51849/pdf.