



Preliminary Study of Chemistry Knowledge through Ethnochemistry Approaches to Communities

Ade P. Maedja & *Purnama Ningsih

Program Studi Pendidikan Kimia/FKIP – Universitas Tadulako, Palu – Indonesia 94119

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Abstract

This research was a descriptive qualitative study using ethnographic methods. It aimed to determine the understanding and application of chemistry knowledge in the daily lives of Wiapore society, Marawola Barat district, through an ethnochemistry approach. Data obtained was in the form of an initial data inventory. These inventory data were then grouped into several data categories, namely categories related to food, beverage, and agriculture categories. The percentage value of each data was as follows, related to food 55.55%, related to drinks were 22.22%, and connected to agriculture were 22.22%. The results of this study are significant for local governments in taking policies relating to education for children and the Wiapore community.

Keywords: Inventory, ethnochemistry, Wiapore society, chemistry knowledge

Introduction

Today's technology has almost controlled all aspects of life: information and communication technology. At this time, we are in an era called the industrial revolution 4.0. This has also led to a paradigm shift in labor from humans to robots (artificial intelligence). Based on this, it is undeniable that there has been a shift in the values of Indonesian indigenous local culture. The reality of this shift in cultural values has resulted in the neglect of local cultural values. One way to correct this shift is education (Yuliana, 2017).

In this life, education cultural values, and society are aspects in a chain that cannot be separated. Education is a process that includes three dimensions, the individual, society or national community of the individual, and the entire content of reality, both material and spiritual, which plays a role in determining nature, destiny, human form, and society (Nurkholis, 2013). Education is the most effective way in the process of preserving culture. Culture results from the human mind from various things and their manifestations; the community itself has an essential role in developing that culture (Darmadi, 2017).

The development of culture in the community itself can be done with several approaches, including the ethnoscience approach. The word ethnoscience (ethnoscience) comes from the word ethnos (Greek), which means nation, and Scientia (Latin),

which means knowledge. Therefore, ethnoscience is the knowledge possessed by a government or, in other words, is a particular ethnic group or social group as a system of learning and cognition typical of a given culture; the emphasis is on systems or knowledge devices which are knowledge that is unique to a society because it is different, with other communities (Parmin, 2017). Ethnoscience itself is divided into several sections, including ethnochemistry. Ethnochemistry is a study of chemistry from a cultural point of view: how chemistry has shaped culture in everyday life and how culture has contributed to science and its changes.

Remote communities are bound by geographical, economic, and socio-cultural units and are poor, small, and socially vulnerable. Remote communities' characteristics are as follows: limited access to essential social services, closed, homogeneous, and their livelihoods depend on natural resources around their daily lives.

The pattern of behavior carried out by this community as a community group firmly adheres to the customs that were passed down from generation to generation by their ancestors (Permana & Sidik, 2016). Although the lifestyle adopted is still pure and considered 'outdated,' several examples contain scientific content. One example of their lifestyle in farming wisely is not continuously managing it. This is intended to restore the fertility of the land. Another example is curing fever, stomach aches,

*Correspondence:

Purnama Ningsih

e-mail: purnamaningsih1012@gmail.com

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coughs. They use the plants that live around them as medicine, without realizing that what they are doing is chemical knowledge that comes from the ethnoscience approach or a particular science, namely the ethnochemical process.

Chemical knowledge is a process that results from learning, methods, and actions regarding behavior carried out in chemistry. Chemistry would be better if given the appearance of natural phenomena or events rather than shown in the form of theory alone. Chemistry learning must stimulate thinking, be scientific and creative and be responsive to relevant practices in everyday life (Istijabatun, 2008). In essence, chemical knowledge is about substances, including composition, structure and properties, changes, dynamics, and energetics that involve skills and reasoning. An example of chemical knowledge in everyday life that is usually not realized by the public in general (Nursaadah et al., 2017) is wood preservation, where this utilization is done by soaking the wood in running water so that the pores of the wood are filled with water, which this prevents damage to the wood, the use of lime, leak, ferns and old honje are used as ingredients for cleaning the body, rock is used for natural toothbrushes by pounding and then rubbing the surface of the teeth, as well as soaking root crops in water so that the sap in tubers out. This is if it is intended in chemical knowledge based on chemistry learning that tubers contain a lot of chemicals such as cyanide so that they are soaked before consumption so that the cyanide content in them is lost. This kind of understanding is meant in the basic knowledge of chemistry. Experience is considered the ability to monitor thoughts through assumptions and implications in activities (Samsudin & Hardini, 2019).

This pattern of behavior is widely found in several remote villages, one of which is in the village of Wiapore, precisely in the West Marawola sub-district, Central Sulawesi province. Wiapore Village is a village that can be considered remote because it is located in the Matantimali mountains with access that is quite difficult to reach. The local community highly respects the treatment of local wisdom, from farming, gardening to the legal system. This is what causes researchers to research ethnochemistry in that place.

This paper is intended to be based on the background discussed above; an initial study is needed to understand the pattern of life behavior related to ethnochemistry among remote communities. Suppose the results of this ethnochemical study can be obtained. In that it is easy for educators to manage the ethnochemical approach into an approach in gaining knowledge by prioritizing daily habits in behavior. For the government, this data helps empower remote communities so that development programs can be felt throughout Central Sulawesi in particular and the territory of Indonesia in general.

Methods

This research is a type of qualitative descriptive research, where the results are data on initial understanding of chemistry knowledge through an ethnochemical approach as intended for this study. This research activity was carried out in the village of Wiapore. The sample in this study is a remote community in one of the hamlets in the area who will be used as resource persons or informants in this study. The informants used were three people: primary informants, key informants, and additional informants (Lusiani, 2015). The informant selection technique is snowball sampling (Sugiyono, 2012).

The instrument used in this research is a list of interview and documentation guidelines. The purpose of using the interview list is to know the topics of the questions. At the same time, documentation aims to document things that can support the validity of the data.

This study's data collection techniques consisted of observation, interviews, documentation, and triangulation (Suhartono et al., 2011). This study's data analysis techniques include data reduction, data display, and conclusions (Sugiyono, 2012).

Results and Discussion

The results of data analysis obtained during data collection activities are presented in Table 1 regarding food analysis data, Table 2 regarding beverage analysis data, and Table 3 concerning agricultural analysis data.

Table 1. Results of food analysis

No.	Food	Function/Use
1.	Cassava	The Main Substitute for Rice (Carbohydrates)
2.	Turmeric	Food coloring
3.	Food Drying	Preservation
4.	Soaking Tubers	Removing Sap
5.	Coconut	Ingredients for Coconut Milk

Table 2. Results of beverage analysis

No.	Food	Function/Use
1.	Boiling water	Prevents stomach and headache
2.	Raw water	Causes stomach and headache

Chemical knowledge in food category

Based on the results of interviews conducted by researchers, there is some knowledge of chemistry in the food sector. According to the main informant named Arman, during an interview on November 27, 2018, said that: "We use cassava (cassava) as a food substitute for rice. This is because the place is far from urban areas so that rice consumption is minimal, so an alternative way to replace rice is by consuming tubers such as cassava (cassava)".

Table 3. Agricultural analysis results

No.	Agriculture	Functions/Usage
1.	Drying coffee and red beans	It makes it easier to separate the skin
2.	Chocolate fruit stay for one night	Eliminates moisture content and speeds up the drying process on chocolate fruit

The use of cassava as the primary substitute for rice (carbohydrates) was also added by a key informant, Mrs. Yuli, when interviewed on December 2, 2018, according to Yuli's mother: "Indeed, cassava has an extensive carbohydrate content, because rice itself is the basic ingredient for making cassava. Rice contains a lot of carbohydrates. This utilization is usually used by mountain people who do not grow rice plants."

According to an additional informant named Laperdi, when interviewed on 27 November, 2018 said, "It is true if indeed rice is a substitute food, one of which is cassava (cassava) by boiling."

The use of cassava as a substitute for rice (carbohydrates) is very appropriate, considering the content of cassava contains a lot of carbohydrates. According to Feliana et al. (2012), 40 grams of cassava contains 2.45% protein, 0.83% fat, 0.66% ash, 66.20% water, 0.73 crude fiber, and 29.13% carbohydrates.

Carbohydrates in cassava are carbohydrates of the oligosaccharide group. Oligosaccharides contain two to ten simple sugar molecules joined by glucoside bonds. Oligosaccharides are often associated with flatulence or abdominal bloating because the fermented oligosaccharides by the intestinal microflora will produce CO₂, H₂, and CH₄ gases. If consumed in excess, it will cause flatulence. To prevent this, before being processed, the sweet potato (cassava) is soaked for 1-2 days because oligosaccharides are carbohydrates of the raffinose family, which are soluble in water so that they can reduce raffinose levels (Deddy, 2017).

In addition to cassava, a turmeric plant is also used as a food coloring. According to Mr. Arman, when interviewed on November 27, 2018, said that: "In addition to spices such as onions, chili, salt, and monosodium glutamate, there is also turmeric which is used as a natural coloring agent in foodstuffs as well as as a flavoring agent."

The additional informant, Mr. Laperdi, said that: "Turmeric is a typical spice plant in addition to other spice plants such as tomatoes and village chili." (Results of the interview on 27 November 2018).

According to a key informant, Yuli's mother, when interviewed on December 2, 2018, said that: "It is true that turmeric is said to be a dye. This is because turmeric contains a lot of curcumin used as a natural dye, and also foods that are added with turmeric can last a long time."

The use of turmeric plants as food coloring cannot be separated from chemical knowledge; according to Sihombing (2017), curcuminoids are compounds that form color in turmeric. Curcuminoids are a mixture of analogs of curcumin, desmethoxy curcumin, and bis-desmethoxy curcumin. Where curcumin is the most dominant component contained in turmeric. Curcumin is a combination of several functional groups. The aromatic ring system, a polyphenol, is linked by two unsaturated carbonyl groups (Mullaicharam & Maheswaran, 2012).

Turmeric containing carotenoids is a group of pigments that are yellow, orange, red-orange, and are soluble in oil. Several types of carotenoids that are widely found in nature and foodstuffs are - carotene (a variety of yellow and red fruits), lycopene (tomatoes), capsaicin (red chilies), and bixin (annatis), as food coloring is very well targeted (Raharjo et al., 2017).

The informant also said that apart from using cassava and turmeric in the food sector, there is also food preservation such as tubers or bananas. According to Pak Arman (interview November 27, 2018), "Usually boiled sweet potatoes can also be dried in the sun to be cooked again later."

According to Pak Laperdi, who is an additional informant, he added: "Indeed, local people usually dry sweet potatoes or bananas. It is usually dried in the sun when it is cooked or before it is cooked." (results of the interview November 27, 2018).

According to Mrs. Yuli as a key informant, she said that: "This drying is done so that the water content in the food ingredients is reduced so that the food will not rot quickly, because if the water content is high in the food, the microbes will grow a lot" (Results of the interview December 2, 2018).

Usually, farmers do the drying method by using sunlight (sun drying) or what is called traditional drying. Traditional drying can use heat from the sun to dry food or agricultural produce. Drying with this technique is very dependent on the weather conditions during drying. When the weather is sunny, drying can take place well, but when the weather is cloudy or even rainy, drying is completely impossible so that the onion bulbs rot quickly. Drying is a way to remove or remove some of the water from the material by evaporating most of the water it contains through heat energy. Usually, the water content of the material is reduced to a limit so that microorganisms can no longer grow in it. The advantage of drying is that the material becomes more durable, and the volume of the material becomes smaller (Zamharir et al., 2016).

In addition to some of the chemical knowledge activities above, there is also other chemical knowledge, such as soaking tubers. According to the main informant, Mr. Arman said, "One way of processing food such as tubers is that before cooking or consumption, first soaking is usually done for one

night, so that the sap in the tubers can be lost.” (Results of the interview November 27, 2018).

According to an additional informant, Mr. Laperdi, who said that: “Tubers such as cassava are soaked before cooking, usually soaked in a container with water flowing directly.” (Results of the interview November 27, 2018).

Ms. Yuli as a key informant, added: “It is true because most of the tubers in the forest contain toxic sap. Toxic sap, which in tubers contains a lot of cyanide acid (HCN), which is very dangerous. So to remove it, soaking is carried out so that the HCN can easily dissolve in water and come out of the tubers. Better immersion can be carried out in running water so that the water-soluble HCN can flow directly with the water”. (Results of the interview December 2, 2018).

Cassava or cassava is one of the staple foods of the Indonesian people besides rice and sago. It tastes good and is very filling, making it a good staple food (Muntoha et al., 2015). According to Irzam & Harijono (2014), the cyanide content in cassava showed that the HCN content of cassava flour with water immersion was lower than the HCN content of cassava flour without soaking water. This is due to the nature of HCN, which is easily soluble in water. In the immersion process, water will cause the linamarin compound to hydrolyze and form cyanide acid, soluble in water. When the soaking water is replaced, the water-soluble HCN will also be wasted along with the water, so the average measured HCN level is lower. This is what causes the need for soaking the tubers before consumption (Putri & Hersoelistyorini, 2012).

In addition, other chemical knowledge carried out by the community in the area is the use of coconuts which are used as ingredients for making coconut milk used for cooking. According to Mr. Arman that: “Coconuts that are used as coconut milk are coconuts obtained from traveling sellers. This is because there are no coconut trees produced by community agriculture in the area. Coconut milk is usually used for cooking foods such as vegetables or tubers”. (Results of the interview November 27, 2018).

According to a key informant, Yuli's mother, when interviewed on December 2, 2018, said that: “Coconut milk is indeed obtained from the inner part of the coconut. Coconut that has been mashed (coconut juice) and soaked in water will later produce coconut milk which can be used for mixing in cooking.”

According to Mahmud & Ferry (2005), coconut milk is a white liquid produced from grated coconut meat and then squeezed after adding water. The composition of coconut milk varies depending on various things such as variety, age, coconut growing environment, and extraction method. Coconut milk is categorized as an oil in water emulsion; coconut milk is a food ingredient that spoils quickly and smells rancid within a few hours because coconut milk has relatively high water, fat, and protein content.

The nutritional content in coconut milk is beneficial for the body, such as the calorie content of coconut milk which is relatively high, 120 calories for every tablespoon of coconut milk. Consuming one tablespoon of coconut milk per day is enough to meet the body's needs. In addition to calories, there are also fats consisting of several types, namely saturated fat, unsaturated fat, omega-3 fat, and omega-6 fat. With proper consumption, fat is still needed by the body. Even omega-3 fatty acids can reduce inflammation and lubricate cells and joints. Calcium also contained in coconut milk is very useful for health; one cup of coconut milk contains about 200 IU of calcium which is beneficial for bones and teeth. The protein in coconut milk is relatively low. Still, the content of alanine, cystine, arginine, and serine, which are easily digested by the body, is still helpful in maintaining and building new cells. Also beneficial for hair, nails, and skin. In addition to these nutritional content, coconut milk also contains minerals such as sodium, potassium, phosphorus, iron, and copper (Sarihusada, 2015).

Chemical knowledge in beverage category

The knowledge of chemistry in Wiapore village is not limited to the food sector, but also in the beverage sector. According to the main informant, Mr. Arman said that the results of interviews conducted by researchers: “The water that local people often consume is water that comes directly from the mountains. The water consumed is water that must be cooked. First, this is done because if you consume raw water, it will cause stomach pain and headaches”. Mr. Arman continued, “Boiling water is done until the water boils perfectly, this is so that the bacteria in the water die” (Results of the interview November 27, 2018).

According to Mr. Laperdi, who is an additional informant said that: “Water obtained directly from the mountain is water that can be consumed directly, but some can also be consumed after cooking. This is done depending on the individual who wants to consume the water” (Results of the interview November 27, 2018).

The use of community chemistry knowledge in Wiapore village was also added by a key informant, Ibu Yuli, who said that:

“There is a category of drinking water that can be consumed directly, one of which is if it does not contain lime and other substances carried by the water flow. Boiling water also aims to kill microbes and remove lime content in the water. (Results of the interview December 2, 2018).

Water is the leading resource that has helped agriculture and society to prosper, and it has become a major limiting factor when mismanaged (Tadele & Lelisa, 2019). Excess lime in water can cause kidney disease. Therefore, the water needs to be boiled until it reaches a boiling point. Heating the water is done repeatedly so that the deposition process can lose the levels of lime and microbes in the water.

Boiling water at 100 °C can kill bacteria in the water. Treatment of drinking water by boiling until boiling aims to kill the germs contained in the water (Sitanto, 2013). Drinking water should not smell and taste (Sitanto, 2013). Indonesians generally use drinking water treatment techniques by cooking until boiling to get water free from germs, fungi, protozoa, spores, viruses, and bacteria (Widarto, 2012).

Boiling water to boiling is the most appropriate way to prevent bad things from happening in the human body. This knowledge is expected by researchers on the understanding of chemical knowledge by the public.

Chemical knowledge in agriculture category

The results of interviews conducted by researchers contained knowledge of chemistry in agriculture. According to the main informant, Mr. Arman (Interview November 27, 2018) said that: "In preparing agricultural land, local people spray grass before and after harvest. They are pouring before yield serves to kill the grass that interferes with farming crops, and spraying after harvest helps to kill the grass that grows after harvest and will later produce natural fertilizer (organic fertilizer).

In addition, Mr. Laperdi, when interviewed on November 27, 2018, said that: "Before starting planting, the land must be sprayed with weed medicine. After a week, the plants are ready to be planted."

According to Mrs. Yuli as a key informant, she said: "Actually, if you do spraying on wild plants that disturb agricultural crops, it has a positive and negative side. This, if spraying is done repeatedly, can reduce nutrients in the soil. But on the positive side, dead wild plants will be a good natural fertilizer for the plant growth process." (Results of the interview December 2, 2018).

According to Hayati et al. (2012), one way to increase crop production is by improving cultivation techniques such as organic fertilizers. Solid organic fertilizer is fertilizer from the weathering of plant remains or organic waste. The waste in question comes from the weathering of plant tissues or plant materials such as straw, husks, leaves in the form of biological waste that is recycled and overhauled. The process of reshuffling organic materials can occur naturally or artificially.

However, according to the researcher, knowledge of chemistry in this field is a bit of a misnomer. In the agricultural business process, there will be washing away and leaching of nutrients that are lost from the soil be enlarged. In addition, the nutrients lost from farmland and plant parts harvested by farmers are also not minor. For example, a rice harvest of 4000 kg of dry rice transported 32 kg of N, P, and K elements from the soil, respectively, of 32 kg of N, 36 kg of P in P₂O₅, and 21 kg of K in K₂O. Nutrients lost with erosion and leaching maybe even more. Therefore, ex-agricultural soils should be fertilized using natural or artificial fertilizers that contain the elements needed

by plants to return the nutrients to the ground (Hardjowigeno, 2015).

In addition, knowledge of chemistry in agriculture is in farming. In this case, they are planting red bean plants. In determining the planting and harvesting of crops, farmers choose it based on the rainy and dry seasons and the quality of the plant's leaf color. According to Mr. Arman: "In starting planting, the farmer determines it through the rainy season and vice versa in determining the ready-to-harvest period, namely in the dry season." (Results of the interview November 27, 2018).

According to Mr. Laperdi said that: "In addition to being determined by the season, plants ready to harvest can also be seen by looking at the physical condition of the red bean plant, which is starting to change the color of the leaves to yellow." (Results of the interview on November 27, 2018).

The information about this knowledge was explained again as an affirmation by the key informant, Mrs. Yuli, who said: "Actually if you look at the physical condition of the plant if the leaves of the plant have turned yellow, there are two possibilities. First, the characteristics of a mature plant are that the plant does not need sunlight to form plant chlorophyll. Secondly, if the plant's leaves have turned yellow, it can indicate that the plant is not growing well. (Results of the interview December 2, 2018).

According to Nugroho et al. (2016), the determination of harvest time can be done using the heat unit method. The unit of heat method is a quantitative method of the relationship between temperature and plants. This method is based on the idea that temperature is seen as a factor that represents the availability of energy for plant growth and development. According to Mr. Arman: "When the harvest period has arrived and coincides with the rainy season, the crop yields will decrease" (Interview November 27, 2018).

This is because red bean plants will rot because the water content in the plant is too high. Determination of time variation is also decisive in determining the harvest period of red bean crops.

According to Mrs. Yuli as a key informant, said that: "It is true that if the determination of a good harvest season can be seen from the rainy or dry season. A good plant if does not contain a lot of water, so that during the harvest process, it is better to do it during the dry season because the temperature dramatically affects the water content of the plant. Vice versa, if the harvest process is during the rainy season, many plants will rot because of very high water levels (Results of the interview December 2, 2018).

The community's agricultural products in Wiapore village are red beans and coffee. Coffee plants in this area do not produce such large yields. Therefore the crops are only used by local people for household purposes. According to the informant, Mr. Arman, when interviewed on November 27,

2018, said, "The processing of coffee beans into powder consists of several stages, including drying to grinding." The informant continued, "Drying is done so that the skin and fruit can be separated when put into a peeler called Dross."

According to a key informant, Ibu Yuli, when interviewed on December 2, 2018, said that: "Drying is a simple technique to remove moisture from plant fruit. If the water content in the fruit has decreased, it is marked by the peeling of the skin from the fruit so that the process of separating the skin from the fruit in the separator can occur correctly. In addition, the loss of water content in the fruit due to heating can maintain the taste and aroma of the fruit of the plant itself."

The role of chemistry in this technique is the influence of temperature (hot sunlight); the longer the drying time, the less water content in the fruit, so that the fruit's skin can easily peel off. In addition, when the water content in coffee is lost, it will preserve coffee in the long term.

Besides red beans and coffee, there is also cacao, a small-scale farming community in Wiapore village. Like coffee and red bean plants, cocoa plants are also plants that, when harvested, will then be processed by themselves from harvesting and drying chocolate. According to Mr. Arman: "Before drying the chocolate under the hot sun, first the chocolate fruit that has been split and separated from the chocolate heart is then left for 1-2 days". (Results of the interview November 27, 2018).

According to Mr. Laperdi (Interview November 27, 2018) added that: "This dwelling aims to reduce the moisture content in the cocoa beans so that when they dry in the sun, they dry quickly."

Meanwhile, a key informant, Yuli's mother, said that: "It is true that standing chocolate for a few days can reduce the moisture content and when dried in the sun it will dry quickly because of the low moisture content." (Results of the interview December 2, 2018).

In addition to removing the moisture content in the cocoa beans, the fermentation process unintentionally occurs. According to Ariyanti (2017), fermentation releases the pulp from the seed chips, thus facilitating the drying process; the seed coat is easily removed from the seed chips. In addition, fermentation also aims to kill the seeds and allow the process to lead to the formation of color, taste, and aroma.

Chemical knowledge can be obtained through formal education and patterns of daily behavior, culture, and customs. This knowledge has indirectly been carried out even though the understanding of what is being done has not been fully realized.

Conclusions

Based on the research and data analysis results, it was obtained some understanding of chemical knowledge in the daily life of the Wiapore village community, such as everyday life related to the categories of food, beverages, and agriculture. The

percentage value in matters about the food category is 55.55%, matters relating to beverages are 22.22%, and matters relating to agriculture are 22.22%. The results of this study are significant to be helpful for the community so that they can increase their knowledge of chemistry in everyday life.

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