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Analysis of the Use of Desiccator Instruments: Literature Review

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Abstract
Introduction: The laboratory is an indispensable tool in science learning. In the laboratory there is a lot of equipment that supports practical work carried out by students. So that the equipment used can be used for a long period of time, it needs to be maintained regularly. Generally laboratory equipment consists of metal, wood and glass. Maintenance of the tool is carried out by storing the tool in a dry place and not exposed to sunlight. Various kinds of laboratory equipment such as glassware: test tubes, Erlenmeyer, measuring cups, etc. Another frequently used equipment is a desiccator. A desiccator is a tool commonly used in laboratories that functions as a tool for cooling samples. The goal is to analyze desiccators, identify desiccators, principles, various types of desiccators, know how to use them and maintain them. Method : This research is descriptive research using a literature review method with reference sources from Google School, Sinta, national and international journals. Result : A desiccator is a tool used as a tool to cool samples. This tool is closely related to the field of chemical engineering. The various types of desiccators are standard desiccators, gas cleaning desiccators, automatic desiccators, vacuum desiccators. The way the desiccator works is to open the lid of the desiccator by moving the lid to the side, place silica gel underneath, place a filter made of porcelain, place the media on top of the filter, before closing, apply a little Vaseline to the lips of the cover. Lastly, set the tap and no air should enter the desiccator. Conclusion : A desiccator is a tool used as a tool to cool samples. It is important to always calibrate the equipment to maintain the quality of the desiccator so that it continues to function properly
Keywords: Laboratory; Instrumentation; Desiccator

1. Introduction

The laboratory is an indispensable tool in science learning. In the laboratory there is a lot of equipment that supports practical work carried out by students. So that the equipment used can be used for a long period of time, it needs to be maintained regularly. Generally laboratory equipment consists of metal, wood and glass. Maintenance of the tool is carried out by storing the tool in a dry place and not exposed to sunlight. It is not impossible for an accident to occur in the laboratory due to errors in the use and use of the equipment used during the practicum. The selection of the type of tool used in the research is adjusted to the research objectives so that the research runs smoothly (Egor Secrieru, 2018). Knowledge about desiccators is very useful to guide us in using these tools (Bestari, 2012).

1.1 Understanding

Desiccator is another name for desiccator, which is a tool in the form of a two-tiered pan whose bottom is filled with drying material (a material that can absorb water vapor), with a cover that is difficult to remove when cold because it is coated with vaseline which is used to prevent water vapor from entering the desiccator. Meanwhile, the top part is used to store dried ingredients. Desiccators are made from semiborosilicate glass, plastic or mica, whereas the glass type is clear or amber. There are 2 types of desiccators, namely ordinary desiccators and vacuum desiccators. The drying process in a vacuum desiccator is of course faster than the regular model because it is assisted by the vacuum process, so in terms of price it is also a little more expensive because additional accessories are required (Kahar, 2022).

A desiccator is a tool commonly used in laboratories that functions as a tool for cooling samples. A desiccator is a container for drying a specimen and protecting it from air humidity. A simple laboratory desiccator is a container that at the bottom contains silica gel or other drying chemicals. The desiccator is equipped with a glass cover coated with vaseline. Vaseline or petroleum jelly is an alkane hydrocarbon with 20 to 30 carbon atoms that comes from petroleum. Vaseline functions as a gap between the lid and the desiccator container so that there is no air flow in or out of the desiccator. Vaseline also functions as an anti-microorganism agent. Based on its conditions, the desiccator has the potential to be developed into an anaerobic jar by removing the gas in the desiccator head space.

A desiccator is a container made of glass that functions to remove water and crystals resulting from purification. The drying agent contained in the desiccator is concentrated sulfuric acid, calcium chloride or silica gel which can keep the substance dry (Humaidah, 2021). In general, desiccators are divided into 2, namely vacuum desiccators and ordinary desiccators. A vacuum desiccator is a desiccator capable of maintaining low humidity at a pressure of no more than 20 mmHg.

The desiccator consists of two parts, at the bottom there is silica gel which functions as a water evaporator and at the top as a dryer for the evaporated material (Frowen, 2020). The way the desiccator works is to open the lid of the desiccator by moving the lid to the side, place silica gel underneath, place a filter made of porcelain, place the media on top of the filter, before closing, apply a little Vaseline to the lips of the cover. Lastly, set the tap and no air should enter the desiccator. The desiccator functions to stabilize the temperature by absorbing heat. In addition, to dry materials that should not be exposed to air.

1.2 Tool Parts

Source: https://microbeonline.com/desiccator-working-mechanism-types-and-uses/

Figure 1. Tool Parts

1. **Desiccator Cabinet/Room:** The desiccator cabinet can be round or cubic. Round desiccators usually have one shelf and a dome-shaped top to provide extra vertical space. Cabinet style desiccators provide easier accessibility, greater storage capacity and stacking capabilities. They often have multiple shelves. The construction can be from glass cabinets, polypropylene, polycarbonate, or acrylic. The design of this type of desiccator aims to maintain an atmosphere with low humidity which is useful for drying hot objects and storing samples for long periods of time without damage due to chemical reactions caused by humidity or mold growth. They can be vacuum and non-vacuum cabinets with different configurations and different height and width options.
2. **Close:** The covering material is the same as the room material. It is placed at the top of the room. Silicone grease applied to the lid and chamber interface maintains an airtight seal.
3. **Desiccator plate:** A pair of nets or sieves are placed in the chamber. The upper perforated plate holds crucibles, Petri dishes, and other materials along with samples to be dried or stored. The bottom plate holds the desiccant. The plate can be made of stainless steel or polypropylene.
4. **Stopcock:** Comes in a vacuum desiccator that helps remove air and moisture from the room.
5. **Pump vacuum:** Pumps air and moisture out of the room, and speeds up the drying process. It only exists in a vacuum desiccator.

1.3 Types

1. Standard Decicator

Source: https://glasswareindonesia.wordpress.com/2020/06/17/fungsi-pengertian-dan-cara-kerja-desikator/

Figure 2. Decicator

This type of desiccator requires manual operation and monitoring. It is flexible as any type of desiccant can be used (silica gel beads, activated charcoal, clay molecular sieve, etc) based on economy and convenience. The dryer is placed under or on any shelf to remove moisture from the room. Continuous drying saturates the desiccant with water molecules. Saturated dryers must be regenerated through heating or replaced. It is economical and convenient to use (Shrestha, 2022).

2. Gas Cleaning Desiccator

Source: https://www.avantorsciences.com/ca/en/product/13247436/sp-bel-art-secador-1-0-2-0-3-0-4-0-gas-purge-desiccator-cabinets-bel-art-products-a-part-of-sp

Figure 3. Gas Cleaning

A slow, steady stream of inert gas (dry nitrogen) is supplied to achieve low humidity levels much faster than drying agents. It works by removing wet air and replacing it with dry gas, hence the name gas cleaning desiccator. It is flexible as it provides the option of closing the stopcock and using a regular dryer instead of inert gas.

The walls of a gas cleaning desiccator consist of gas inlets and outlets that allow gas movement. These desiccators can reach the desired humidity level much faster than standard and automatic desiccators and provide a dust-free environment (Shrestha, 2022).

3. Automatic Desiccator

Source: https://www.axel-gl.com/id-id/asone/d/1-5486-21/

Figure 4. Automatic Desiccator

These desiccators require minimal manual monitoring compared to standard desiccators due to their ability to regenerate the desiccant. The electric fan and heater present continuously regenerate the dryer by preventing burnout and automatically maintaining a low humidity environment. It uses silica gel beads as a desiccant. This desiccant lasts for thousands of regeneration cycles. It operates on a specific drying schedule followed by a regeneration period (Shrestha, 2022).

4. Vacuum Desiccator

Source: https://pelitadwiasa.wixsite.com/laboratorium/product-page/desiccator-desikator-vacuum-duran

Figure 5. Vacuum Desiccator

Vacuum desiccators remove air and moisture through the use of a vacuum pump. The use of a vacuum pump reduces humidity which helps evacuate air from the room and also reduces oxygen levels. The stopcock on a vacuum desiccator helps evacuate liquid or gas from the inside. It can also be operated using a dryer. Vacuum desiccator cabinets are available in round/jar or cubic shapes.

It is best for long-term storage of materials that can damage the air. Another use is for degassing techniques. It is flexible as the stopcock can be removed to release the vacuum pump to use a regular dryer inside (Shrestha, 2022)

1.4 Functions and Tools

Citing books Introduction to IPA Practical Tools by Rasmini, et al (2021), The function of a desiccator in microbiology is to remove the water content in a test sample. This laboratory tool also functions to remove crystals in experimental samples.

This tool can function optimally because of the presence of silica gel which acts as an evaporating agent, so it is able to bind water in the sample.

Silica gel is a type of laboratory reagent formula that comes from the coagulation process of sodium silicate sol or nasio2. This jelly-like sol is dehydrating, so it can turn into glass-like granules. This property makes silica capable of acting as an absorbent and drying agent (Rasmini et al, 2021).

1.5 Principle

The working principle of a laboratory desiccator is to use a drying agent to absorb water from the air in the desiccator. Drying agents commonly used in desiccators are silica gel, calcium chloride, and concentrated sulfuric acid (Envilife, 2022).

1.6 Ways of Working

1. Prepare the desiccator and drying agent. The desiccator must be clean and dry. The drying materials must be in good condition and none of them are saturated.
2. Fill the desiccator with drying agent. The desiccant is usually placed in a small container at the bottom of the desiccator tube. The amount of drying agent used depends on the size of the desiccator and the substance to be dried.
3. Place the substance to be dried in the desiccator. The substance to be dried is placed on the drying agent.
4. Close the desiccator carefully. Make sure the desiccator lid is installed tightly so that outside air cannot enter.
5. Leave the substance to be dried for some time. The length of drying time depends on the type of substance to be dried.
6. After the substance is dry, remove the substance from the desiccator. The dried substance can be used immediately or stored in a dry and cool place.

1.7 Maintenance

1. Open the desiccator lid by sliding it, use one hand to hold the bottom of the desiccator (avoid lifting the lid to open the desiccator).
2. Make sure the desiccator lid is evenly coated with Vaseline.
3. If the silica gel has changed color from the original (saturated with water), dry it using an oven at 105° C for several hours, or replace it with new silica gel if necessary.
4. Clean the inside of the desiccator and keep it dry.
5. If the Silica gel has turned blue then bake it until the color changes to clear white.

1.8 Calibration

Several things that need to be considered or the calibration system when using and maintaining a desiccator are as follows:

1. Open the desiccator lid by sliding it, use one hand to hold the bottom of the desiccator (avoid lifting the lid to open the desiccator).
2. Make sure the desiccator lid is evenly coated with Vaseline.
3. If the silica gel has changed color from the original (saturated with water), dry it using an oven at 105 degrees for several hours, or replace it with new silica gel if necessary (SHE Chemical Laboratory, 2019)

1.9 Advantages and Disadvantages of Tools

Advantages

1. The operating method is relatively easy because it is done manually without requiring control settings.
2. Does not require electricity resources to use.
3. The price is relatively cheaper, it is not easily damaged so it can be used for a long time.
4. Relatively large container capacity, depending on needs with capacity variants ranging from liters to 20 liters.

Disadvantages

1. Its use is limited to materials that are organic, namely those containing organic compounds such as fat, protein, fiber, carbohydrates or materials that contain water minerals bound in organic or free compounds.
2. Requires auxiliary media (desiccant), such as silica gel in the working process. This means that the desiccator must also be prepared with desiccant material for its operation (Laboratory Solutions, 2022).

2. Methodology

This research is descriptive research using a literature review method with reference sources from Google School, Sinta, national and international journals. The goal is to analyze desiccators, identify desiccators, principles, various types of desiccators, know how to use them and maintain them.

3. Results and Discussion

A desiccator is a tool used as a tool to cool samples. This tool is closely related to the field of chemical engineering. The various types of desiccators are standard desiccators, gas cleaning desiccators, automatic desiccators, vacuum desiccators. The way the desiccator works is to open the lid of the desiccator by moving the lid to the side, place silica gel underneath, place a filter made of porcelain, place the media on top of the filter, before closing, apply a little Vaseline to the lips of the cover. Lastly, set the tap and no air should enter the desiccator.

Table 1. Journal Review

No	Writer	Title	Discussion	Conclusion
1	Shofiyanita, Sri Nurhayati. (2018). Determining the Content of Nutrition and Organoleptic Test of Chips from Jackfruit Seed and Durian seed. Indonesian Journal of Chemical Science and Technology, Vol. 01(1), 43 - 49.	Determining the Content of Nutrition and Organoleptic Test of Chips from Jackfruit Seed and Durian seed	This study compared the nutritional composition and sensory attributes of jackfruit seed chips and durian seed chips. Even though the nutritional content is different between the two types of chips, there is no significant difference in terms of color, taste, aroma and texture. Both types of chips were well received by panelists, indicating positive acceptance of new food products made from jackfruit and durian seeds	Based on the research conducted, it can be concluded that jackfruit seed crackers have a protein content of 1.1151%, fat 0.9687%, water 9.3626%, ash 4.3118% and carbohydrates 84.2419% while the nutritional content of durian seed crackers has protein content. 1.0786%, fat 2.7932%, water 8.8043%, ash 3.4763%, and carbohydrates 83.8477%. The organoleptic test results of jackfruit seed crackers and durian seed crackers regarding color, taste, aroma and texture were liked by many panelists and did not show significant differences between jackfruit seed crackers and durian seed crackers.
2	Rosirda, Dianty Dewi K., Ira P., & Yuni R. (2015). Isolation of Anaerobic Microorganisms in Textile Liquid Waste Using a Desiccator as an Anaerobic Incubator. Journal of Fluids, Vol. 11(1), 26-33.	Isolation of Anaerobic Microorganisms in Textile Liquid Waste Using a Desiccator as an Anaerobic Incubator	This research aims to isolate anaerobic microorganisms from textile wastewater by using a desiccator as an anaerobic incubator. By modifying the desiccator with nitrogen gas to remove oxygen, it was found to be effective for anaerobic incubation and succeeded in isolating anaerobic microorganisms from textile wastewater. This isolation method produces a consortium of anaerobic microorganisms that can be used in textile wastewater treatment. This research contributes to the field of	1. Desiccators modified to use nitrogen gas are effective as anaerobic incubators, where anaerobic bacteria can grow. In this desiccator, obligate aerobic and facultative aerobic bacteria can still grow because the media used still contains dissolved oxygen which is marked with pink at the top of the media. A simply modified desiccator using wax as an indicator for the presence of oxygen has also shown effectiveness for use as an anaerobic incubator. 2. The results of microbial isolation from anaerobic

			textile wastewater treatment by exploring combined anaerobic-aerobic systems.	processing of textile factory waste obtained 6 types of isolates, resulting in an anaerobic consortium of microorganisms (mixed culture).
3	Engelen, Adnan., Sugiyono., & Slamet B. (2017). Chemical Characteristics of Making Sago Noodles. Journal of Halal Argoindustry, Vol. 3 (1).	Chemical Characteristics of Making Sago Noodles	This research aims to produce dried sago noodles using a double screw extruder with the addition of GMS (Glycerol Monostearate) and ISP (Isolated Soybean Protein). This research found that dried sago noodles have a chemical composition including water, ash, protein, fat, carbohydrates and certain color values. There is no significant difference between dry sago noodles and wheat noodles in terms of hardness, stickiness, elongation and overall characteristics. This research is very important to develop local sago-based products and reduce dependence on wheat imports. The production process involves various steps such as chemical analysis to determine composition, color analysis to assess color characteristics, and sensory evaluation to measure consumer preferences. The results of proximate analysis show that the water content is 10.32% in dried sago noodles, meeting the specified quality standards.	The chemical composition and color of dried sago noodles are water (10.32%), ash (0.20%), protein (2.63%), fat (0.21%), carbohydrates (86.63%), and color value (L = 34.70, a 2.56, b = 6.19). The results of the sensory scores between wheat noodle products and dried sago noodle products showed that there was no significant difference in the attributes of hardness, stickiness, elongation and overall.
4	Fikriyah, Yuka U., Reni Silvia N. (2021). Analysis of Water Content and Ash Content in Black Tea Sold on the Market using the Gravimetric Method. Amina Journal, Vol. 3(2).	Analysis of water content and ash content in the black sold on the market using the gravimetric method	This paper discusses the process of testing the water content and ash content of black tea bags in accordance with the SNI 3753:2014 quality standard. High ash content indicates a high mineral content in the sample, although excessive mineral content is not recommended in food products. Factors such as the age of the leaves and processing methods also influence the quality of the	The process of testing water content and ash content uses the gravimetric method with the principle that water content loses weight when heated at 105°C, while the ash content using the dry process has the principle of oxidizing all organic substances at high temperatures, namely around 500-600°C. The process of testing water content and ash content on the six samples used, all

			tea. The gravimetric method was used for testing, and all black tea bag samples met the established quality standards. Another study analyzed the water and ash content in black tea available on the market using the gravimetric method. Research findings show that the water and mineral content in black tea meets quality standards, with water content ranging from 6.213% to 7.632% and ash content ranging from 5.287% to 5.898%. Monitoring the water and mineral content in black tea is very important to determine the quality and safety of consumption.	complies with SNI 3753:2014, requirements for the quality of black tea bags. In the six samples tested, the lowest water content was the TG sample, which was 6.213%, while the highest was the TB sample, which was 7.632%, and the lowest ash content was in the TCP sample, which was 5.287%, and the highest ash content was in the TBM sample, which was 5.287%. 5.898%.
5	Ariska, Nana., Dewi J., Sumeinika Fitria L., Mila A. Effect of Silica Gel Dosage for Several Storage Times on the Physiological Performance of Rabbit Variety Peanut Seeds. Agrium Journal, Vol. 25 (1).	Effect of Silica Gel Dosage for Several Storage Times on the Physiological Performance of Rabbit Variety Peanut Seeds	The research, which was carried out using a Completely Randomized Design (CRD) with a Non-Factory pattern, which was repeated 4 times, aimed to test the effect of different doses of Silica Gel on the viability and vigor of peanut seeds. The results showed that a 30g dose of silica gel provided the best performance for seeds stored for 120 days, while a 10g dose showed a negative response. Seed viability and vigor are influenced by the water content of the seed during storage. This research was funded by the PNBPT Institute of Teuku Umar University. Another study focused on testing the impact of various doses of silica gel on the storage capacity of rabbit variety peanut seeds, with a dose of 30g proving to be the most effective for seed viability and vigor. This research is very important to extend the storage period of peanut seeds.	The use of silica gel affects the physiological performance of peanut seeds stored for 120 DAPS. The 30g dose of silica gel is the best dose for the visibility and vigor of peanut seeds, the use of a 10g dose of silica gel shows a negative response to the physiological performance of peanut seeds.

4. Conclusion and Recommendations

A desiccator is a tool used to remove moisture from a material or substance. A desiccator consists of a desiccator tube and a moisture absorbing material which can be salt, silica gel, or other materials. Desiccators are useful for storing substances that are easily oxidized or contaminated by air humidity, as well as storing items that are easily damaged if exposed to humidity. Desiccators are widely used in the chemical, pharmaceutical and other fields to extend the shelf life of goods that are easily damaged when exposed to moisture. Recommendation: You must use a desiccator tool in accordance with standard operating procedures and you must calibrate the tool regularly.

Further Study

Future studies and policy initiatives should build upon these findings to ensure that artificial intelligence is utilised ethically and efficiently for the benefit of society.

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