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Utilization of Used Bottles and Cans as Media Practicum on Pressure Material

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ABSTRACT: *Implementation of the 2013 Curriculum is currently being promoted by student learning independently and creatively by prioritizing High Order Thinking Skill (HOTS) in students. In this case, in some subjects requires a practicum to test the theory as in Physics subjects. In practicum, a practicum media is needed which supports the running of the practicum to the fullest. However, in some schools located in areas that are difficult to reach, practicum media are difficult to fulfill, so simple practicum media are needed that can be processed from inorganic waste such as plastic bottles and used cans. This study aims to determine the benefits of plastic bottles and used cans into vacuum cleaners as a practicum media on the concept of pressure, especially atmospheric pressure material. This research was conducted using an experimental method by changing the diameter of the fan propeller. From the results of research that has been done it is known that the diameter affects the effectiveness of suction power from a vacuum cleaner. The effectiveness of suction power The vacuum cleaner is higher if the diameter of the fan propeller blade is getting bigger. Therefore a vacuum cleaner is very effective in cleaning quickly and effectively with the difference in air pressure and can be used as a learning medium.*

KEYWORDS -*Vacuum Cleaner, Effectiveness, Atmospheric Pressure*

I. INTRODUCTION

Implementation of the 2013 Curriculum is currently being promoted by student learning independently and creatively by prioritizing High Order Thinking Skills (HOTS) in students [1]. Physics produces the fundamental knowledge needed for future technological advances that will continue to drive the machinery of the world economy [2,3]. This will be a contribution to technology and infrastructure to provide trained personnel needed to take advantage of scientific advances and discoveries [4]. All school systems have provisions for studying physics. The method of teaching physics commonly used in schools in the city of Banda Aceh is the traditional lecture method. This technique has not been found to be effective for teaching science because of the low performance of students [5]. Traditional lecture methods only produce little or no change in the understanding of most students about how world works in physics [6,7]. Therefore students can be active in creating and expanding their knowledge through practicum, but not all Banda Aceh schools have adequate practical facilities and are in accordance with what is needed so that a new breakthrough is needed using materials that are available and no longer used to meet practicum equipment in a simple manner that is adequate for school.

Waste is one example of unused material that can be used to produce simple practicum media. Waste is a waste produced by both production and domestic processes [8]. The area around the settlement certainly has various kinds of waste, ranging from wasted water, leaves and tree branches, to used plastic bottles and cans. Waste plastic bottles and used cans are inorganic waste which is very difficult to decompose. In addition, plastic waste is the biggest contributor of waste other than cans [9]. Therefore, these materials can be used as simple practical media so that environmental pollution can be avoided.

The utilization of waste from plastic bottles and used cans will be designed as a vacuum cleaner or mini vacuum cleaner that is safe and practical to use for vacuum cleaners and can be used in learning practicums, especially Physics subjects with the concept of Pressure. A vacuum cleaner is a modern equipment that is very helpful in household work, especially for cleaning dust quickly and efficiently. Vacuum comes from Latin vacua, which means the room has no air, while the

technical term is a room that has very low gas density [10]. The vacuum cleaner component that functions as a liquid or air suction is a vacuum pump [11]. In principle, the vacuum pump works with a suction method with vacuum pressure (<1 atm). This vacuum pump works by flowing or pushing the gas in such a way that the gas is pushed from the inlet pump to the outlet pump. The air from the outside is sucked by an electric motor so that it enters the vacuum tube, inside the vacuum air tube is vacuumed so that the air pressure becomes very low [12].

The amount of suction capacity depends on the capacity of the machine itself. As stated by Ivan [13] in his research that vacuum cleaners as small dirt cleaners can perform the desired task. The vacuum cleaner is needed in the community because it has functions that can facilitate human work quickly compared to ordinary tools such as brooms [14]. Thus, research activities on the use of used plastic bottles and cans are expected to reduce the intensity of inorganic waste gradually. In addition, this study also revealed the effectiveness of vacuum suction power from mini vacuum cleaner devices. The use of plastic bottles and used cans into mini vacuum cleaners is one of the steps to the utilization of unused waste which is quite effective. Besides being able to reduce inorganic waste, the use of these wastes can also meet the learning media at school.

II. METHODOLOGY OF RESEARCH

1. General Background of Research

This study uses experimental methods, namely conducting direct testing of the test equipment in order to obtain the desired data to answer / resolve problems [15]. This writing seeks to produce a simple vacuum cleaner design using USB resources.

2. Instrument and Procedures

The instruments or materials used in this study are simple tools including used bottles, beverage cans, filters, DC motors, USB cables, chargers Mobile phones, scissors, glue, and cutters.

3. ProsedurDesain Vacuum cleaner

In designing this tool there are four basic components that need to be considered, namely; DC motors, USB cables, dust filters, and vacuum chambers from used bottles.

1) Cut the used bottle with the cutter in two parts like the picture below, which will be used as a vacuum chamber.

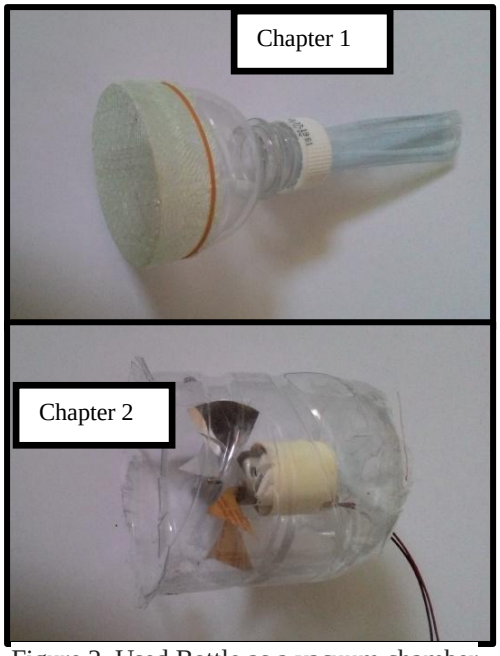

Figure 2. Used Bottle as a vacuum chamber

2) In part 1, a dust filter from the fabric is installed at the bottom that serves as a filter, and at the top is designed a hole that serves to enter the air and dust, also known as the intake port.
3) In part 2, hole the back by using a cutter that functions as a place of discharge or known as the exhaust port, make a fan of used canned drink bottles, make sure the fan size is the size of the bottle

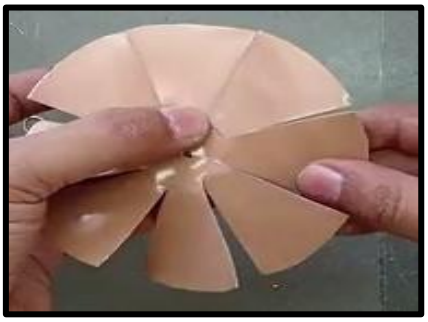

Figure 3. Fan Blades from Used Bottles

4) Connect the fan with the DC motor and use the adhesive, connect the DC motor with the USB cable and design it in such a way, glue the DC motor that has the fan installed on the bottom of the bottle part 2, then use the adhesive so that the DC motor does not shift. Make a small hole in the surface of part 2 as shown above so that it can be easily

connected to part 1. Then connect parts 1 and 2 so that the tool can work.

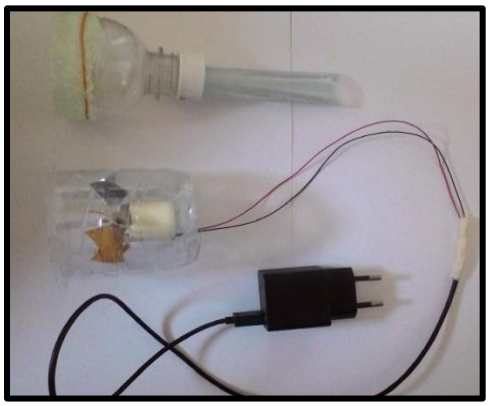

Figure 4. Simple vacuum cleaner tool

4. Data Analysis

Data analysis was carried out theoretically based on experimental data by determining the conditions in each trial cycle.

III. RESULT

1. Effectiveness of Vacuum Suction Power on Vacuum Cleaners

Based on the results of data processing from the measurement of the fan propeller blades on the Vacuum cleaner to the large amount of dust particles that can be sucked can be seen in table 1.

Table 1. Comparison of Fan Blade and Particle Dust Blade Diameter

No	Diameter of fan propeller (cm)	Large Particle Dust (cm)	Effectiveness of suction power (%)
1	8	0,001 – 0,1	10 – 100
2	6	0,001 – 0,01	1 – 10
3	4	0,001	1

2. Discussions

Based on Table 1, it is found that the effectiveness of vacuum suction power from a simple vacuum device becomes higher when the diameter is enlarged. The largest diameter is 8 cm with an effectiveness of 100% or very effective, while the smallest diameter is 4 cm with an effectiveness of 1% or not effective at all. The working principle of a vacuum cleaner is to utilize the principle of pressure and vacuum. The fan (fan) will reduce the pressure inside the vacuum cleaner so that vacuum space occurs. Furthermore, atmospheric pressure will push the outside air into the vacuum cleaner so that the dust will be sucked into the dust bag inside the vacuum cleaner. Dust and air that is sucked through the suction (intake port) passes through the filter (filter) then accommodated in a dust bag (dust bag) and the air is disposed of in a clean condition to the atmosphere after passing through the filter. Thus, a vacuum cleaner is very effective in cleaning quickly and effectively with the difference in air pressure and can be used as a learning medium.

3. Simple Vacuum Cleaner Working System

The working ability of a vacuum cleaner is strongly influenced by the strength of the DC motor used, the size of the intake port is small or small. The addition of suction capability in a vacuum cleaner can be done by replacing a more powerful DC motor, using a mobile charger that has a greater voltage. As stated by Ardhi[16] which affects the suction ability of the vacuum cleaner, which is the shape of the air suction tunnel, strong gusts of wind from the fan and the size of the opening on the intake port.

Based on the description above, there is a simple work system of vacuum cleaner; the USB cable that is installed with the cellphone charger is then connected to a voltage source so that electric current flows, the electric current will move the rotor so that the fan moves alongMohan [17].In his research stated that when the switch is in position then the components that are from this tool start working, such as the pump will start working by circulating water and spraying water in the drum, the blower will spin so that the dust outside can be sucked into the drum room. With the rotation of the fan makes the air in the room become vacuum so that the air pressure in the atmosphere is stronger than the air in the vacuum, because of the difference in air pressure, the outside air enters the vacuum along with the dust. Vacuum shows that the volume of space is basically empty of matter, so the air pressure is lower than atmospheric pressure.

Perkins research [18] explains that to know what happens in a vacuum we must understand the mechanism of a vacuum cleaner. This can be explained by breathing water from a straw. Inhaling creates a pressure difference between the bottom and the top and the fluid is pushed into the low pressure area. Vacuum cleaners work in the same way, because the particles are being suctioned due to pressure differences.

IV. CONCLUSION

1) Using plastic bottles and used cans can be modified into a simple vacuum cleaner

(Vacuum Cleaner) by utilizing the concept of air pressure difference.

2) The effectiveness of suction power Vacuum cleaner depends on the diameter of the fan blades, the greater the fan diameter, the higher the effectiveness of vacuum cleaner suction power.
3) A vacuum cleaner created from this waste is only able to lift dust with a mass of 0.001 - 0.01 gr.

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REFERENCES

[1]. Abdullah, A.H., Mokhtar, M., Halim, N.D.A., Ali, D.F., Tahir, L.M, &Kohar, U.H.A. (2017). Mathematics Teachers' Level of Knowledge and Practice on the Implementation of Higher-Order Thinking Skills (HOTS). EURASIA Journal of Mathematics Science and Technology Education, 13(1), 3-17.

[2]. Amunga, J. K., Musasia, M. A., &Musera, G. (201l). Disparities in the Physics Achievement and Enrolment in Secondary Schools in Western Province: Implications for Strategy and Renewal, Problems of Education in the 21st Century, 31(31), 18-32, ISSN: 1822- 7864.

[3]. Nashon, S.M (1989). Practical work in science: A critical look at practical work in Kenyan secondary schools. Unpublished. Dissertation, School of Education, The University of Leeds.

[4]. Kühn S., Vanderhasselt M. A., De Raedt R., Gallinat J. (2012). Why ruminators won't stop: the structural and resting state correlates of rumination and its relation to depression. J. Affect. Disord. 141, 352–360

[5]. Toplis, M.J., Mizzon, H., &Monnereau, M. (2013). Chondritic models of 4 Vesta: Implication for geochemical and geophysical properties. *Meteoritics& Planetary Science,* 48, 2300-2315.

[6]. Cachia, R., Ferrari, A., Ala-Mutka, K., &Punie, Y. (2010). Creative Learning and Innovative Teaching: Final Report on the Study on Creativity and Innovation in Education in the EU Member State. *Journal Joint Research Center Insitute for Prospective Technological Studies.JRC European Commission*. Retrieved 28/04/2018, from http://ftp.jrc.es/EURdoc/JRC62370.pdf

[7]. Johnson, G. M. (2010). Internet use and child development: The techno-microsystem. *Australian Journal of Educational and Developmental Psychology*, *10*, 32-43.

[8]. Jorgensen, N.J., Madsen, K.D, &Lessoe, J. (2018). Waste in Education: The Potential of Materiality and Practice. Enviromental Education Reseacrh, 24(6), 807-817.

[9]. Karmana, O. (2007). *CerdasBelajarBiologiuntukKelas XI SekolahMenengahAtas.*Bandung: Grafindo Media Pratama.

[10]. Gajbhiye, V., Ahmad, N, &Tufail, M.S. (2018). Design and Application of D.C. Vacuum Cleaner using Axial Flow Fan. International Journal of Engineering and Techniques, 4 (1), 467-474.

[11]. Mansuri, F. &Sutji, L. (2018). Perancangan Dan PembuatanAlatVakumPembersih*Engine Cleaner* PadaRuangBakar Mobil.TeknikIndustri: Universitas 17 Agustus 1945 Surabaya.

[12]. Mulyanto, & Ahmad, A. (2015). Implementasi Highly Available Website Dengan Distributed Replicated Block Device. *Indonesian Journal of Computing and Cybernetics Systems*, 10(2): 149-160

[13]. Ivan, M. (2014). *ModulPelatihan SPSS*.FakultasPsikologi. UIN SUSKA Riau

[14]. Rusman (2015), PengaruhVariasiBebanTerhadap Solar Cell DenganKapasitas 50wp. Turbo *Jurnal Program StudiTeknikMesin*, 4(2). 84-90

[15]. Purnomo, H. (2015). AnalisisKarakteristikUnjukKerjaSistemPendingin (Air Conditioning) Yang Menggunakan Freon R-22 BerdasarkanPadaVariasiPutaranKipasPendingin Kondensor.*KAPAL: JurnalIlmuPengetahuandanTeknologiKelautan*, 12(1): 1-8.

[16]. Ardhi, S. (2016). PembuatanAlatPembersihLantai Yang Dikendalikan Dari Bluetooth Software Android. *Seminar NasionalInovasi Dan AplikasiTeknologiDi Industri (Seniati)*, 1-10.

[17]. Mohan, N. (2007). *Power Electronics and Applications*, Wiley: India

[18]. Perkins, W.G. (1973). Permeation and Outgassing of Vacuum Materials.*Journal Vacuum Science Technology*, 10(4), 25-35.