ANALYSIS ON DIFFERENT TYPES OF VISCOMETERS, DESIGN, MATERIALS AND TECHNOLOGY

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Abstract
A possible quality control parameter for a simple and quick fluid evaluation is a viscosity as a sensitive measurement of fluid changes. Viscosity measurement is important both as a potential hemodynamic biomarker for quality assurance for liquid products and for the monitoring of viscosity of clinical fluids. In order to test kerosene, ethanol and plasma, the fabricated viscometer yielded the following findings; respectively 0.00134, 0.0011 and 0.0034. These values are closely related to various literature and a significant average 5.9% error.This demonstrates that the produced viscometer is reliable and compliant and can be used for laboratory, building, food processing, and education purposes. Even after so much development, the choice of best production systems in terms especially of simplifying the process, cost and time is also one of the constant challenges facing the development of micro-fluidic devices. Here is a 3-D electro-fluidic viscometer printed (EMV).By automatically evaluating the transit time of the sample fluid versus the reference fluid viscosity under laminar flow, the EMV measures it. We disregard the various types of viscometers, design, materials and technology in this paper.
Key words :viscometer ,materials ,3D printing ,technologies

1. Introduction
Science and technology are developing rapidly and increasingly sophisticated nowadays. The needs and the accuracy, precision, efficacy and eco-friendly nature of the measurements measured to achieve object characteristics begin to increase for the researchers. These measurements could take the form of macro and micro research. The Brownian Movement, a random movement phenomenon of certain particles which can be observed below the target lens of a microscope due to collisions between participles and surrounding fluid molecules, is one of the measurements that play a role in micro-scale measurements[1].
In several studies such as biology, medical science and physics, brownian motion has been used in general. This method is especially useful for microrheology, which uses a high-resolution video camera and microsCope optic systems to obtain viscosity values, to combine micro-sized dielectric balls and, in other words, micro-percussions into a fluid. The Brownian motion system is designed to produce an easier and simpler method by using minimum quantity fluid to measure the viscosity of a fluid with equipment than conventional methods (in microliters).
Not all fluids are the same, some thin and flow fast, while others flow slowly or thickly. This property is known as viscosity as a reason for these differences in the flow properties. Defines viscosity as the measure of its deformation resistance at a certain rate which is in line with the informal concept of liquid thickness. The international unit systems (SI) measure viscosity unit per meter squared per second in Newton (Ns/m2), which is equivalent to a second pascal (Pa s). The imperial units measure ibfs/ft2 viscosity per foot in pounds-force second [6].
In the world of science, measuring viscosity is very important. Hydraulics, lubrication, construction, cooling and manufacturing are some of the areas in which viscosity measurement is important. Lubricating oils are of various grades in lubrication and the viscosity of these grades is highly determined. Therefore, viscosity[8] is considered a major lubricating oil property. Viscosity measurement of the construction sector is important for qualitative control in paint industries; the production of adhesives and in concrete determines the autonomous pumping and pumping behavior of a mix. Viscometers are used for viscosity measures and are available in seven classesThe following are: capillary viscometers, high temperature viscometers of high shear velocity, rotary viscometers, drop viscometers of the ball, vibration and ultrasonic viscometers.
A micro viscometer in which two immiscible fluids flow under laminar flow in a solitary Y-shaped microchannel, one being a reference fluid, the other being a test fluid. The width occupied by both fluids varied [13] on the basis of the viscosities of both fluids.This was demonstrated by modelling, simulating and experiencing various approaches to the manufacture of biodiesel blending, milk adulteration and auto fuel adulteration for various applications [14].

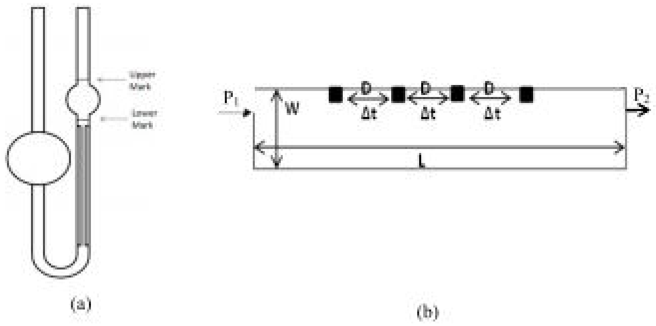

Fig.1. (a) Schematic of a typical Ostwald viscometer. (b) Schematic of the proposed micro fluidic device

The need to capture and analyze images persists however. In addition, with the variation of the camera inclination during picture capture the viscosity values were found to change. This approach aims to develop an integrated, miniaturized, rugged and automated micro fluidic device that is able to use a simple, inexpensive 3Dp to calculate viscosity using microelectronics to prevent the image acquisition.

2. Literature review

2.1 General study

In the world of science, measuring viscosity is very important. Hydraulics, lubrication, construction, cooling and manufacturing are some of the areas in which viscosity measurement is important. Lubricating oils are of various grades in lubrication and the viscosity of these grades is highly determined. Viscosity is therefore regarded as an important property of lubricating oil. Viscosity measurement in the construction sector is important for quality control, adhesive production, and concreting in paint industries, and defines the comportement of self-elevation and pumping of the mixture.Viscometers are used for viscosity measurements and are available in seven classes. These are capillary viscometers, viscometers for aperture, viscometers for high temperatures, viscometers for rotations, viscometers for balls, viscometers for vibration and the viscometers for ultrasound.

2.2 Designing of viscometer

Derrick, 2018: Joseph Michael: Current laboratory equipment for bachelor's degree courses can also be expensively enriched by adding procurement boards and requiring students to write code to provide information from those devices. Prior to the lab-session, the programming can be completed and the code is then tested. This paper presents a study at the Purdue University in Indiana, Indianapolis (IUPUI). The principal goals of the project were the development, compared with the current model, of a viscometer device prototype (1) with substantially lower acquisition costs and (2) to help students understand viscosity and drag principles.The device is used in the fluid mechanics laboratory of the Department of Mechanical and Energy Engineering of IUPUI. Actual acquisition costs are shown to be costly, and due to the test method, inaccurate data can be generated. Increasing results accuracy will enable students to be more assured of the fundamental theory they teach. A prototype that fulfills the sponsor requirements, engineering requirements and ASTM viscometer measuring standards has been developed.The fully constructed and assembled prototype is a cost-effective way of determining the viscosity of different oils accurately and accurately. The newer model showed a 30-40 percent decline in error compared with the older model. An evaluation study is in progress to determine the overall impact on the student learning that the redesign and programming add.

Ogwu Skull Augustine,2019: In science and engineering, viscosity plays an important role. In liquid production, quality control and development, knowledge of the viscosity and flow parameters is essential. For different applications the construction industry uses various liquids.The liquid used in the construction industry are plasters, sealers bond breakers, fluid ground hardders, coatings and many more. Conclusions on processing, pump capacity, spray resistance, and flow ability and application properties can be drawn from successful measurements. Consequently, related measurements with equipment which are accurate and less costly should be carried out. This paper presents the design, manufacturing and testing of a viscometer, which measures the viscosity of fluids through an opening.In the design of viscometers, the following considerations were applied: corrosion resistance for material selection, ease of manufacture and use. In order to test kerosene, ethanol and plasma, the fabricated viscometer yielded the following findings; respectively 0.00134, 0.0011 and 0.0034. These values are closely related to various literature and a significant average 5.9% error. This demonstrates that the produced viscometer is reliable and compliant and can be used for laboratory, building, food processing, and education purposes.

I P Kondrashov,2020: This paper examines the issue of determining a Newtonian liquid viscosity coefficient for the development of a rotating viscometer. For the processing of measurement results, the least square method is proposed. Electrical sensor readings conversion factors are suggested. The measuring instrument is designed to calculate the torsional moment to sensor current conversion coefficient. For the calculation of a rotary viscometer with a more exact processing of the measurement results, the suggested formulas are useful.

3. Materials and Method

A. Materials

It consists of a fluid container, a water bath (the water bath), a fluid feeder, a stiff stand, a beaker and a stop watch. The material used to manufacture and test the device is:
i. mild steel angle iron
ii. Stainless steel hollow pipe
iii. Galvanised steel metal sheet
iv. Mild steel billet
v. Beaker
vi. Stop watch and test liquids

B. Design and Material Selection for Components

Based on the following considerations the different components were designed.
i. Liquid container: corrosion-resistant, good heat conduction material for the liquid bath should be available at low cost. In the liquid bath, inox steel was found worthy and used.
ii. A hollow cylinder of 5.0 cm of internal diameter that can hold 500 ml of liquid was taken into account for the liquid bath dimension. It was calculated that the length needed was 25.4cm. 25.4cm of a 5cm internal diameter stainless steel tube was cut with a hack screw. The pipe was made to smooth both ends.
iii. The water bath: corrosion resistant materials used for the bath should be readily available and cheap, have good manufacturing properties and should be light weighted. The water bath was picked from galvanized steel. The diameter for this liquid container was calculated to be 19.3cm, with two boiling rings on either side of the liquid container inside the water bath. With a clearance of 8cm, a water bath diameter of 27.3cm was taken.The sheet length used to produce a cylinder has been calculated with a diameter of 27.3 cm; sheet length = cylinder circumference = αd (3) 'd' is the diameter of the cylinder and the 'α' diameter is 3.14; sheet dimensions used in preparing the water bath have been marked on a galvanized sheet of a thickness of 1 mm using a scriber. A cut-off machine was used to cut the marked portion. The galvanized plate was rolling and the ends were knitted manually into a cylindrical.The cylinder base has been marked and cut. In the center of the base a bore of 2.6cm was made. The slot for the hole billet is this opening. It was placed at the base.
iv. Strong Stand: because of its rigidity, the material chosen for the rigid stand was mild iron of the steel angle. The angle bar used had a thickness of 5cm*5cm*0.01cm. The initial length of the steel angle bar of the original 520cm was cut. The 520cm bar has been cut into pieces using a hacking saw to the necessary dimensions.The components were jointly sold by electric arc welding machine v. Orifice Billet: The billet for the orifice was used with mild steel because of its good production properties. The billet was marked with a 2.3cm diameter and cut out of a mild steel billet. A 2mm diameter boiler machine has been used to boil through the center billet.

3. Experimental Results

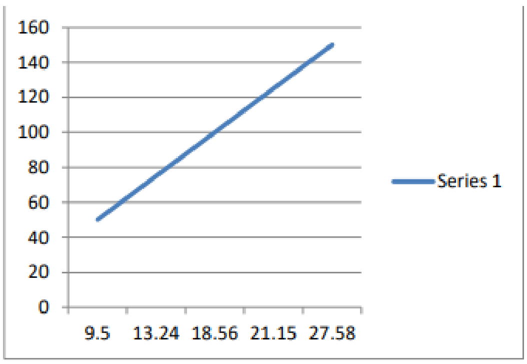

Figure 2: Graph of volume against time for water

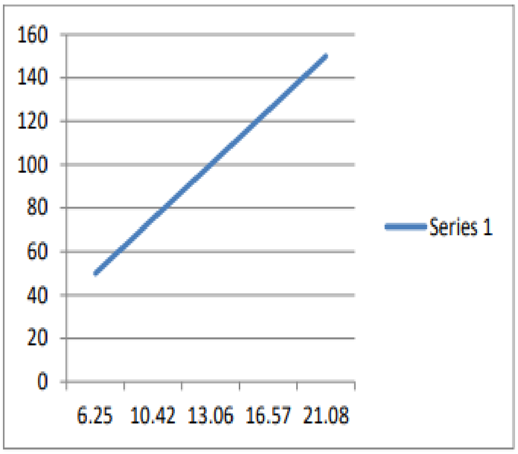

Figure 3: graph of volume against time for kerosene.

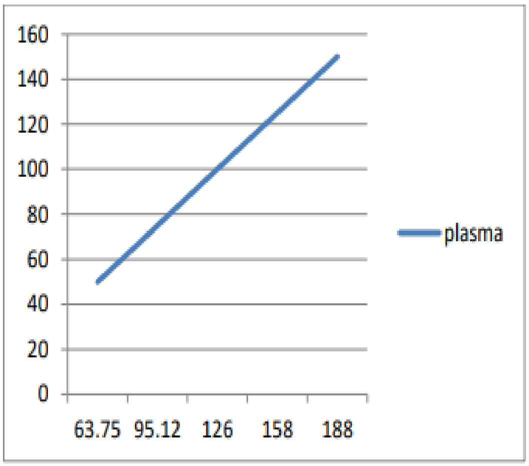

Figure 4: graph of volume against time of discharge for plasma

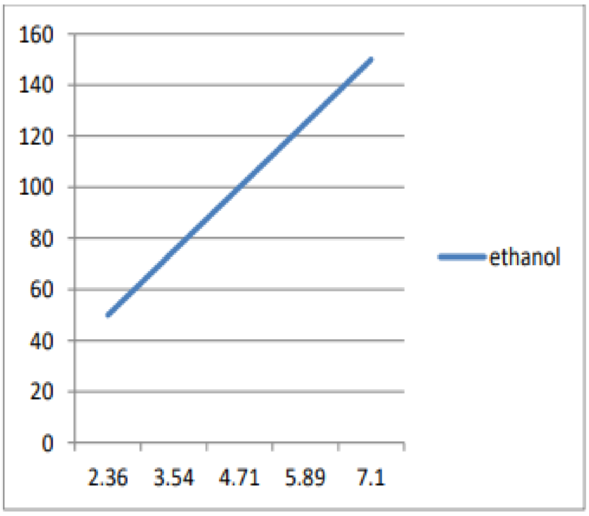

Figure 5: graph of volume against time for ethanol

Conclusion

We disregard the different types of viscometers, design, materials and technology in this review. Also, for high-throughput viscosity measurement, the 3D printed multi-channel viscometer compares several flows without any inter-chanson interference. The proposed 3D multi-channel viscometer allows cost-efficient, accurate, high-power measurement of fluid viscosity and field deployable measurements. The micro fluid device was manufactured in one step with a simple and cheap 3-DP desktop with micro channel and embedded electric connections.Due to the flow rate through a circular orifice, the viscometer which determines the viscosity of fluids has been designed and manufactured. The viscometer was tested and a 5.9 percent average error was found. This shows that the designed and manufactured viscometer is effective and can be used for viscosity determination of fluids.

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