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Design And Fabrication of Peristaltic Pump

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Abstract: *The main objective for this research is to design and develop a rotary peristaltic pump. This type of pump is hard to find on the market and also very rare. However, this pump has a wide application in medical sector. In order to prototype a peristaltic pump, its basic concept and function must be understood. The scope of this research are to design the pump for fabrication and determining the component that will be apply on the pump. Then engineering analysis and testing is done on the prototype to test its functionality. This prototype was successfully prototype with all the systematics plans and procedures .This prototype weight is 4 kilograms, long 25 cm, height 22.5 cm and width 18 cm. This project basically use mild steel angle bar and aluminium and powered by an electric motor. Improvement to the part of the pump like housing and motor are recommended for further stage of the study.*

Keywords: *peristaltic pumps, Newtonian, and Non-Newtonian fluid,*

I. Introduction

Peristalsis

A lot of equipment around us uses the mechanisms of pump, from the smallest pump used in the house to the biggest scales and specification pump used in industries. A peristaltic pump is a type of positive displacement pump used for pumping a variety of fluids. The fluid is contained within a flexible tube fitted inside a circular pump casing (though linear peristaltic pumps have been made). A rotor with a number of 'rollers', 'shoes' or 'wipers' attached to the external circumference compresses the flexible tube. As the rotor turns, the part of tube under compression closes thus forcing the fluid to be pumped to move through the tube. Additionally, as the tube opens to its natural state after the passing of the cam ('restitution') fluid flow is induced to the pump. This process is called peristalsis and is used in many natural biological systems such as the gastrointestinal tract. Peristaltic pumps are typically used to pump clean or sterile fluids because the pump cannot contaminate the fluid, or to pump aggressive fluids because the fluid cannot contaminate the pump. Some common applications include pumping aggressive chemicals, high solids slurries and other materials where isolation of the product from the environment, and the environment from the product, are critical. Suitable with the widely used of pump application, this research is currently focusing on designing and developing small scale of rotary peristaltic pump that will be used by small food industries and house use.

II. Phenomena Associated with Peristalsis

Reflux

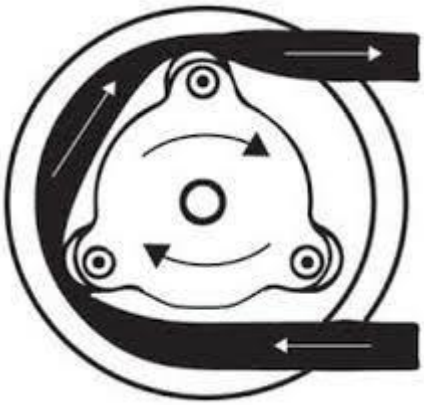
There are contradicting definitions of Reflux in peristaltic motion. Shapiro and his associates propagated the first one while the second one was by Fung and his colleagues. (Shapiro A.M. 1967, pumping and retrograde diffusion in peristaltic waves. Proc. Workshop is urethral Reflux in children 109-126) (Fung Y.C. and Yen C.S. 1968, Peristaltic transport Trans ASME.E.J.Appl.Mech.35 669-675). Shapiro gave his definition with the back word migration of bacteria from the bladder to the kidneys. According to him, it refers to the presence of fluid particles that move on an average, in the direction of opposite to the net flow near the walls. The backward migration takes place near the walls. It was experimentally verified by Weinberg et al., (1971) (Weinberg, S.L., Eckstein, E.C. and Shapiro A.H.) (1971) –An experimental study of peristaltic pumping .J. Fluid Mech., 461-479). According to Fung, it is the average mean flow reversal near the axis of the duct. Shapiro proposed that Eulerian time mean velocity must be taken into consideration whereas Fung considered Lagrangian displacement of fluid particles.

III. Indentation

The study is started by determine appropriate specification of the peristaltic pump. The specification of the pump is rotary peristaltic pump. Then followed by concept design. Basically there are four type of concept design for peristaltic pump but this project only concentate on the concept 2 as final design. The chosen design needed to be draw using Solidwork software. The design have been analyzed by using manual calculation. The

material used to fabricate the peristaltic pump is iron and aluminium. After all the selection have been decided, fabrication process are started. The last scope is to test the functionality of the peristaltic pump.

A Peristaltic Pump is a type of a Positive Displacement Pump. It is often used to pump different types of fluids. The principle of positive displacement uses a mechanism to repeatedly expand a cavity so as to allow fluids to flow into the cavity, and then seal that cavity. The fluid then moves forward. The only pumping element of peristaltic pump is flexible tube. The pump works by squeezing the tube with rollers or shoes. This means that pump can run dry, self prime and handle viscous or abrasive liquids, plus, as the tube is one complete unit, there are no seals. This makes the pump leak free and hygienic.



Basic Shape of Rotary Peristaltic Pump

IV. Basic Operation of Peristaltic Pump

Figure shown that basic operation for rotary peristaltic pump .Principle of operating are very easy. Figure , shown that when rotor is rotate ,fluid is enter the hose because of attraction force from vacuum produce after hose push by rotor. it shown that hose are fully pressed by rotor along the hose and then fluid is push and flow to the output. that fluid is shift to output and the other place which operator wish. Part of shoe were form vacuum and attract the fluid that want to pump. This operation stay repeatedly until the power of motor are off.

Pump System
Number of rollers Occlusion setting Rotation speed.

Tubing
Inner Diameter
Wall Thickness
Age of Tubing

Liquid
Type of liquid
Temperature
Viscosity

Application
Conditions Suction lift / vacuum Differential pressure
Tubing: It is important to select tubing with appropriate chemical resistance towards the liquid being pumped. Types of tubing commonly used in peristaltic pumps include:

- Polyvinyl chloride (PVC)
- Silicone rubber
- Fluor polymer

Key features for selection of peristaltic pump tubing are as follows:

Chemical Attack: One of the key factors affecting pump tubing performance is the fluid being transported. Chemical attack leads to absorption or swelling of tubing, which shortens tubing life. The chemical resistance to a specific fluid should always be determined when selecting a pump tubing

Pressure: Every pumping system has some degree of back pressure. Pressure will generally increase with the length of transport line or with the elevation of the outlet. Exceeding the pressure limits of tubing will decrease its life and leads to tubing rupture.

Pump RPM: As the roller makes impact on tube when it comes in contact, it is compressed, squeezed and then released to allow for recovery. This cycle is repeated. Various tubing materials have different degree of resistance to its flexural fatigue. The number of impacts given tubing is able to withstand is finite. So the tubing life is dependent on pump rpm and number of rollers.

V. Conclusion

The literature review shows that reviewers / authors were researched in depth mathematically and thousands of mathematical models considered Newtonian and non newtonian fluids. But, most of the researchers have not shown the flow characteristics in the physical models interpreting the mathematical models. In the present research work, peristaltic transport with single fluid and fluids with two different viscosities was presented. Considering the parameter $\emptyset = 0.6$ and wavelength , the peristaltic pump were designed, which is a new type of pump with cam rollers. The design aspects are presented. Based on the Results and Discussion the following conclusions are drawn followed by scope for the future work.

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References

[1]. WILIAM F. KAHLER – peristaltic pump with tube holding mechanism (US4925376 a)
[2]. MOHD FIRDAUS BIN MANSOR DESIGN AND PROTOTYPING A PERISTALTIC PUMP 14 NOVEMBER 2008
[3]. HENRIC EJSING‘ peristaltic pump’ an answer to increasing demand within the biopharma industry, europian industrial pharmacy, issue 6 June 2010
[4]. Negi el abbasi fluid structural interaction analysis of peristaltic pump, 12 November 2013
[5]. MICHEL SMITH ENGINEERS,LTD. How peristaltic pump works
[6]. LOUISE V.PARKAR- The effect of ground water sampling devices on water quality
[7]. Micro piv characterizations of laminar development flows of Newtonian and Non Newtonian fluids in a slit channel the fluid structural interaction of peristaltic pumps; basics and analysis