Transforming Lead-Free Fuel: Filter less Filtration Process by using Ultrasonic Waves

R. Srivel, Ramanarayan Sankriti, P.Nandha Kumar

Abstract— The main objective of the study is focused on removing the impurities in fuel substances. In the filtration process, sound waves are passed, as the longitudinal wave is also called as a compression wave. Ultrasonic signals are created with the help of transformer and that feeds into the transducer. When the output of the transducer is passed to the liquid medium it collides with dust particles and pushes the dust particles downwards. The subsequent ultrasonic waves retain the impurities in the bottom. Then the pure material is obtained in the upper part and the impurities in the bottom are removed by opening the lower part. The proposed method of ultrasonic filter will filter the dust particles in the liquid using polystyrene microscope and frequency sweep techniques, it generates the constant longitudinal ultrasonic waves in horizontal direction of a glass tube having large radius. This method makes the dust particles to settle down at the bottom and pure liquid will be present at the top layer.

Keywords—Filtration, transducer, micro-particle, ultrasonic waves

I. INTRODUCTION

The density of micro-particle is manipulating caused by unleaded fuel. This method helps to trap, sort, and filter the unleaded fuel into a purified fuel which is a crucial process in the field of Automobile technology. It can improve the engine performance and also better the mileage. However, in today's petroleum market the available of liquid contains a high level of lead particles that creates very serious environmental issues and various hazards on the human's health (1).

There are various methods for identifying micro-particle manipulations based on the physical principles which have identified by adding optical radiation force and electrostatic force. For example, the manipulation of bio-cells identified in biotechnology is practically possible. the proposed ultra-sonic filtration method uses Electronic timer circuit is used to give an timing pulse to frequency sweep technique to generates a constant longitudinal aquatic ultra-sonic Aquatic sound waves inside the liquid in horizontal (longitudinal) direction.which creates a constant vibration inside the liquid and it makes the micro dust particles to move towards at pressure node or anti node.[5]

This makes the microscopic dust particles to vibrate and to settle down at specific region of the channel the remaining liquids are allowed to flow through the different outlet of the glass tube, without using any barrier filter inside the tube. In existing method [6],[7] such as barrier filtration and centrifugal filter uses a separate filter membrane inside the glass tube to filter the dust particle, in that method even though the microscopic dust particles will still exist in the liquid layer.

The frequency sweep technique generates the ultra-sonic aquatic sound waves with respect to frequency in the range of few MHZ to GHZ. The deviation in the frequency will reduces the filter efficiency. In such cases the node plane should be situated at the center of the channel in order to protect the resonance of the frequency. In the proposed method we constructed the node plane is placed at the center of the channel and creates a two outlet in the glass tube having large diameter. One outlet is used to collect the purified liquid and another outlet is used to collect the dust particles. The based on different time periods the frequency sweep techniques generates different frequency based on the user selection of dust particles size.

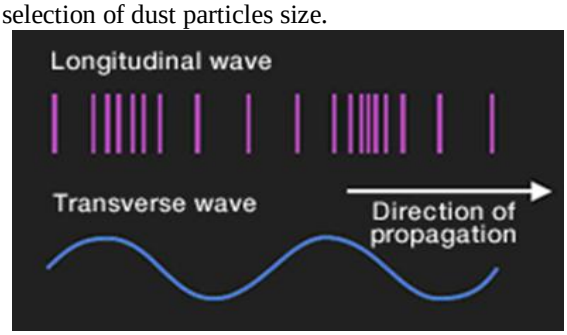

Fig longitudinal waves

Our proposed technique will make a simple flow-through filtration method by using frequency sweep technique. In the proposed approach, the direction of the ultra-sonic sound waves will create an acoustic radiation force on microscopic dust particles is perpendicular to the direction of liquid flow, whereby radiation force by the created by small ultra-sonic aquatic longitudinal waves can translocate microscopic dust particles instantly. The modularized device with narrow channel is made of steel and acrylic fiber.

II. EXISTING SYSTEM

Coarse filtration, microfiltration, ultrafiltration, reverse osmosis, distillation are the existing systems for purification. Distillation method: The action of purifying a liquid by a process of heating and cooling. The major drawbacks of

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existing system require a Separate filter membrane and distillation process needs a large amount of energy, boiling point of water. Even though the microscopic dust particles will still exist in the liquid layer and it cannot be removed efficiently and the entire existing filtration method requires a high cost.

III. PROPOSED SYSTEM

The main objective of the Proposed system is to remove the impurities in liquid substance. The user selectable particle size and no filter medium is required. For this filtration process ultra-sonic sound waves are passed as a longitudinal wave to vibrate in the glass tube having a large diameter. It used frequency sweep technique to generate the constant longitudinal ultra-sonic sound waves inside the liquid. Ultrasonic wave signals are created with the help of transformer and fed it into transducer. The output of transducer has ultra-sonic longitudinal waves is passed through the liquid medium. Due to constant vibration of longitudinal ultra-sonic sound waves using frequency sweep technique will make the microscopic dust particles to move in nodal and anti-nodal direction. Then, it pushes the particles downwards and pure material is obtained in the upper part.

A. Merits

The major merits of this method:

1. No filter medium is required
2. Clotting does not occur.
3. User selectable particle size.
4. Cost is low

A. Block Diagram of the system:

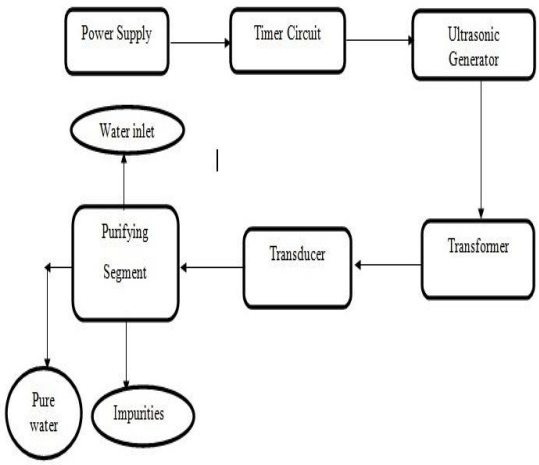

Fig. 1. Block Diagram of the system

B.Transformer :-

In this method we have used two types of transformer the reduce and increase the power supply voltage varies from 0V to 230 Volts. The transformer used to reduce the input power supply voltage by 7.5Volts. And the reduced input power supply voltage is given as an input to one end of the transducer. And second transformer will increase the input power supply voltage by 17.5 volts. The increased output voltage is given as a input to another terminal of the transducer. The figure shows the output voltage of the transformer.

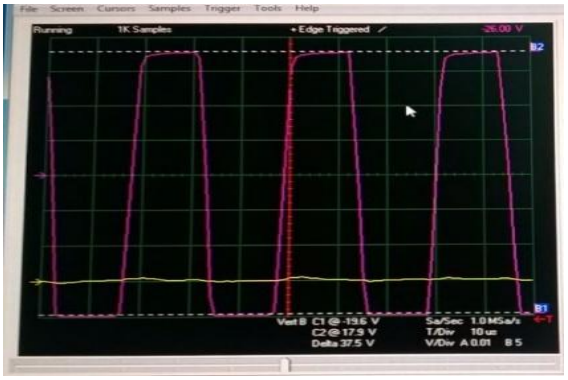

Fig: Voltage waveform of Transformer

C.Transducer :

Transducer is a device which is used to convert physical form of energy into Electrical signals either voltage or current. In our proposed method the output of transformer is connected to the transducer to convert the electrical signal into an Electronic ultra-sonic aquatic sound waves to generate inside the liquid. The transducer consists of an acrylic fibre and LEAD ZIRCONATE TITANATE (PZT) using piezo electric effect & Electronic timer control circuit method, it generates a different frequency based on the time period to produce the longitudinal ultra-sonic aquatic sound waves at constant vibration inside the glass tube to filter the dust particles in the liquid.

Fig a transducer connection

fig b transducer three-dimensional view

D. Properties of ultrasonic waves: -

1. It is an energetic wave.
2. Frequency range from 20KHz to several giga Hertz
3. These waves travel with in a same velocity of light in a given medium.
4. These waves can filter the microscopic plastics particles, small metals etc.
5. These can produce oscillations in low viscosity liquids.
6. The ultrasonic waves are following the same principle of light waves.

E.Characteristics of Acrylic fiber:

1. It is made up of polyacrylonitrile polymer.
2. Acrylic Fiber are the High Performance Fiber.
3. It contain 85% acrylonitrile monomer.
4. it is also called as Synthetic Fiber.
4. It absorbs the sound waves and it doesn't emit the sound waves.
5. It have low elasticity and it have an elongation increases when wet.

F.Characteristic of LEAD ZIRCONATE TITANATE (PZT):

1. PZT develops a voltage (or potential difference) across two of its faces when compressed
2. It is doped either acceptor or donor, because it is not used in pure form.
3. By using a piezo electric principle, it generates a constant frequency of oscillation.
4. This material is placed in the mid of transducer.
5. It can transmit and receive high frequency.
6. High sensitivity for active or passive use.

IV. CONSTANT FREQUENCY GENERATION USING ELECTRONIC TIMER CIRCUIT.

The Transducer produces Electrical signal voltage as the output and it is passed to the Piezo electric material called **LEAD ZIRCONATE TITANATE** (PZT). It receives the input from the transducer, based on the transducer output voltage the Piezo Electric Material (PZT) works on the piezo electric effect and it generates a constant Frequency of oscillations. the generated constant frequency is passed to the Electronic frequency Sweep Technique to generate the Ultra-sonic constant aquatic sound waves inside the liquid inside the glass tube having a large radius.

The generated Ultra-sonic constant aquatic sound waves creates a constant acoustic radiative vibration force with respect to frequency .The liquid present inside the glass tube will starts to oscillate in up and down due to constant acoustic radiation force, Due to this constant vibration it makes the micro dust particles to move towards at anti node i.e. at the bottom layer. The filter liquid will be present in the top layer. This microscopic dust particles have to vibrate and to settle down at specific region of the channel the remaining liquids are allowed to flow through the different outlet of the glass tube.

In our proposed method we constructed the node plane is placed at the center of the channel and creates a two outlet in the glass tube having large diameter. One outlet is used to collect the purified liquid and another outlet is used to collect the dust particles. The modularized device with narrow channel is made of steel and acrylic fiber. The acrylic fiber is used for producing more damping when the ultrasonic aquatic sound waves is passed inside the liquid.

Type	Length(mm)	Weight(g)	Frequency(KHz)	Resonance Impedance (Ω)	Static Capacity (F) ±10 %	Input Power(W)
UCE-UT-13550 PZT-4	54	215	40	10-20	4200	50

Table

Inside the glass tube the fluid consists of many dust particles such as small ceramic particles, bacteria cell and small polystyrene beads, when the ultra-sonic aquatic sound waves varies with respect to frequency in the range of few MHZ to GHZ. The deviation in the frequency will reduces the filter efficiency. In such cases the node plane should be situated at the center of the channel in order to protect the resonance of the frequency

Fig Shows the Hardware connections

. V. ELECTRONIC TIMER CIRCUIT TO GENERATE PERIODICAL FREQUENCY & RESULTS

Due to variation in frequency range in the order of MHZ to GHZ. Either it increases or decreases the aquatic sound vibration inside the liquid. Due to this it decreases the efficiency of the filtration process. And some of the dust particle still present inside the liquid. In order to increase the efficiency of the filtration process we are using an Electronic timer circuit to used to avoid the sudden increase and Decrease in frequency.

VI. FREQUENCY VIBRATION IN LEAD ZIRCONATE TITANATE (PZT) USING TIMER CONTROL CIRCUIT

In our proposed Method we use Electronic timer circuit to generate the particular time period of frequency to filter the dust particles such as (SIC), polystyrene dust particles, lead and small plastic dust particles. In this proposed method the user has to select the time period based on the dust particles. For dust particle such as SIC the time period should be selected as t= '1' and for polystyrene Dust particle time period should t= '3' seconds should be set in timer circuit. So that for the particular time duration it generates the ultrasonic aquatic sound waves with respect to particular frequency, it will produce the vibration inside the liquid and

then it filter the dust particles at the bottom layer of the glass tube.

VII. CONCLUSION

In our above investigation, the ultra-sonic aquatic sound waves generation using frequency sweep technique will to filter the Microscopic dust particles like Sic and polystyrene diluted in liquid with the flow rate of 0.1 ml/min. our proposed filtration method, the frequency range and sweep time period calculated, as t= 1 seconds for SIC Dust particles and t= 3 seconds for Polystyrene particles were determined to filter the dust particles present in liquid. For the liquid flow filtration experiments requires a large microchannel device made of steel and acrylic was manufactured. The proposed method shows the successful results in filtration performance on dust particles present inside the liquid. This method can be practically implemented in operating micro-fluidic devices to filter the impurities present in the liquid.

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