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Development of I.C. Engine Based Fumigation System for Agricultural Application

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Abstract: **The main aim objective of this project is to make use of I.C. engine technology for development of agro product for purpose of fumigation. We also wish to make this product with minimum cost and with high cost effectiveness. This will result in welfare and upliftment of farmer. We believe that with hard work and determination we can make a magnificent project, which will be beneficial for agro society as a whole. We also have faith that with advanced techniques and knowledge we can use this project for various other applications.**

Keywords: **I c engine, fumigation, insecticide, envelope.**

I. INTRODUCTION

The insecticides are sprayed on the plant/crop and this method is called Fumigation. The conventional method of fumigation is to spray a mixture of water and insecticide/pesticide/fungicide on the plant. When the mixture is sprayed on the crop it effect on the digestive of the plant. There is probability that the mixture is sprayed during the day. At that time some of the part of insecticide is drop on soil. During the day water is evaporated. The effectiveness of insecticide also decreases. Also soil quality is decreases. Hence to avoid this we develop a new system. End of outlet tube we provide low heat to diesel its makes fog or envelops. Inside this envelope insecticides drop on the crop. Hence there is probability to waste the insecticide and drop on soil is reduces and it gives more Efficiency also it is helpful to farmer. An attempt is made to develop fog based fumigation system using a I.C. engine technology for better coverage of fumigation area. When this mixture is sprayed on the crop it affects the digestive of the plant. It being hot during the day

The water gets evaporated. The effectiveness of the insecticide also decreases as the day passes. To feel cool the insects generally hide on the beneath of the leaf. The apparatus used for this process consists of an air blower which blows the mixture on the crop. However, this process has a few disadvantages:

- When this mixture is sprayed on the crop, it affects the digestive system of the plant
- If the mixture is sprayed during the day, due to heat of sunlight, the water gets evaporated and the effectiveness of the insecticide decreases as the day progresses.

During day time the insects generally hide below the leaves to protect themselves from direct heat of sunlight. The mixture is normally sprayed on the top. It affects only the digestive system of crop. Hence, it needs to be sprayed multiple times.

I.C Engine is the heart of the fumigation system designed by us. In this system, diesel has been used as carrier for an oil based liquid insecticide/pesticide and is half burnt. Due to half burning of diesel, a fog is produced which has following advantages:

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- A fog pushed by thrust provides better coverage area of fumigation.

In the process of burning, CO2 is evolved and it is utilized by the plant for photosynthesis. When a Mixture of diesel and insecticide/pesticide/fungicide is directed through exhaust pipe around the plant/crop, it creates a mist that suffocates the insects and forces them to come on the upper portion of the leaf for breathing. The diesel being light in weight evaporates fast and insecticide attacks the insects and kills them.

I.C. Engine is the principal part of this fumigation system. Initial cycle starts with pumping action. The mixture of air and gasoline is pumped inside the carburetor. Mixture of Air and fuel then moves towards the primary combustion chamber. By manually activating the spark plug circuit, a spark is ignited and fire ball is produced. The mixture of air and fuel then expands and moves to the secondary combustion chamber After the secondary combustion chamber it passes through the nozzle where there is drop in pressure and increase in velocity. High velocity gases then exit from the nozzle pipe in the form of thrust. Meanwhile diesel mixed with the insecticide, enters the exhaust pipe. Due to 250^0 C temperatures of the exhaust gases, diesel is half burnt and exits in the form of Fog along with the insecticide. The Fog then mixes with the air and diesel gets evaporated. While the insecticide remains on the leaves.

II. EXPERIMENTAL SET UP

Gas continues to exit from the nozzle pipe and partial vacuum is created inside the engine. Due to this partial exhaust gases come back to the combustion chamber. At the same time due to drop in pressure below atmospheric pressure, fresh air and Fuel are inducted inside. Combustion takes place due to temperature of returned exhaust gases. The cycle continues till the fuel is available in the tank. A Reed Valve is preset to the marked position to maintain the constant air and fuel ratio

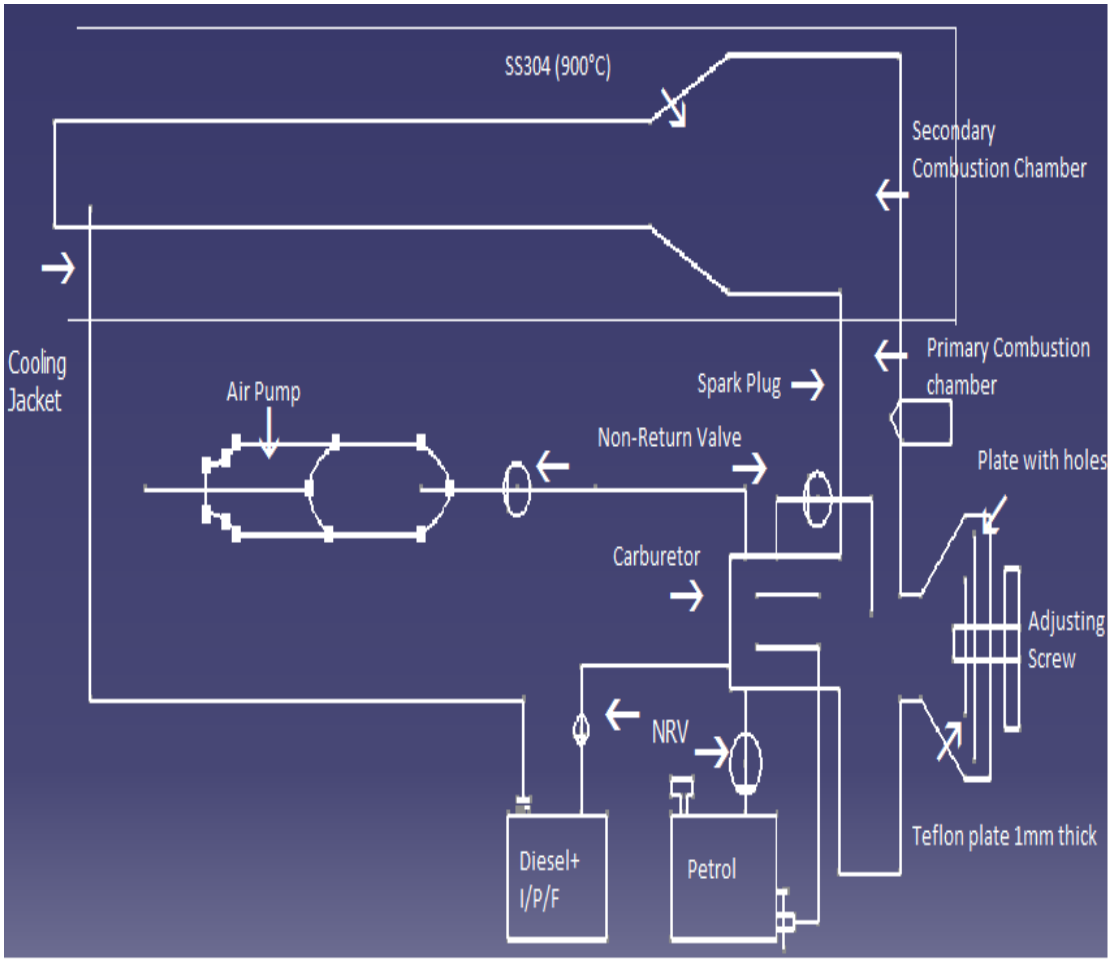

Figure 1: Schematic Representation of Fumigation System

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NRV's are employed to avoid the return flow of air and fuel mixture and also it helps to maintain the pressure. Other assemblies to form a fog will be added to this to form a full fledge fumigation system.

Figure 2 Experimental Set Up

Figure shows a complete assembly of the system, ready for testing at shop floor. Various instruments like pressure gauge, flow meter thermocouple based temperature gauge, equipment are used to measure various parameters of the system.

Major parts of the system are as follows:

- Mist Blower With I.C. Engine
- Pesticide tank where is mixed with the diesel.
- Petrol tank
- Electric Junction Box for initial supply to spark plug.
- Hand pump with red Handle for building the initial pressure for fuel pumping and air supply
- Stand Assembly.
- Duly covered nozzle pipe
- Normally all the heating section is covered with perforated round mesh cover. It is removed to facilitate the measurement of various parameters.

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A) Testing Procedure:

1. Check the readiness of the system for the trials.
2. Put the mask and other PPEs before starting the trial.
3. Pump the system 2-3 times and keep the ignition switch ON. Adjust reed valve gap to adjust the required proportion of mixture of air and fuel. By screwing clock wise the gap can be reduced to make the mixture richer. This results into more development of thrust.
4. Engine may start after 3 -4 attempts, the exhaust gases will start coming out. There will be buzzing noise in the engine.
5. Measure the pressure at the hand pump, primary manifold and secondary manifold at entry and exit of nozzle respectively
6. Measure temperature at various stages of the system with the help of high temperature thermocouple.
7. The requirement of thrust is 12 Kg. Adjust the valve till the pointer shows the reading of 3 meter.
8. Ambient temperature is measured and noted.
9. Thermocouple inserted in combustion chamber is giving digital read out of temperature at that stage, T1 and T2 are measured.
10. P1 and P2 are measured with Mercury Manometer.

III. RESULTS AND DISCUSSION

Following figures are deduced and can be taken for design purpose.

A) Pressure at Hand pump: Normally based on the diameter and stroke the pressure can be calculated analytically. However pressure is checked with putting the press gauge. It is checked for 10 cycle and average maximum value is noted the maximum pressure is found as 4 bar This pressure is mainly developed to create the pressure difference at the carburetor. It will allow pumping the gasoline from the tank.

***B) Pressure and temperature at combustion chamber before nozzle*:** A metered quantity is delivered through carburetor and air is mixed through the fixed Reed valve. The Gap is defined after trial and the predefined Gap is found 0.5 mm. battery operated spark plug ignites the mixture and fire ball develop and will sweep from Primary combustion chamber to the nozzle the pressure before the nozzle is found approx 8 bar. Temperature is measured and approximated to 9000 C

C) Pressure and temperature at combustion chamber after nozzle: At the nozzle there is change in pressure and conversion in to velocity. Pressure is found to be 4.3 bar and temperature variation found to approximated figure of 6000 C after nozzle to 2500 C at the certain distance away from nozzle.

***D) Fog Exhaust* :** Diesel is half burn at 250^0 C, an inlet of mixture of Diesel and insecticide is kept at this position and the exhaust carries the fog of mixture of half burn diesel and insecticide The trial were taken at various atmospheric temperature from 25^0 to 45^0C and results are noted and found satisfactory. There is drop in pressure inside the exhaust pipe. This will bring back some amount of flue gases along with fresh air and next combustion cycle will start.

E) Trials on crops: Field Trials were taken on Cotton, sugarcane; the reach was up to 10 feet. With 1 liter of Gasoline, 4 Liter capacity of Diesel and 200 ml insecticide last for approximately 1hour.

IV. CONCLUSION

The main aim for selection of this project was to make use of I.C.engine technology for development of agro product for purpose of fumigation. We also wish to make this product with minimum cost and effectiveness.

This will result in welfare and upliftment of farmer we believe that with hard work and determination we can make a magnificent project, which will be beneficial for agro society as a whole. We also have faith that with advanced techniques and knowledge we can use this project for various other applications.

Lastly, we want to conclude that efforts put by our team will be responsible for successful completion of the project.

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