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PRODUCED GASES ANALYSIS OF PLASTIC WASTE FORENERGY CONVERSION USING ARDUINO

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Abstract : *Plastic production has been rapidly growing across the world and, at the end of their use, many of the plastic products become waste disposed of in landfills or dispersed, causing serious environmental and health issues. From a sustainability point of view, the conversion of plastic waste to fuels or, better yet,to individual monomers, leads to a much greener waste management compared to landfill disposal. In this project, we systematically review the potential of pyrolysis as an effective thermochemical conversion method for the valorisation of plastic waste. Different pyrolysis types, along with the influence of operating conditions, e.g., catalyst types, temperature, type of gases produced, vapor residence time, and plastic wastetypes, quality, and applications of the cracking plastic products are discussed. The quality of pyrolysis plastic oil, before and after upgrading, is compared to conventional diesel fuel. Plastic oil has a heating value approximately equivalent to that of diesel fuel, i.e., 45 MJ/kg, no sulphur, a very low water and ash content,and an almost neutral pH, making it a promising alternative to conventional petroleum-based fuels. This oil, as-is or after minor modifications, can be readily used in conventional diesel engines.*

I. INTRODUCTION

Plastic products play a critical role in our lives and are being used in large quantities due to their durability, versatility, light weight, and low cost. Plastic waste materials, generated in different sectors of the economy, such as agriculture, residential and commercial, automobiles, construction and demolition, packing materials, toys, and electrical equipment are growing rapidly and are either recycled, combusted (waste incineration), or disposed of . Reportedly, plastic waste is the third largest contributor of municipal solid waste .The global production of plastic has increased, from 1.5 million tons in 1950 to approximately 359 million tons in 2018 and is attributed to a rapid rise in the packaging/wrapping sector. Today, over250 million tons per year are either landfilled or dispersed in the environment and an estimated 10 million tons per yearend up in the oceans. Considering an increase of 9–13% of plastic waste per year, it is predicted that billions of tons of plastic could be produced by 2050, of which the greatest portion could go to landfills or be dispersed, both in the land environment and in the oceans. An increase in daily demand of plastic materials, which are petroleum-based substances,can result in the depletion of non-renewable fossil resources.

In this paper, we systematically review the potential of Waste to electrical energy as an effective thermo-chemical conversion method for the valorizatio of plastic waste and analysing gases produced in waste, data validation and the plotting graph for the same gases.

II. OBJECTIVE

The objective of this Project is to

1. To analyse the gases and data validation and the plotting graph.
2. To find out best plastic composite to be worked as fuel for energy generation

III. COMPONANT DETAILS

3.1 Arduino Nano

ardunio nano

Pin No.	Name	Type	Description
1-2, 5-16	D13	I/O	Digital input/output port 0 to 13
3, 28	RESET	Input	Reset (active low)
4, 29	GND	PWR	Supply ground
17	3V3	Output	+3.3V output (from FTDI)
18	AREF	Input	ADC reference
26	A0	Input	Analog input channel 0 to 7
27	+5V	Output or Input	+5V output (from on-board regulator) or +5V (input from external power supply)
30	VIN	PWR	Supply voltage

3.2 MQ8 Gas Sensor (hydrogen sensor)

MQ 8 gas sensors are a family of sensors which are used to detect a wide variety of gases like alcohol, smoke, methane, LPG, hydrogen, NH3, Benzene, Propane etc. These sensors are made up of electrode which is coated with a sensing material, and it is heated to make it more reactive and sensitive.

3.3Methane Gas Sensor MQ-4

This semiconductor gas sensor detects the presence of methane (CNG) gas at concentrations from 300 ppm to 10,000 ppm, a range suitable for detecting gas leaks.

3.3 MQ-7 GAS SENSOR

The most important fire hazard, from the standpoint of toxicity, is considered to be carbon monoxide (CO), which represents an intermediate stage of oxidation. Carbon monoxide is an almost universal product of combustion. And in any situation in which heat, flame, and smoke are produced, CO is sure to be present. The incomplete or inefficient

combustion of any carbonaceous material will result in greater production of CO than does efficient and complete combustion. Depletion of oxygen in a fire, as well as water and low temperature, will result in the production of increasing amounts of CO as the fire progresses.

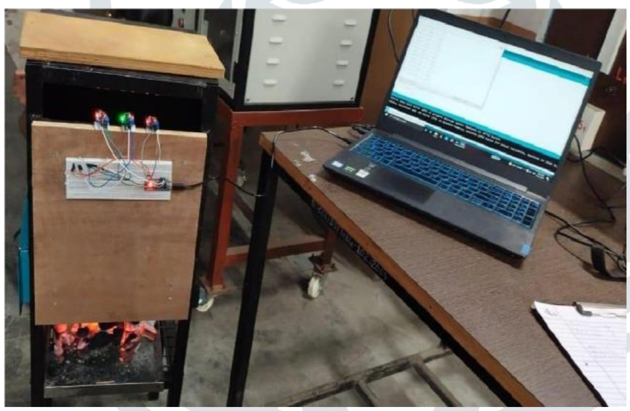
3.4 Serial Monitor

The Serial Monitor is an essential tool when creating projects with Arduino. It can be used as a debugging tool, testing out concepts or to communicate directly with the Arduino board

3.5 Hot Chamber

The small scale Chamber use for combustion of coal and providing heat to the plastic waste

IV. EXPERIMENTAL SETUP



The small pilot scale Chamber has the capability to be used as both a thermal and catalytic pyrolysis, using different feed stocks such as plastic. In this Project, crushed plastic were added in the chamber with the feedstock. As the temperature increases above certain values, the plastic waste (organic polymers) converts into monomers, where these into liquid oiland generates flue gases which is sensing by sensors.

V. WORKING OF PROJECT

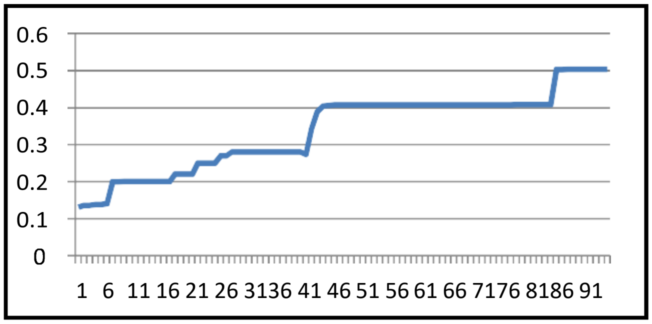
Discussion of the toxicity of the thermal degradation and combustion products of some plastics states that the burning process takes place stages:

1. Destructive distillation of the material occurs, which produces gases whose nature depends on the composition of the plastic.
2. Oxygen unites with free carbon to form CO and a dense smoke usually forms - if sufficient oxygen is present -combining with the flammable gases produced in the first stage.
3. Generated gases is sensed by gas sensors which is mounted at the exhaust.
4. And serial monitor showing the gases generated in ppm.

By using this statistical data we analyse gases generated and plotting graph for the same

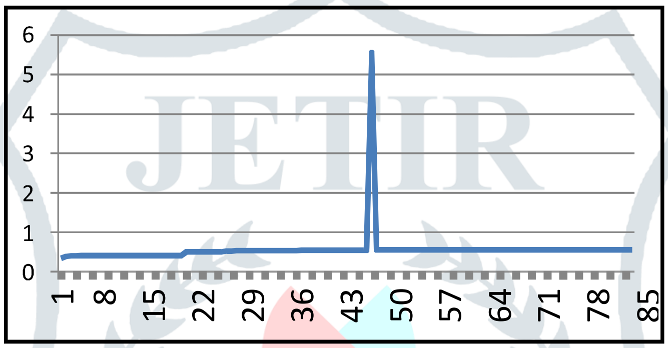
V. RESULT

Having obtained the combustion properties of plastics, it can be concluded that the experimental facilities used are well suited for the broad range of analyses presented here. Valuable information on the burning behavior of plastics was obtained. Hydrogen is extracted from combustion of plastic is about 88% then we can use for making hydrogen fuel cell. Graph for

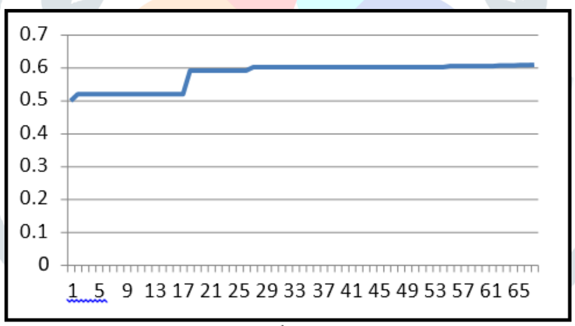


generated gases as follow:

CH4



CO



Hydrogen

VI. APPLICATIONS

1. The liquid oil produced from the catalytic pyrolysis of different types of plastic feedstock has a high number ofaromatic, olefin, and naphthalene compounds that are found in petroleum products.
2. Thus, the pyrolysis liquid oil produced from various plastic wastes has the potential to be used as an alternativesource of energy.
3. The production of electricity is achievable using pyrolysis liquid oil in a diesel engine.
4. The produced aromatic compounds can be used as raw material for polymerization in various chemicalindustries.
5. Used in various energy and transportation applications after further treatment and refining.

VII. CONCLUSION

This Project is a step toward developing plastic waste based Fuels which can produce Electricity. It have a great potential to convert waste into energy and other valuable products and could help to achieve circular economies. However, there are many technical, operational, and socio-economic challenges, that we analysed in order to achieve the maximum economic and environmental benefits of such fuel from the plastic waste. Therefore, it has the potential to be used in various energy and transportation applications after further treatment and refining.

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