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Pyrolysis of LDPE Plastics for Producing Fuels

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ABSTRACT:

A wide range of methods are used for preparation of fuels from LDPE plastic materials. There are different catalysts used for pyrolysis process. By this process we are going to know how the plastics are converted into fuels and what are their advantages against normal fuels. The pollution caused from plastic fuels will be less than the normal fuels. This can also be eco friendly because the plastic waste is going to be recycled. The products obtained from this process are of classified by various physical and chemical tests.

INTRODUCTION:

For reducing the pollution coming from normal fuels, we are using fuels that are obtained from plastic materials by using pyrolysis process. In this we are going to study about pyrolysis of LDPE plastic material for producing fuels. There are many types of pyrolysis processes for preparing fuels from LDPE plastic. we can also improve the bio-quality of the fuel by this pyrolysis process. The processes we are going to see for pyrolysis of the LDPE plastics are: 1) catalytic pyrolysis of LDPE 2) comparative pyrolysis of LDPE 3) pyrolysis using TGA and ANN prediction 6) By varying activization 7) computer aided modelling 8) fluidized bed pyrolysis 8) By using synthetic catalysts 9) Fast co pyrolysis method 10) deoxygenations and denitrification. The pollution caused by the fuel from pyrolysis of LDPE for plastic material is less then the pollution caused due to the normal fuels.

By using catalytic pyrolysis method:

The temperature required for pyrolysis process is almost 500 ^{0}C to 900^{0}C. due to this thermal degradation and catalytic degradation occurs. We can overcome to this problem by Catalytic pyrolysis method. Suitable catalyst is used to control the yield of product and distribution of the product and this will reduce the temperature of this reaction. The materials used for this process are shopping bags, and plastics of LDPE. The decomposition will be a single step process. The catalysts used in this process are CaC_2, MgO, mixture of SiO_2 and Al_2O_3.

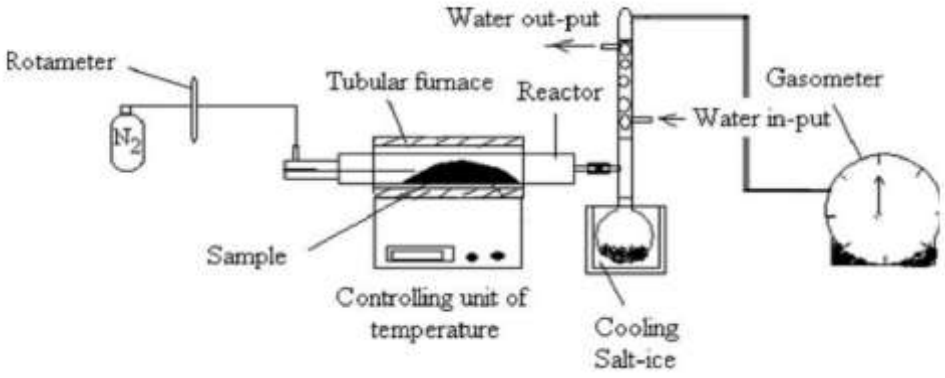
The CaC_2 was the best catalyst used for conversion of LDPE plastic into fuel. This was a physical test. The test results are compared with kerosene and Diesel oil.

The catalytic process of the LDPE produces mixture of alkanes, alkenes, carbonyl group containing. This helps in reduction of waste problem.

Comparative pyrolysis of LDPE:

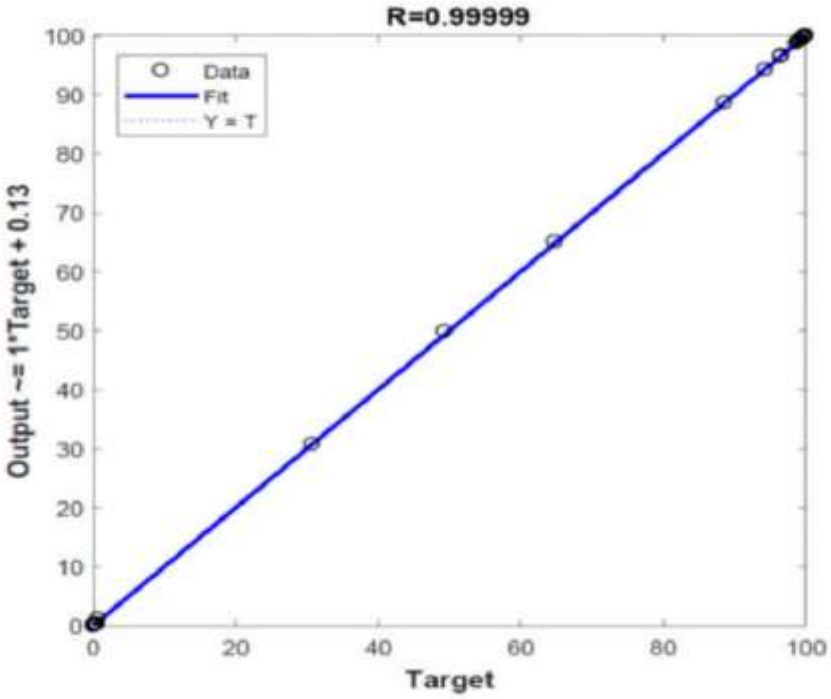
In this process a tubular reactor will be used. The experiment was conducted in an inert atmosphere. The temperature used in this product lies between 673k-973k. This method forms a free radicals. They are responsible for low molecular weight gases. The gas will be generated at low temperature. This produces tar. This will form C1+C2, C4, C6+C7.

Tubular reactor:



By using TGA DATA and ANN prediction:

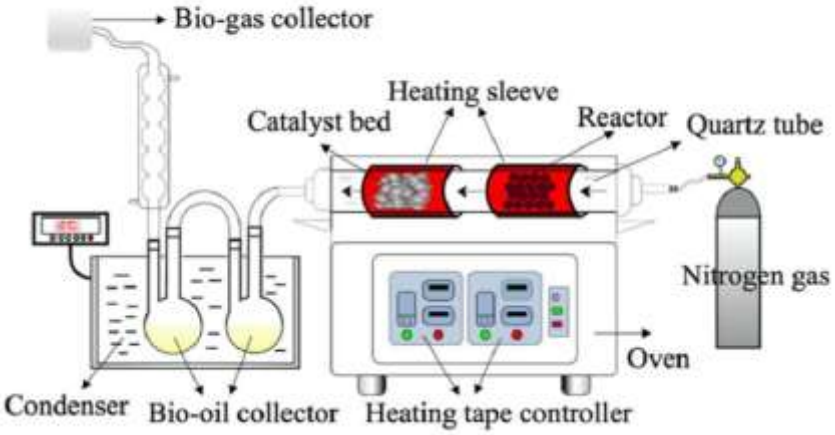
TGA means thermogravimetric analysis and ANN means artificial neural network. They are used to investigate and predict the kinetic parameters of LDPE plastic. The TGA data will confirms about one reaction region which is a first ordered straight line. ANN model is used to predict thermal decomposition of LDPE.



Liner regression of the tested ANN data

Effect of varying activation and pyrolysis parameters:

Activated carbons are used as catalysts in converting LDPE into valuable fuels. The effects of structure characters and operating conditions on reaction of LDPE is not well interpreted. The catalyst used in this process is chestnut shell (CNSACC). The ex-situ pyrolysis was conducted for producing jet fuels. Hydrogen in bio-gas is also achieved.



Ex-situ catalytic pyrolysis process

Computer aided modelling method:

Aspen HYSYS wanted to develop a computational steady state model for simulation of LDPE for pyrolysis process. The temperature is about 450 ^{0}C. In this method 92% yield was obtained. The conversion temperature will have a good relationship with simulation. This was continuously stirred by tank reactor. This will give a good yield of liquid product.

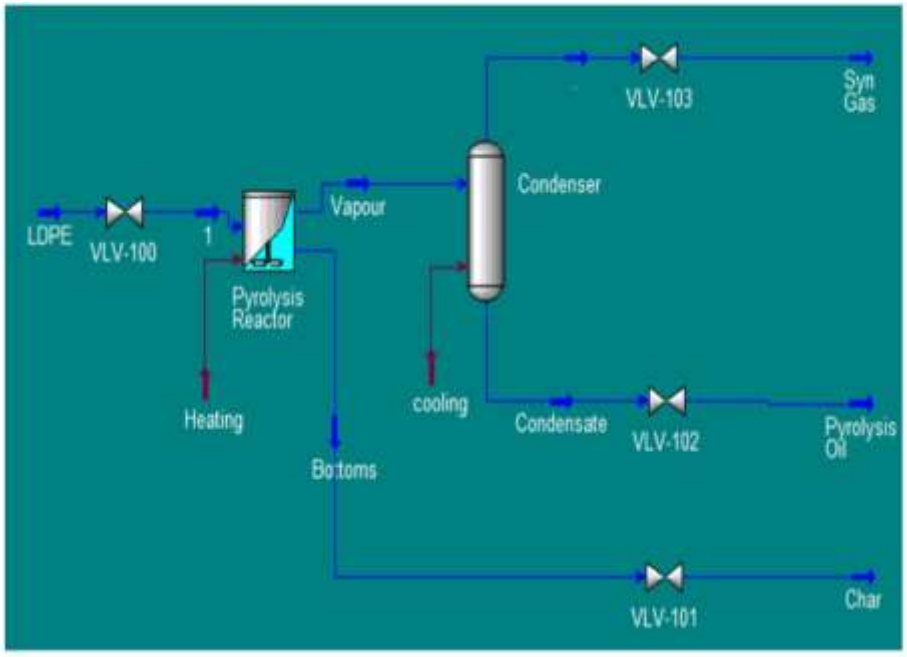
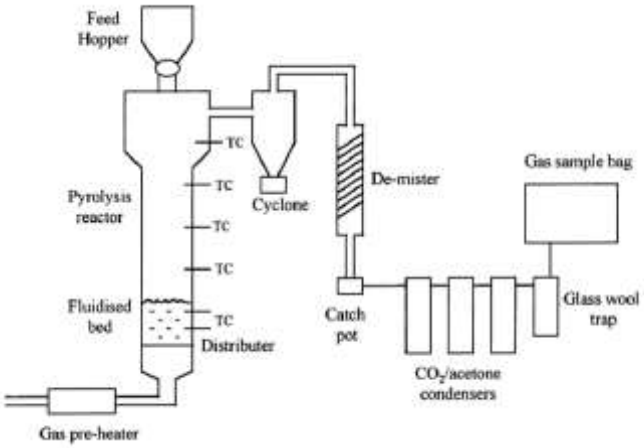


Diagram of steady state simulation

Fluidised bed pyrolysis:

In this method a reactor called fluidized bed pyrolysis reactor was used to produce petrochemical feedstock. It is used to make virgin plastics and redefined fuels. The gases produced in this process are hydrogen, methane, ethane, ethene. If the temperature in this process increases then the yield will also increases. In this process oil and wax also derived. The oil and wax are recycled in petrochemical industries as feedstock. They produce new type of plastic for redefined fuels.



Fluidized bed pyrolysis reactor

Pyrolysis of LDPE by synthetic catalysts derived from fly ash:

The catalysts used in this process are zeolites. Zeolites are three dimensional crystalline solids of aluminum silicate. The pollutants caused by zeolites are oxides of sodium, oxides of nitrogen and hydrocarbons. The weight ratio of NaOH and fly ash is 1:2. The activation time of this catalyst is 8 hours. It is a good catalyst for recycling of old plastics.

Fly ash

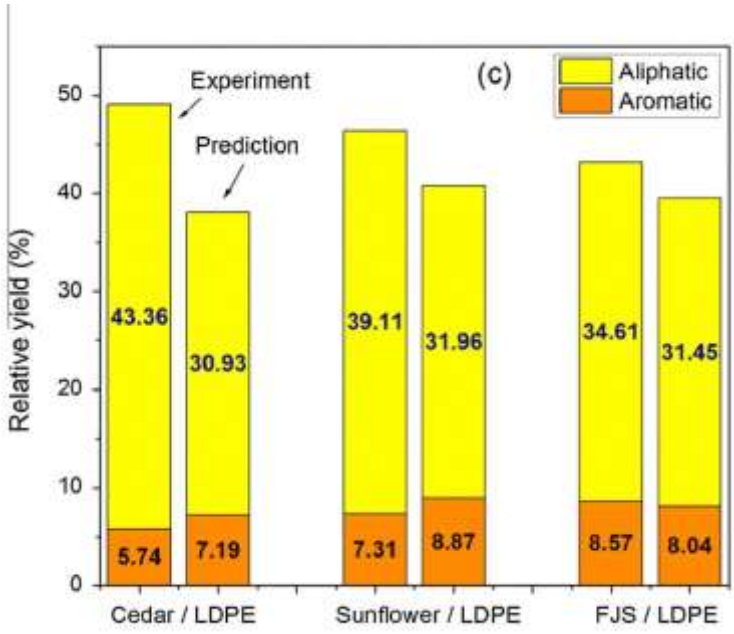
Synergies during devolatilization and condensation:

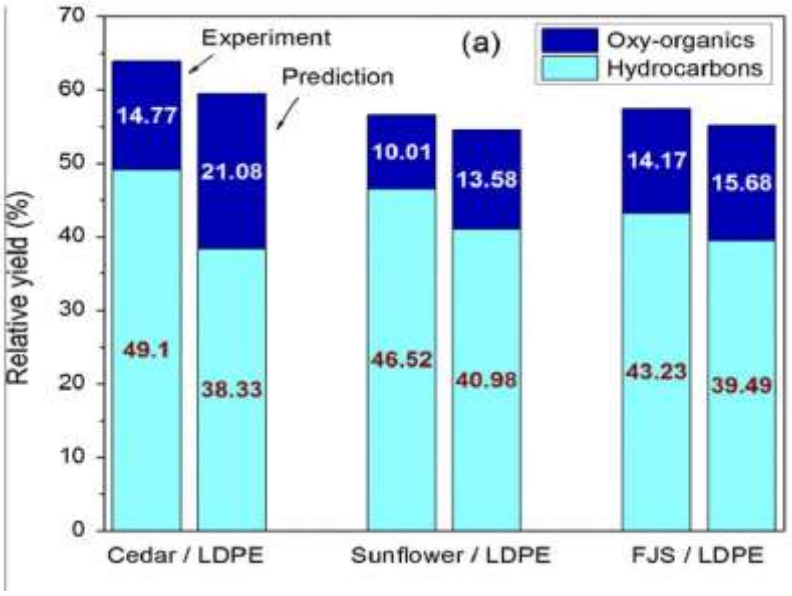
During pyrolysis of LDPE the synergies effect was observed. The components are municipal solid wastes. They are investigated at milligram and gram scale. By mixing of LDPE and cellulose the yield percentage will be increased. They were prepared at a temperature of the catalyst used in this process. During devolotilization gas-gas and solid-gas interactions could be identified and during condensation liquid-gas and liquid-liquid interactions are identified.

Fast co-pyrolysis for oil and biomass production:

This was performed in a drop-down tube reactor. Cedar wood, sunflower stalk and FJS are used for the investigation of relative yield and the quality of oil. The relative yield will be obtained at 600 ^{0}C. They improve hydrocarbon content. They will also upgrade the oil quality.

The graph represents the relative yield percentage of the above products.





Co-pyrolysis of LDPE for deoxygenati and denitrification:

N and O behavior was studied for this process. The interactions of products are always depends on the components of algae. The rich lipids will increase the N yield. Lipids and carbohydrates release N containing gas.

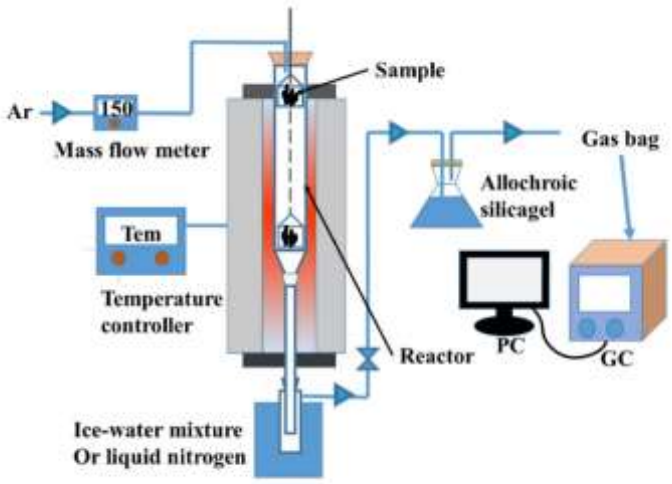


Fig. 1. The experimental system of co-pyrolysis of algae and LDPE.

Conclusion:

A wide range of LDPE plastics are used for recycling purpose. The pyrolysis also helps in recycling the plastic by converting them into fuels which give less pollution than diesel and petrol. There are many processing techniques for the pyrolysis of LDPE. The test results showed that the plastic fuels give less pollution. They reduce pollution. Due to this pyrolysis of LDPE a large amount of LDPE plastic is reused and recovered. This is eco friendly process. The temperature required for this process is also very low as compared to the petroleum fuels. The reaction process needs different types of catalysts according to the process which is used.

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