ELIMINATION OF ORGANOSULFUR COMPOUNDS FROM MODEL FUELS WITH BIOLOGICAL WASTES: TACKLING THE ACID RAIN

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Introduction

The purpose of this research is to investigate the most important parameters that maximizes the uptake of organosulfur compound, Dibenzothiophene (DBT), from model fuels using lime, pineapple and orange peels as adsorbents, to prevent the problem of acid rain as a result of SOx emission from the fuels.

Methods and Materials

Preparation of Adsorbents

Orange peels(OR), pineapple peels(PN) and lime peels(LM) gotten from fresh ripe fruits were washed and dried in the oven at a temperature below 60°C. The peels were grinded and rinsed with deionized water to eliminate impurities. The final adsorbents were dried and stored for the adsorption experiment.

Synthetic Fuel and Solution

Hexadecane was used as the synthetic gasoline, and a 1:1 mixture of decane and hexadecane was used for diesel. All solvents used had a purity of 99% or above.

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Adsorption Experiments

- ❖ Batch experiments involvind adsorption of DBT by the fruit peels were carried out in duplicate at room temperature in an orbital shaker.
- ❖ To maximize uptake of DBT, different parameters such as adsorbent mass and DBT concentration were changed.
- ❖ Fuels were purified by pumping them through columns containing fruit peels.

Analysis of Data

The amount of DBT adsorbed by the adsorbents was expressed as Adsorption Percentage (%ADS) and calculated as shown in Equation:

$$\%(ADS) = (Ci - Cf / Ci) * 100$$

Where Ci and Cf are initial and final concentrations of DBT expressed in mg/L in the solution.

Results

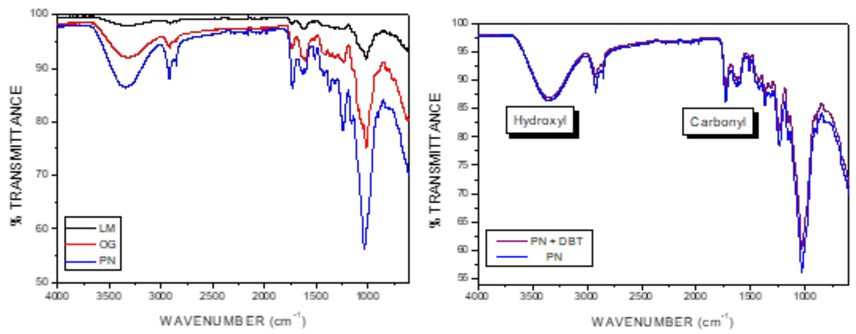

Figure 1: FTIR spectra of the adsorbents used in this project (left) and the comparison before and after the adsorption of DBT onto PN.

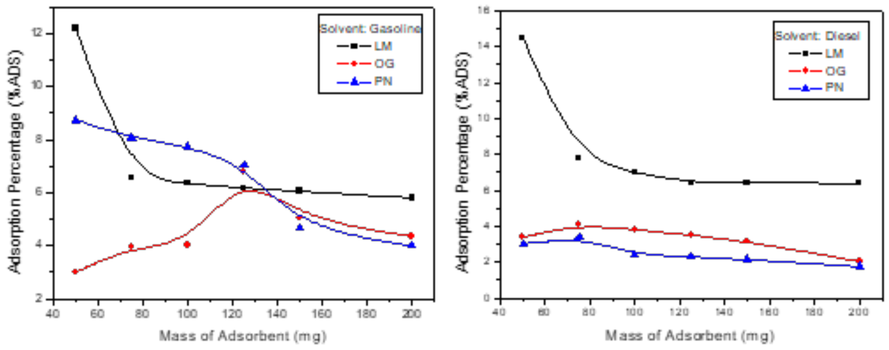

Figure 2: Effect of the mass of adsorbent on the adsorption of DBT in gasoline (left) and diesel (right) fuels.

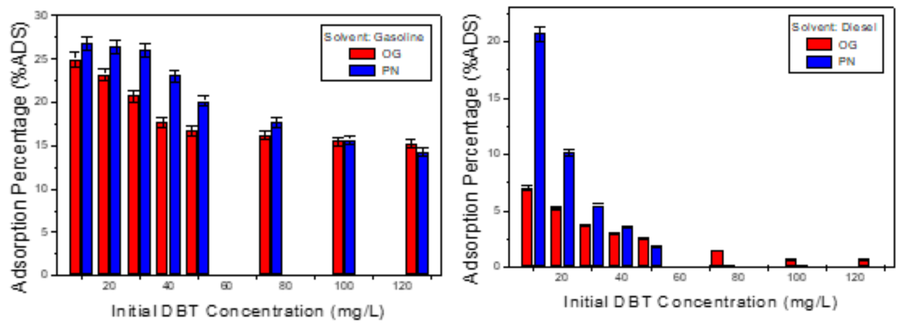

Figure 3: Effect of the initial DBT concentration on the adsorption of DBT in gasoline (left) and diesel (right) fuels.

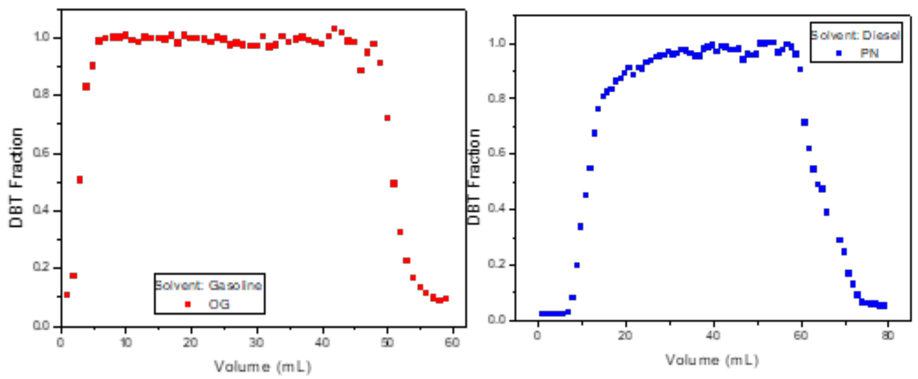

Figure 4: Continuous-flow experiments for the removal of DBT with OG in gasoline (left) and PN in diesel (right).

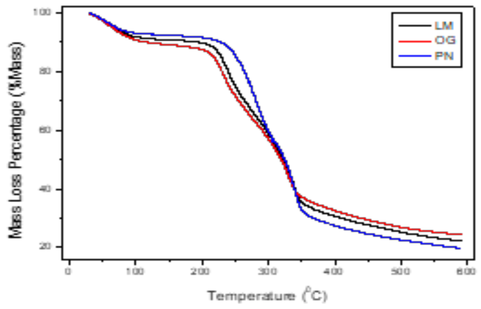

Figure 5: TGA plots of the adsorbents used in the removal of DBT.

Conclusions

- ➢ The research demonstrates that fruit peels can be potentially utilized as adsorbents of dibenzothiophene (DBT).
- ➢ Batch experiment demostrate that LM has a higher affinity towards DBT in both fuels.
- ➢ Continuous-flow experiments indicate the potential of these adsorbents as filtration devices in industrial application.
- ➢ The versatility of biological wastes such as fruit peels as adsorbent of organosulfur compounds opens door to low cost purification

References

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Acknowledgements

The Cuny Research Scholars Program and Science Department are greatly acknowledged for the provision of instruments and resources to the success of this research.