The Clean Superpower: How Dimethyl Ether is Produced from Methanol

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Introduction

- Diesel gas produces large greenhouse gas emissions that harm the environment, and this experiment produces a cleaner alternative that does not affect the environment
- Dimethyl Ether (DME) is a clean alternative for diesel made through a chemical reaction with methanol and makes a byproduct of Methylal
- Methylal is suspected to aid in the production of DME and being a clean alternative for gas

Objective

What is DME and why is it better for the environment than diesel gas

Methods

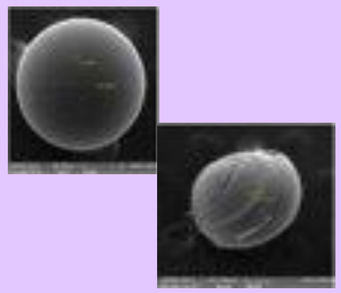
- We put 4 different chemical stimulants called catalysts into our methanol reactor along with pure methanol to see which one produced the most DME
- The product of the reactor was injected into vials by the Opentrons robot connected to the reactor and the vials were put into a gas chromatographer
- The gas chromatographer is a machine that measures the amount of DME in the vials to produce results that tell us which catalysts made the most DME filled vials (and Methylal)

Controlled Variables:

- Temperature (135 C)
- Pressure (130 psi)
- Methanol flow (0.22mL/min)
- Vial size (20 mL)
- Run time (5 hrs, 50 min intervals)

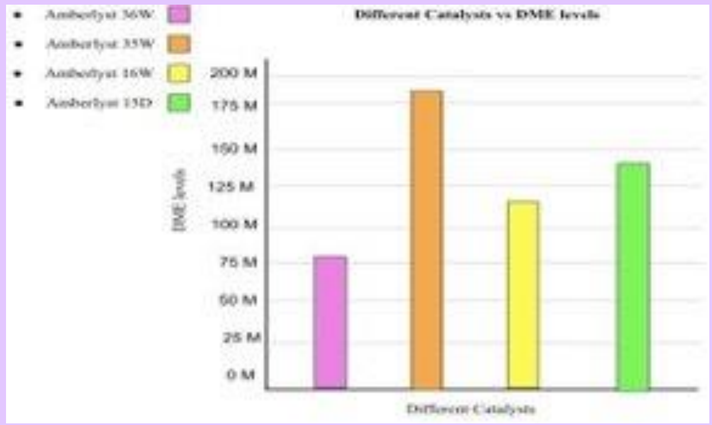
Manipulated Variable:

- Catalyst type

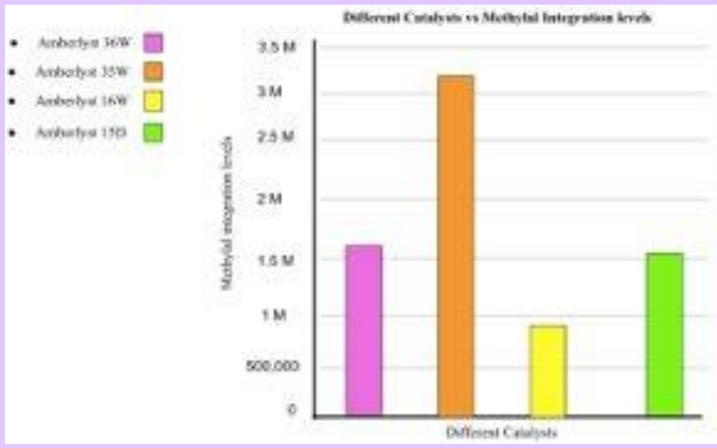


- ***Figure 1 (top left). One of the catalysts before dehydration***
- ***Figure 2 (bottom right). The same catalyst after dehydration***

Results



- ***Figure 3. Integration levels of DME produced from each of the catalysts after 4 runs through the methanol reactor. There are 7 vials for each catalyst and each of their results were averaged out***



- ***Figure 4. Integrations levels of Methylal produced from each catalyst after 4 runs through the methanol reactor. There are 7 vials for each catalyst and each of the results were averaged out***

Conclusions

- We concluded that the catalyst A 35W was the most efficient because it not only produced the largest amounts of DME but also methylal
- catalyst A 36W was the least efficient because It produced the least amount of DME
- Because A 35W produced the most DME it will be used as a catalyst in another methanol reactor on a larger scale
- Further inquiry into Methylal and how it can also be used is another possibility for this experiment
- By doing this on a larger scale, we can reduce greenhouse gas emissions
- The reason why DME is better for the environment is because its chemical structure does not have carbon to carbon bonds meaning it does not produce carbon dioxide when burned!

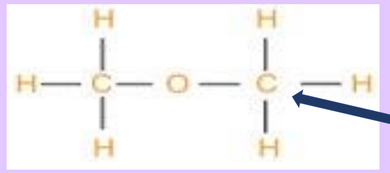


Figure 5. Chemical structure of DME

NO CARBON BONDS!

Citations

NAIT. (2022). DME-Methylal Ratios - 4 Run Averages(E. Nokes & D. Dar, Eds.) [Review of DME-Methylal Ratios – 4 Run Averages].

Acknowledgments

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