Chemical Signatures of Environmental Change: Unraveling Nature's Responses

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ABSTRACT

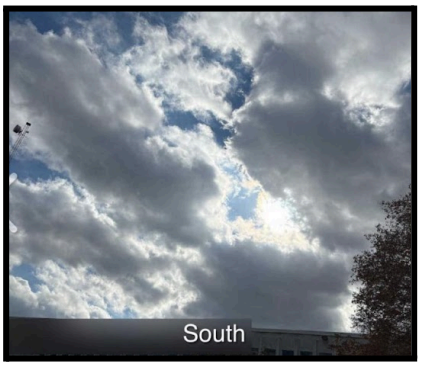
This paper will demonstrate the relationship between nature and chemistry, including how chemistry shapes the natural world surrounding us. By blending comprehension from nature and chemistry, we reveal the hidden connections that undergo climate change, seasonal variation, and cloud formation. Furthermore, we will understand how chemistry causes changes occurring on Earth. By working together, we can address the environmental challenges and create a healthier planet for the future.

1. Introduction

Nature and chemistry work together to shape our world, creating the beautiful scenery we see and the phenomena we experience. From the changing colors of leaves to the formation of clouds, science helps us understand the complexity of our environment. By exploring this relationship, we discover how chemistry influences nature and why it's crucial for protecting our planet's health

2. Materials and Methods

In October at Melvindale High School, we checked out the changing leaf colors and dived into clouds using the Globe Observer App. Our October 4, 12, and 27 notes covered things like wind, temperature, and cloud shapes. Using the Globe Observer App, we identified different cloud formations. During observations, it was around 76 degrees Fahrenheit with 68% humidity, suggesting mostly clear skies (10-25% cloud cover) and a light blue sky with hazy visibility. As the month progressed, it got cooler due to clouds near the ground blocking sunlight, forming strato cumulus clouds. Despite an expected temperature drop, it rose to 78 degrees Fahrenheit later, revealing cirro stratus clouds – a surprise due to climate change. Using Globe Observer, we pinpointed these cloud types, uncovering the secrets of weather.



3. Data Summary and Analysis

Throughout the examination of the variation of seasons, we witnessed that the leaves started changing color around October. We identified some of the chemicals in them such as carbon, oxygen, nitrogen, and hydrogen. We discovered that chlorophyll production decreases and finally disappears when night extends in the fall, and all of the chlorophyll becomes destroyed. It was the time that the leaf's carotenoids and these compounds revealed their vibrant colors. Some of the vibrant colors that we observed are green, vibrant red, orange, yellow, and purple. By the end of October, the leaves have almost completely fallen out of the trees, and are in very vibrant colors. During the first two months of the year 2024, we noticed that trees started to leaf early this year due to climate change. To examine and identify the leaves from October to this day, we used Globe Observer as our tool to help us during the observation.

During our observations, we heard many sounds, including the hum of airplanes, the chirping of crickets, the rustling of trees, and the wind blowing. The scent of dirt and wet grass mingled with the faint scent of rain. In Michigan, the weather has been fluctuating due to climate change. While there may still be colder temperatures with highs in the range of 40 to 50°F, there are also periods of warmer weather and more extreme fluctuations. These temperature changes can lead to unpredictable weather patterns, including cold snaps and heat waves. Additionally, changing precipitation patterns may result in heavy rainfall and flooding events.

Furthermore, climate change can make El Niño events often happen by warming oceans. Due to climate change, the chemistry of the oceans also changes. This interferes with the movement of El Niño events. For example, they could become stronger or weaker. Besides, El Niño can bring difficulty to the weather globally, and climate change makes this even more chaotic. Overall, Michigan is experiencing a mix of weather extremes, from colder temperatures to occasional warmer weather. To observe weather changes, we used Globe Observer and The Weather Channel to aid in our observations.

4. Results, Conclusions, and Discussion

We observed that the greenhouse effect happens when certain gasses in the air, like carbon dioxide, trap heat from the Earth, keeping it warm. But because of things people do, like burning fossil fuels, there's more carbon dioxide in the air than before, causing global warming. In 2023, it was the hottest year ever, with the United States having extreme temperatures. Let's look into how the extra carbon dioxide affected temperatures in the U.S. during that year. In the United States, most of the CO2 pollution comes from burning things like coal, oil, and gas for things like powering our homes, driving cars, and running factories. A report by NOAA says that in 2023, the world released the highest amount of CO2 from burning fossil fuels, at 36.8 billion tons. That caused the amount of CO2 in the air to reach 419.2 parts per million, which is 51% more than what it was before the widespread burning of fossil fuels started. This extra CO2 acts like a blanket around Earth, trapping more heat and slowly making the temperature rise to be warmer.

Scientists from NASA states, "Summer of 2023 was Earth's hottest since global records began in 1880," It was much hotter than usual, with temperatures averaging 2.4 degrees Fahrenheit (or 1.3 degrees Celsius) higher than what we typically saw in the 1900s. The hot temperatures in 2023 brought real problems for many people and places. Hotter and drier conditions fueled wildfires that damaged property and made the air harder to breathe in the West. Changing weather patterns also brought droughts to some regions and floods to others, hurting farms and making it harder to get water, and rising sea levels threatened coastal communities with even more flooding.

Our investigation showed how nature and science work together to create things like colorful fall leaves and different cloud formations. We saw how the changing colors of leaves are linked to chemicals inside them, and how an app helped us track these changes.

We also learned about climate change and how it affects the Earth in many ways. We noticed trees starting to grow leaves earlier this year, and the weather in Michigan has been unpredictable with both cold and warm spells.

We discovered that burning things like coal and oil releases gasses that trap heat around the Earth, making it warmer. This "greenhouse effect" is why 2023 was the hottest year ever recorded, causing problems like wildfires, droughts, and floods.

So, by understanding how nature and science work together, we can see the real effects of climate change and work towards making our planet healthier for everyone.

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