Chicken Feathers: The Future of Metal Recovery From Waste Water

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Introduction

- Access to clean water is essential to all living creatures. According to the World Health Organization around one million people die each year from diarrhoea due to unsafe drinking water. (1)
- Within the oil and gas industry, metals such as zinc, copper and lithium are found in oil sands processed-affected water(OSPW), a byproduct of the oil and gas mining, by reclaiming these metals, we could use it for other applications.(2)
- This project uses modified keratin from a waste product(chicken feathers) to reabsorb these inorganic materials as it is sustainable, accessible and cheaper than other sorption methods.(3)
- Different percentages of the crosslinking agent (5% and 7%) was added and the modified keratin's chemical structure was analyzed.

Methods

- The chicken feather was first dissolved and reduced with the use of sodium sulfite, tris-base, Ethylenediaminetetraacetic acid, and urea. A base solution was also added. It was heated and stirred in the hot plate, then was centrifuged.
- After, a crosslinking agent and a polymer was added to modify the keratin in order to better the keratin's absorption of metals. It was heated and stirred in the hot plate, then was centrifuged.
- The keratin then is further purified through osmosis with the use of a dialysis tubing and dried in a vacuum.
- Lastly, the keratin grinded to a powder and was tested using the Fourier Transform Infrared Spectroscopy (FTIR) and Thermogravimetric analysis(TGA).

Figure 1.0 Dissolution of CFK

Figure 1.1 CFK with crosslinking agent and polymer

Figure 1.3 CFK solution in a dialysis tubing to be filtered.

Figure 1.4 Dried keratin solution with the use of a vacuum. Solution with 7% (right) and 5% (left) crosslinking agent.

Figure 1.4 Powder of dried solutions 7% (right) and 5% (left)

Results

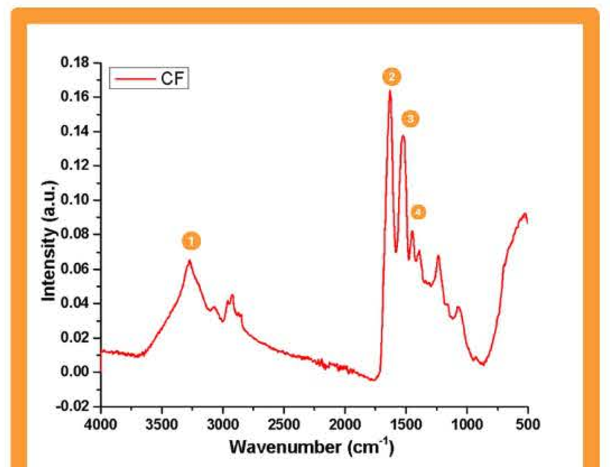

Figure 2.1 Graph of the original chicken feather on the FTIR.

Graph 1
- Point 1 peaks at and intensity of ≈0.0650
- Point 2 peaks at an intensity of ≈0.1650
- Point 3 peaks at an intensity of ≈0.1375
- Point 4 peaks at an intensity of ≈0.0825

Graph 2
- Point 1 peaks at and intensity of ≈0.0165
- Point 2 peaks at an intensity of ≈0.0475
- Point 3 peaks at an intensity of ≈0.0358
- Point 4 peaks at an intensity of ≈0.0260

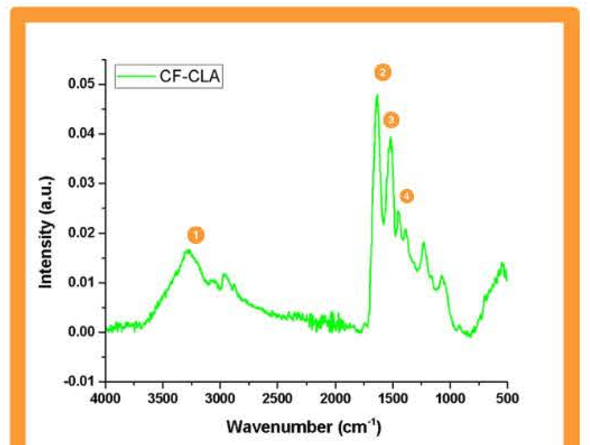

Figure 2.2 Graph of the modified keratin on the FTIR.

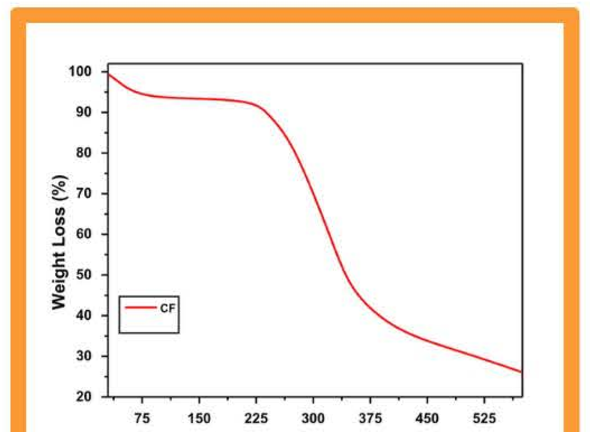

Figure 2.3 Graph of the chicken feather on the TGA.

Graph-TGA
- This test is used to figure out the thermal capacity of a material in this case chicken feather.
- Due to time constraints we were unable to test our samples of modified keratin using this method.

Discussion

- Through the FTIR test we are able to analyze the change within the intensity of the wavelengths which indicates that the keratin was modified.
- All 4 peaks(modified keratin)greatly reduced at an average of 72% compared to the peaks of the chicken feather.
- Although the FTIR test signifies a chemical change within the keratin, this does not conclude that the keratin can absorb inorganic materials within OSPW.
- Because our project only focuses on the first part in creating a biosorbent(modifying keratin), further research would need to be done in order to create a solution that can absorb metals from waste water.
- Later on, with the addition of acid, these metals can be reclaimed from the absorbed products based on past research. (4)

References

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