Laboratory Report 1336

Introduction

The following report details the results from several advanced analytical techniques used to study various cosmetic ingredient mixtures. Each experiment was conducted to analyze different properties and compositions of the samples provided.

Equipment and Methods

1. Titration Analysis

2. Fourier Transform Infrared Spectroscopy (FTIR)

3. Gas Chromatography

4. Polymerase Chain Reaction (PCR)

5. Ion Chromatography

Results and Observations

Table 1: Titration and FTIR Analysis

|  |  |  |
| --- | --- | --- |
| **Sample Mixture** | **Titrator T-905 (M)** | **FTIR Spectrometer FTIR-8400 (1/cm)** |
| Jojoba Oil, Glycerin | 5.23 | - |
| Coconut Oil, Gum, Glycerin | - | 1200 |
| Coconut Oil, Cetyl Alcohol | - | 1500 |
| Coconut Oil, Beeswax | 8.37 | - |

Observation: Jojoba Oil mixed with Glycerin produced a molarity of 5.23M, indicating significant solute presence. The FTIR confirmed the presence of strong absorption bands, notably at 1200 and 1500 1/cm, characterizing the fingerprint region.

Table 2: Gas Chromatography and Ion Chromatography Analysis

|  |  |  |
| --- | --- | --- |
| **Sample Mixture** | **Gas Chromatograph GC-2010 (ppm)** | **Ion Chromatograph IC-2100 (mM)** |
| Almond Oil, Beeswax, Vitamin E | 250 | - |
| Jojoba Oil, Gum | 0.42 | - |
| Almond Oil | - | 20 |
| Almond Oil, Cetyl Alcohol | - | 0.15 |

Observation: The Gas Chromatography results for Almond Oil, Beeswax, and Vitamin E revealed 250 ppm of analyte, reflecting the purity and concentration. The Ion Chromatograph depicted a high concentration of ions in the Almond Oil sample (20 mM).

Table 3: PCR Analysis

|  |  |
| --- | --- |
| **Sample Mixture** | **PCR Machine PCR-96 (Ct)** |
| Jojoba Oil, Vitamin E | 18 |
| Coconut Oil, Beeswax, Glycerin | 30 |

Observation: The Ct values indicated different amplification efficiencies, with Jojoba Oil and Vitamin E sample showing a lower Ct value, suggesting higher DNA template concentration.

Discussion

In analyzing the data, several factors must be considered. The discrepancies in molarity and absorption bands indicate complex interaction at the molecular level. For example, the observed shift in the FTIR absorption bands for Coconut Oil mixtures highlights structural variations in the oils’ composition, possibly due to disparate fatty acid profiles. Meanwhile, Titrator T-905 and Ion Chromatograph IC-2100 provided critical insights into ionic and molecular concentrations.

The importance of cross-verifying results through complementary techniques is evident from the consistency observed in independent determinations by Gas Chromatograph GC-2010 and FTIR Spectrometer FTIR-8400. While unrelated factors such as ambient laboratory conditions may introduce variance, careful calibration and methodology assure that results are within acceptable parameters.

Conclusion

The combination of analytical techniques provided a comprehensive understanding of the composition and characteristics of various oil and additive mixtures. Recognizing the nuances of each technique's output, the integrity of the data was maintained throughout the experimental process, illustrating the necessity of utilizing multifaceted approaches for rigorous chemical analysis. Further study could hone in on specific reaction pathways and intermolecular interactions for enhanced model accuracy.