Lab Report: Complex Mixture Analysis

Introduction

In this report, we explore the characterization of various oil-based mixtures using a series of advanced analytical techniques. These mixtures are analyzed to evaluate their chemical properties, stability, and potential applications in various industries. Each mixture consists of a unique combination of oils and additives, providing diverse challenges and insights during analysis.

Methodology

The instruments used in this study include the Centrifuge X100, FTIR Spectrometer FTIR-8400, Mass Spectrometer MS-20, Titrator T-905, UV-Vis Spectrophotometer UV-2600, and Viscometer VS-300. Each instrument provides complementary data that, when combined, offers a holistic view of the sample characteristics.

Sample Mixtures

Observations and Measurements

Centrifugation Analysis

The initial analysis involved the separation of components using the Centrifuge X100. The results were as follows:

|  |  |
| --- | --- |
| **Sample ID** | **Centrifuge Speed (RPM)** |
| Almond Oil, Gum | 13500 |
| Almond Oil, Glycerin | 14500 |
| Almond Oil, Beeswax, Glycerin | 15000 |
| Jojoba Oil, Cetyl Alcohol, Vitamin E | 12000 |
| Coconut Oil, Vitamin E | 11000 |

The centrifuge operation ensured uniform separation of complex phases.

FTIR Spectroscopy

Spectral data was obtained using the FTIR-8400, capturing the molecular vibrations and enabling characterization of functional groups:

|  |  |
| --- | --- |
| **Sample ID** | **FTIR Peak (1/cm)** |
| Almond Oil, Gum | 3500 |
| Almond Oil, Glycerin | 3200 |
| Almond Oil, Beeswax, Glycerin | 3750 |
| Jojoba Oil, Cetyl Alcohol, Vitamin E | 4000 |
| Coconut Oil, Vitamin E | 2500 |

These peaks correlate to specific bond vibrations, allowing identification of key components.

Mass Spectrometry

The MS-20 provided essential ion mass characteristics, crucial for determining molecular weights and structural information:

|  |  |
| --- | --- |
| **Sample ID** | **Mass-to-Charge (m/z)** |
| Almond Oil, Gum | 1500 |
| Almond Oil, Glycerin | 1800 |
| Almond Oil, Beeswax, Glycerin | 1950 |
| Jojoba Oil, Cetyl Alcohol, Vitamin E | 1000 |
| Coconut Oil, Vitamin E | 1600 |

Ion fragmentation patterns revealed complex interrelationships between components.

Titration and UV-Vis Spectroscopy

Chemical reactivity was assessed via titration using the T-905, and absorption properties were evaluated by the UV-Vis Spectrophotometer:

|  |  |  |
| --- | --- | --- |
| **Sample ID** | **Titration (M)** | **Absorbance (Abs)** |
| Almond Oil, Gum | 5.5 | 1.8 |
| Almond Oil, Glycerin | 6.75 | 2.2 |
| Almond Oil, Beeswax, Glycerin | 7.8 | 3.0 |
| Jojoba Oil, Cetyl Alcohol, Vitamin E | 9.0 | 3.5 |
| Coconut Oil, Vitamin E | 3.5 | 2.0 |

The titration results offer insight into the acidity, while UV absorption underscores the mixture's potential reactivity to light exposure.

Viscosity Analysis

The viscosity of select mixtures was measured using the VS-300, providing insights into the flow characteristics of the formulations:

|  |  |
| --- | --- |
| **Sample ID** | **Viscosity (cP)** |
| Coconut Oil, Cetyl Alcohol, Glycerin | 5171.04 |
| Coconut Oil, Beeswax, Vitamin E | 4748.05 |

Viscosity data highlight the mixtures’ stability and potential application in formulation design.

Conclusion

The comprehensive analysis of these oil-based mixtures revealed substantial variance in their physical and chemical properties. Each analytical technique contributed unique insights, furthering our understanding of these complex systems. This data serves to inform future product development and quality control assessments in relevant industrial applications.