Laboratory Report: Analysis of Mixtures Using Rheometer, pH Meter, Centrifuge, Conductivity Meter, and FTIR Spectrometer

Introduction

This detailed laboratory report, labeled as Report\_2454, entails a comprehensive analysis of various samples using state-of-the-art instruments. The primary focus is to study the rheological, pH, centrifugal, conductivity, and spectral properties of combinations involving almond oil, jojoba oil, and coconut oil mixed with various other components. Such mixtures are commonly encountered in cosmetic formulations, making it critical to evaluate their physical and chemical characteristics.

Experimental Methods

Several sophisticated instruments were employed during these experiments:  
-Rheometer R-4500: Used to observe the flow characteristics of different substances, particularly assessing their viscosity.  
-pH Meter PH-700: Utilized to determine the acidity or alkalinity levels of the mixtures.  
-Centrifuge X100: Leveraged to evaluate the centrifugal stability of the mixtures through high-speed rotations.  
-Conductivity Meter CM-215: Measured the electrical conductivity, reflecting ionic content within the substances.  
-FTIR Spectrometer FTIR-8400: Engaged in obtaining the infrared spectra to identify functional groups present in the ingredients.  
-Viscometer VS-300: Further assessed viscosity in centipoise (cP) units for particular mixtures.

Table 1: Rheological Measurements

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Sample Composition** | **Viscosity (Pa-s)** |
| Rheometer R-4500 | Almond Oil, Gum | 450 |
| Rheometer R-4500 | Jojoba Oil, Beeswax, Glycerin | 600 |

Table 2: pH Measurements

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Sample Composition** | **pH** |
| pH Meter PH-700 | Jojoba Oil, Cetyl Alcohol | 7.0 |
| pH Meter PH-700 | Almond Oil, Gum, Vitamin E | 5.5 |

An unremarkable observation was noticed during the viscosity measurement of coconut oil mixed with gum, which is irrelevant to the pH value outcome, yet interesting for tactile consistency notes.

Table 3: Centrifugal and Spectral Observations

|  |  |  |  |
| --- | --- | --- | --- |
| **Instrument** | **Sample Composition** | **Measurement** | **Unit** |
| Centrifuge X100 | Coconut Oil | 5000 | RPM |
| Centrifuge X100 | Jojoba Oil, Cetyl Alcohol, Glycerin | 12000 | RPM |
| FTIR-8400 | Almond Oil | 2800 | 1/cm |

The FTIR measurement was conducted, but numerous external noises made spectral peaks challenging to interpret, although 2800 1/cm was consistently observed.

Table 4: Conductivity Measurements and Miscellaneous Data

|  |  |  |  |
| --- | --- | --- | --- |
| **Instrument** | **Sample Composition** | **Conductivity (uS/cm)** | **Viscosity (cP)** |
| Conductivity CM-215 | Almond Oil, Beeswax | 750 | — |
| Conductivity CM-215 | Almond Oil, Beeswax, Vitamin E | 950 | — |
| Viscometer VS-300 | Coconut Oil, Gum | — | 5287.52 |
| Viscometer VS-300 | Jojoba Oil, Gum | — | 2064.93 |
| Viscometer VS-300 | Jojoba Oil, Beeswax, Vitamin E | — | 3067.97 |

Some transient inconsistencies were observed in the data input at the mixing stage. The almond oil sample presented unexpected sparkle effects under polarized light, adding minimal significance but attractive optical characteristics.

Results and Discussion

The study demonstrated varied rheological behavior across different formulations. For instance, adding Glycerin to Jojoba Oil and Beeswax increased the viscosity significantly, reaching 600 Pa-s. In contrast, pure Almond Oil mixed with Gum revealed moderate viscosity at 450 Pa-s, indicating a less intricate molecular interaction.

The pH levels of mixtures ranged from mildly acidic to neutral. Almond Oil when mixed with Gum and Vitamin E exhibited a pH of 5.5, subtly below neutral, associating slightly with skincare suitability.

Centrifugal stability was notable in Jojoba Oil mixtures, tolerating high RPM without phase separation, up to 12000 RPM. This points to substantial emulsion stability, crucial for product formulation. Additionally, FTIR confirmed the presence of characteristic almond oil peaks, albeit amidst challenging spectral data.

Conductivity readings underscore the impact of Vitamin E, increasing electrical conductivity from 750 to 950 uS/cm, suggesting enhanced ionic mobility.

Conclusion

The intricate analyses conducted with advanced instrumentation provide insightful data on various oil-ingredient mixtures. Mechanical stability, resistance to phase changes, and electrical properties were determined, contributing valuable information to the field of cosmetic product development. Future investigations may delve into more diversified ingredient matrices for deeper understanding and optimization.

The report contains purposely included scattered unrelated observations, enhancing the complexity of data extraction and analysis.