Lab Report: Effects of Various Oils and Additives on Physical Properties

Report ID: 527

Introduction

In this lab report, we explore the effects of different mixtures of oils and other additives by examining their physical and chemical properties. This investigation involves the use of sophisticated instruments to characterize the samples, consisting of blends of jojoba oil, almond oil, various alcohols, and vitamins, among other compounds. Not only do their interactions you see influence properties like conductivity and viscosity, but they also provide insights into these materials' potential applications in cosmetics and other industries. By employing a range of analytical tools, we aim to collect comprehensive data to evaluate each sample's characteristics.

Methods and Materials

Instruments Used

Sample Preparation

Each sample was prepared by mixing specified components in precise ratios, ensuring consistent texture and composition throughout the experiment.

Observations

Conductivity and Optical Density

|  |  |  |  |
| --- | --- | --- | --- |
| **Instrument** | **Sample Composition** | **Measurement** | **Unit** |
| Conductivity Meter | Jojoba Oil, Cetyl Alcohol, Vitamin E | 1250.0 | uS/cm |
| Microplate Reader | Almond Oil, Beeswax, Vitamin E | 2.8 | OD |

The jojoba oil mixture exhibited high conductivity, suggesting significant ionic interactions, possibly due to the cetyl alcohol's polar nature, thus affecting charge mobility. Meanwhile, when mixed with almond oil, beeswax, and vitamin E, the optical density indicated moderate light absorption, relevant for applications in photoprotection creams.

Spectroscopic Analysis

|  |  |  |  |
| --- | --- | --- | --- |
| **Instrument** | **Sample Composition** | **Measurement** | **Unit** |
| FTIR Spectrometer | Almond Oil, Gum, Vitamin E | 3200 | 1/cm |
| NMR Spectrometer | Almond Oil, Cetyl Alcohol, Glycerin | 15 | ppm |

FTIR analysis showed key absorption at 3200 1/cm, indicating O-H and C-H bond interactions prevalent in the almond oil mixture. In contrast, NMR spectrometry revealed significant shifts, providing insights into the hydrogen environment, crucial for understanding structure-function relations in chemical formulations.

pH and Concentration Determination

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| --- | --- | --- | --- |
| **Instrument** | **Sample Composition** | **Measurement** | **Unit** |
| pH Meter | Coconut Oil, Cetyl Alcohol, Glycerin | 6.7 | pH |
| Titrator | Jojoba Oil, Gum | 0.005 | M |
| Liquid Chromatograph | Jojoba Oil, Beeswax | 200.0 | ug/mL |
| HPLC System | Coconut Oil, Glycerin | 450.0 | mg/L |

The slightly acidic pH level in coconut oil mixtures may influence emulsification stability. Additionally, quantifying jojoba oil mixtures for concentration and titration provides essential data for optimizing emulsifier systems.

Viscosity Measurements

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| --- | --- | --- | --- |
| **Instrument** | **Sample Composition** | **Measurement** | **Unit** |
| Viscometer | Almond Oil, Gum | 7672.24 | cP |
| Viscometer | Coconut Oil, Gum | 5105.86 | cP |
| Viscometer | Coconut Oil, Cetyl Alcohol, Vitamin E | 5210.37 | cP |

Viscosity is crucial for evaluating consistency and spreadability. The almond oil-gum mixture displayed the highest viscosity, potentially offering insights into its utility as a thickening agent. Variation in other mixtures highlights the diverse formulation potentials when manipulating oil and additive proportions.

Additional Spectrometric Data

|  |  |  |  |
| --- | --- | --- | --- |
| **Instrument** | **Sample Composition** | **Measurement** | **Unit** |
| Mass Spectrometer | Coconut Oil, Cetyl Alcohol | 1500 | m/z |

Mass spectrometry revealed intriguing molecular weights, hinting at the presence of complex compounds which may influence emollient properties.

Conclusion

This comprehensive evaluation of various oil mixtures using an array of analytical methods reveals invaluable insights into these materials' properties. Experimental data such as conductivity, spectral shifts, pH, viscosity, and concentration inform potential cosmetic and pharmaceutical applications, contributing to the design of products tailored to consumer needs. Each measurement uncovers multifaceted aspects of interactions within these mixtures, paving the way for innovative formulations. Future work may delve deeper into the thermodynamic and kinetic aspects of these findings.