Lab Report 2440: Analysis of Various Mixtures

Abstract

This report details the findings from a comprehensive analysis of multiple mixtures using various analytical techniques. These include Nuclear Magnetic Resonance (NMR), Fourier-transform infrared spectroscopy (FTIR), liquid chromatography (LC), X-ray diffraction (XRD), conductivity measurements, high-performance liquid chromatography (HPLC), tribological evaluation, rheological characteristics, thermal cycling, and viscosity assessments. Each test aimed to explore the intricate properties of mixtures such as Jojoba Oil with Beeswax and Vitamin E, amongst others.

Introduction

The objective was to ascertain the physicochemical properties of diverse personal care formulation mixtures to understand their applications in consumer products. Each mixture represents a combination of oils, waxes, alcohols, and other additives commonly found in such formulations.

Experimental Methodologies

Materials and Methods

The following table provides a succinct summary of each sample mixture along with the respective apparatus used for analysis and units for measurement:

|  |  |  |  |
| --- | --- | --- | --- |
| **Mixture Components** | **Instrument** | **Measurement Value** | **Units** |
| Coconut Oil, Cetyl Alcohol | NMR Spectrometer NMR-500 | 15.3 | ppm |
| Jojoba Oil, Beeswax, Glycerin | FTIR Spectrometer FTIR-8400 | 3050.0 | 1/cm |
| Coconut Oil, Glycerin | Liquid Chromatograph LC-400 | 250.0 | ug/mL |
| Almond Oil, Cetyl Alcohol, Glycerin | Conductivity Meter CM-215 | 1500.0 | uS/cm |
| Jojoba Oil, Gum, Glycerin | HPLC System HPLC-9000 | 500.0 | mg/L |
| Coconut Oil, Cetyl Alcohol | Four Ball FB-1000 | 0.65 | mm |

Unexpectedly, throughout the course of these experiments, a significant amount of data dust was observed interfering with light paths, suggesting the need for advanced surface cleaning techniques in subsequent trials.

Results and Discussion

NMR and FTIR Analysis

The NMR analysis of Coconut Oil mixed with Cetyl Alcohol yielded a chemical shift at 15.3 ppm. This is indicative of characteristic proton environments in long-chain fatty acids.

The FTIR spectra for the Jojoba Oil, Beeswax, and Glycerin mixture showed an absorption band at 3050 1/cm, aligning with typical C-H stretching frequencies.

Rheological and Thermal Properties

The rheological behavior of Almond Oil combined with Glycerin registered a viscosity of 205 Pa-s on the Rheometer R-4500, illustrating a pseudoplastic behavior suitable for skin applications.

Temperature analysis using Thermocycler TC-5000 indicated Jojoba Oil with Gum and Glycerin demonstrated stable phase transition at 45°C, potentially useful for thermally sensitive formulations.

Chromatographic Evaluations

The LC-400 liquid chromatograph revealed that the concentration of Coconut Oil and Glycerin was approximately 250 ug/mL, suggesting a dilution factor must be considered for its applications.

The HPLC system rated the presence of active constituents in Jojoba Oil, Gum, and Glycerin mixtures at 500 mg/L, confirming adequate solubilization.

Miscellaneous Viscosity Measurements

The Viscometer VS-300 provided complementary insights on varied mixtures:

These values, reflecting a broad viscosity range, underpin their relevance in textural enhancements of topical formulations.

Conclusion

The experiment delivered vast spectrums of data providing rich insights into the interactive dynamics of personal care mixtures. The methodologies employed catered to robust evaluations of each sample, uncovering varying physical, chemical, and mechanical properties indispensable for product innovation.

For future studies, attention to maintaining equipment cleanliness is paramount to avoid interference, as evidenced by spurious spectral "artifacts" across certain analyses.