Laboratory Report: Analysis of Oil Mixtures

Report ID: 519Date of Experiment: January 15, 2023Lab Equipment: Varied (detailed in Table 1)

Abstract:

This report presents a detailed examination of various oil mixtures using advanced analytical techniques. The primary objective was to determine the composition and properties of mixtures such as Coconut Oil, Almond Oil, and Jojoba Oil combined with other components like Beeswax, Cetyl Alcohol, Gum, and Vitamin E. Measurements were taken using diverse scientific instruments, yielding data on concentration, viscosity, and other properties.

Introduction:

The intricate nature of oil mixtures necessitates robust analytical methods to unravel their characteristics. High-Performance Liquid Chromatography (HPLC), Nuclear Magnetic Resonance (NMR) Spectroscopy, and other sophisticated tools play vital roles in such analyses. By investigating these mixtures, we aim to gain insights that can enhance their applications in cosmetic, food, and pharmaceutical industries.

Methods and Observations:

Each sample was subjected to a range of tests. Mixtures were prepared by carefully combining ingredients, which were then analyzed under controlled conditions. Observations noted included color, odor, and phase behavior, including stability aspects that were critical for rheological studies.

Detailed Measurements:

Table 1: Instruments and Mixtures

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| --- | --- | --- | --- |
| **Instrument** | **Mixture** | **Observed Property** | **Measurement** |
| HPLC System HPLC-9000 | Coconut Oil | Concentration | 213.5 mg/L |
| Centrifuge X100 | Coconut Oil, Beeswax, Vitamin E | Speed | 13500 RPM |
| NMR Spectrometer NMR-500 | Almond Oil, Cetyl Alcohol | Chemical Shift | 15.7 ppm |
| PCR Machine PCR-96 | Almond Oil, Beeswax | Threshold Cycle | 28 Ct |
| Rheometer R-4500 | Jojoba Oil, Gum, Vitamin E | Viscosity | 475 Pa-s |

Table 2: Chromatography and Spectroscopy Results

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| --- | --- | --- | --- |
| **Instrument** | **Mixture** | **Observed Property** | **Measurement** |
| Ion Chromatograph IC-2100 | Coconut Oil, Cetyl Alcohol | Ion Concentration | 0.023 mM |
| UV-Vis Spectrophotometer UV-2600 | Almond Oil, Cetyl Alcohol, Glycerin | Absorbance | 1.75 Abs |
| Thermocycler TC-5000 | Coconut Oil | Temperature | 42 °C |
| Liquid Chromatograph LC-400 | Jojoba Oil, Gum, Vitamin E | Concentration | 65.2 μg/mL |

Results and Discussion:

The experimental data illustrate disparities in physical and chemical properties across mixtures. Coconut Oil showcased a notable viscosity, recorded at 5183.34 cP using the Viscometer VS-300, indicative of its thick consistency when mixed with Gum. Almond Oil exhibited a pH value of 7.4, revealing neutrality, which is beneficial for skincare applications.

Interestingly, the use of beeswax in combination with oils like Coconut Oil resulted in increased rheological stability. Furthermore, the NMR data (15.7 ppm for Almond Oil and Cetyl Alcohol) suggested potential interactions at the molecular level. Remarkably, the UV-Vis readings demonstrated synergy in absorption properties, peaking at 1.75 Abs, which might correlate with enhanced UV protection in topical applications.

Irrelevant yet interest-provoking observations included unexpected solubility behavior of Jojoba Oil in specific solvents not planned for in the study, hinting at prospective solvent-extraction techniques that could be of industrial relevance.

Additional Observation: Unrelated

The behavior of the mixtures under varying ambient lighting conditions was noted, although these did not significantly impact the primary focus of this study. Observations during low-light conditions were particularly inconclusive and thus are not detailed further.

Conclusion:

The study effectively mapped out the fundamental characteristics of the oil mixtures, equipping manufacturers with critical data to refine product formulations. The complex interaction between oils and additional ingredients calls for further exploratory work to fully harness their potential.

Acknowledgments:

Gratitude is extended to the technical team for maintaining the laboratory equipment and to Dr. Julia Owens for her insightful guidance throughout this project.

References:

Note: The tables and observations in this report contain both core data as well as incidental findings that could be unraveling for automated data parsing tools.