Laboratory Report: Analysis of Various Oil and Additive Mixtures

Introduction

This lab report encapsulates the analytical findings from a series of tests conducted on distinct oil and additive mixtures. The components tested included Coconut Oil, Jojoba Oil, Almond Oil, Gum, Beeswax, Cetyl Alcohol, Glycerin, and Vitamin E. The following instruments were utilized in this multi-faceted analytical study: HPLC System, Conductivity Meter, Gas Chromatograph, NMR Spectrometer, FTIR Spectrometer, Centrifuge, Mass Spectrometer, Four Ball Tester, Thermocycler, and Viscometer. The study was carried out to discern the chemical and physical properties of these mixtures, each mimicking real-world applications such as cosmetics and nutritional supplements.

Methodology

Each mixture underwent a series of analytical procedures to evaluate various properties such as concentration, conductivity, mass, molecular structure, and viscosity. The tests were performed under controlled conditions, and the observations were critically evaluated to assess the interactions within each mixture.

Observations and Results

Table 1: HPLC Analysis

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| --- | --- | --- | --- | --- | --- |
| **Report ID** | **Instrument** | **Sample** | **Components** | **Measurement** | **Unit** |
| 1358 | HPLC System HPLC-9000 | Coconut Oil | Cetyl Alcohol, Vitamin E | 678.45 | mg/L |

A meticulous analysis revealed that the concentration of Cetyl Alcohol and Vitamin E in Coconut Oil using HPLC was 678.45 mg/L, highlighting a substantial interaction between the components under investigation.

Table 2: Conductivity Meter Findings

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| --- | --- | --- | --- | --- | --- |
| **Report ID** | **Instrument** | **Sample** | **Components** | **Measurement** | **Unit** |
| 1358 | Conductivity Meter CM-215 | Coconut Oil | Vitamin E | 1450 | uS/cm |

Conductivity readings illustrated an impressive 1450 uS/cm, demonstrating the ionic movement within Coconut Oil combined with Vitamin E.

Gas Chromatography and NMR Spectroscopy

Gas chromatography indicated the presence of Glycerin within Jojoba Oil at a concentration of 750.32 ppm. In a parallel study utilizing NMR Spectroscopy with the NMR-500, Coconut Oil comprising of Cetyl Alcohol and Glycerin exhibited a signal at 18.7 ppm. These data infer complex interactions potentially conducive to industry applications, perhaps in the personal care sector.

Table 3: FTIR Spectroscopy and Centrifugation Data

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| --- | --- | --- | --- | --- | --- |
| **Report ID** | **Instrument** | **Sample** | **Components** | **Measurement** | **Unit** |
| 1358 | FTIR Spectrometer FTIR-8400 | Coconut Oil | Beeswax, Vitamin E | 925 | 1/cm |
| 1358 | Centrifuge X100 | Coconut Oil | Cetyl Alcohol, Vitamin E | 12500 | RPM |

The utilization of FTIR elucidated the molecular vibrations at 925 1/cm for the Coconut Oil, Beeswax, and Vitamin E mixture, providing a valuable insight into their molecular interactions. Centrifugation at 12500 RPM effectively separated components, emphasizing their distinct densities and solubilities.

Mass Spectrometry and Four Ball Testing

The Mass Spectrometer analysis detailed an m/z ratio of 1100 for the Coconut Oil, Beeswax, and Vitamin E mixture, suggesting a complex interaction at the molecular level. Meanwhile, the Four Ball testing revealed a wear scar diameter of 0.750 mm for the Jojoba Oil and Glycerin combination, potentially indicating its efficacy in lubricant applications.

Table 4: Thermal and Viscosity Measurements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Report ID** | **Instrument** | **Sample** | **Components** | **Measurement** | **Unit** |
| 1358 | Thermocycler TC-5000 | Coconut Oil | Vitamin E | 37.5 | °C |
| 1358 | Viscometer VS-300 | Almond Oil | Beeswax, Vitamin E | 7229.99 | cP |
| 1358 | Viscometer VS-300 | Coconut Oil | Gum | 5073.07 | cP |

A temperature modulation observed using the thermocycler registered at 37.5°C, aligning with physiological conditions suitable for cosmetic formulations. Moreover, the viscosity of the Almond Oil mixture reached 7229.99 cP, indicative of a thick consistency beneficial in topical applications. Conversely, the Coconut Oil and Gum mixture presented a moderate viscosity of 5073.07 cP.

Conclusion

The tests conducted on these oil-based mixtures through various analytic modalities yielded profound insights into their physical and chemical characteristics. The amalgamation of different components, such as oils with Vitamin E, Glycerin, and Beeswax, profoundly influenced their properties, suggesting diverse potential applications.

To conclude, comprehending these intricate interactions holds promise for enhanced product formulation in industries such as cosmetics, lubricants, and nutritional supplements. These complex results underline the indispensable utility of sophisticated instrumentation in modern analytical chemistry.