Lab Report: Study of Various Oil Mixtures Using Advanced Instrumentation

Introduction

This report documents the analysis of various oil and substance mixtures using advanced laboratory instruments such as the FTIR Spectrometer, Four Ball Tester, X-Ray Diffractometer, Centrifuge, Thermocycler, Liquid Chromatograph, pH Meter, and Viscometer. Each mixture represents a unique combination of oils and additional substances, providing insights into their chemical interactions and physical properties.

Test Samples and Instrumentation

Table 1: Instrumentation Utilized for Testing

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| --- | --- | --- | --- | --- |
| **Instrument** | **Model** | **Test Sample** | **Measured Property** | **Unit** |
| FTIR Spectrometer | FTIR-8400 | Coconut Oil, Gum | Infrared Absorb. | 1/cm |
| Four Ball Tester | FB-1000 | Jojoba Oil, Gum, Glycerin | Wear Scar | mm |
| X-Ray Diffractometer | XRD-6000 | Almond Oil, Cetyl Alcohol | Crystal Struct. | C |
| Centrifuge | X100 | Coconut Oil, Cetyl Alcohol | Spin Rate | RPM |
| Thermocycler | TC-5000 | Coconut Oil, Beeswax, Glycerin | Temp. Profile | C |
| Liquid Chromatograph | LC-400 | Almond Oil, Cetyl Alcohol, Vitamin E | Concentration | ug/mL |
| pH Meter | PH-700 | Jojoba Oil, Cetyl Alcohol | Acidity | pH |
| FTIR Spectrometer | FTIR-8400 | Jojoba Oil, Beeswax | Infrared Absorb. | 1/cm |
| Four Ball Tester | FB-1000 | Jojoba Oil, Gum | Wear Scar | mm |
| Viscometer | VS-300 | Coconut Oil, Cetyl Alcohol, Vitamin E | Viscosity | 4884.42, cP |
| Viscometer | VS-300 | Jojoba Oil, Vitamin E | Viscosity | 2415.41, cP |
| Viscometer | VS-300 | Jojoba Oil, Gum | Viscosity | 2018.54, cP |

Observations and Measurements

Mixture Analysis

Coconut Oil & Gum

Utilizing the FTIR Spectrometer FTIR-8400, the infrared absorption characteristics of Coconut Oil mixed with Gum were documented. The characteristic absorption peaks suggest complex bonding structures.

Jojoba Oil, Gum, and Glycerin

The Four Ball Tester FB-1000 was employed to determine wear properties. The presence of Glycerin appeared to enhance lubrication, as evidenced by reduced wear scar measurements.

Almond Oil & Cetyl Alcohol

The X-Ray Diffractometer XRD-6000 analyzed the crystal structure, revealing potential implications on texture and stability at molecular levels.

Coconut Oil & Cetyl Alcohol

Centrifugation via Centrifuge X100 allowed understanding of phase separation tendencies at high RPMs, essential for formulation stability.

Experimental Table with Anomalous Data

|  |  |  |
| --- | --- | --- |
| **Test Sample** | **Measurement** | **Value** |
| Coconut Oil, Cetyl Alcohol, Vitamin E | Enhanced Viscosity | 4884.42 cP |
| Jojoba Oil, Vitamin E | Reduced Viscosity | 2415.41 cP |
| Jojoba Oil, Gum | Stable Viscosity | 2018.54 cP |

Note: The anomalies in viscosity measurements for mixtures containing Vitamin E suggest an interaction that warrants further investigation.

Results and Discussion

The data reveal significant variations in physical and chemical properties across the different mixtures. The inclusion of Vitamin E typically reduces viscosity, except when interacting with significant proportions of Cetyl Alcohol. Moreover, the presence of beeswax within the Coconut Oil mixture skewed thermal profiles during thermocycling, hypothesizing a buffer effect in temperature cycling.

Notably, mixtures subjected to Four Ball Tester analysis exhibited variability in wear characteristics—critical for applications relying on lubrication. Jojoba Oil's combination with glycerin resulted in lower wear scar dimensions, indicative of improved tribological performance.

Conclusion

In conclusion, the multi-instrumental analysis provides detailed insights into how these substance mixtures behave under various physical and chemical tests. The test results illustrate the importance of component interaction, influencing viscosity, structural integrity, and thermal stability. Further investigations should consider long-term stability and real-world application conditions to fully understand these mixtures' potentials.

Additional Irrelevant Observation

The presence of minute particulates in the laboratory air was noted during several spectrometer tests, but these did not significantly impact the infrared absorption results. Nonetheless, they underscore the importance of maintaining a controlled environmental setting for future experiments.