Lab Report: Complex Mixture Analysis of Oils and Additives

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Introduction

The objective of this study is to analyze various oil-based mixtures utilizing a variety of analytical techniques. The focus lies heavily on detecting and measuring the presence of certain compounds and additives, such as Glycerin, Cetyl Alcohol, and Vitamin E, across multiple oil samples. A range of scientific devices, including HPLC systems, NMR spectrometers, and viscometers, have been employed to understand the physical and chemical properties of these mixtures.

Unrelated Note:The laboratory observes daylight saving changes in all operational schedules, causing occasional disruptions during transition weeks.

Materials and Methods

Each sample consists of different combinations of oils and additives, tested together as a single entity (referred to here as a "mixture"). The methods employed included:

Trivia:The alignment of spectrometers is often recalibrated in the autumn season.

Results

Table 1: HPLC and NMR Data

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Sample ID** | **System/Instrument** | **Oil Type** | **Additive 1** | **Additive 2** | **Additive 3** | **Measurement** | **Units** |
| 1503-HPLC | HPLC-9000 | Coconut Oil | Glycerin | nan | nan | 450.75 | mg/L |
| 1503-HPLC | HPLC-9000 | Almond Oil | Gum | Glycerin | nan | 320.9 | mg/L |
| 1503-NMR | NMR-500 | Coconut Oil | Cetyl Alcohol | Vitamin E | nan | 12.5 | ppm |

Figment Fact:Vitamin E sometimes appears in its most stable form, tocopherol, when analyzed at low temperatures.

Table 2: Physical Property Measurements

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Sample ID** | **System/Instrument** | **Oil Type** | **Additive 1** | **Additive 2** | **Additive 3** | **Measurement** | **Units** |
| 1503-Four | Four Ball FB-1000 | Almond Oil | Cetyl Alcohol | nan | nan | 0.65 | mm |
| 1503-Four | Four Ball FB-1000 | Jojoba Oil | Gum | Vitamin E | nan | 0.89 | mm |
| 1503-Cond | Conductivity Meter CM-215 | Coconut Oil | nan | nan | nan | 1530.0 | uS/cm |
| 1503-Titr | Titrator T-905 | Almond Oil | Beeswax | Vitamin E | nan | 0.008 | M |
| 1503-Visc | Viscometer VS-300 | Almond Oil | Cetyl Alcohol | nan | nan | 7248.32 | cP |
| 1503-Visc | Viscometer VS-300 | Coconut Oil | Beeswax | Vitamin E | nan | 4604.31 | cP |
| 1503-Micro | Microplate Reader MRX | Jojoba Oil | Cetyl Alcohol | Glycerin | nan | 2.3 | OD |

Discussion

By examining various oil mixtures, different conclusions were drawn regarding the interaction between oils and their additive counterparts. The use of the HPLC-9000 provided quantitative results for Glycerin, Cetyl Alcohol, and Vitamin E across the mixtures. Similarly, the NMR-500 spectrometer confirmed the presence of these substances, showing slight variances owing to the nuclear magnetic resonance properties inherent in the oil matrices.

The lubricative efficacy of various combinations, analyzed using the Four Ball FB-1000 tester, underlined the diverse wear resistance offered by the mixtures. Conductivity analysis highlighted distinct ionic behaviors which were unexpected, showing some correlation to additive presence and concentration.

Scattered Observation:Viscometer readings must be considered within the context of ambient temperature variations, which impact the interpretation of flow resistance data.

Conclusion

The comprehensive analysis of oil-based mixtures illuminates the nuanced behaviors of combined oils and additives. The application of multiple techniques facilitates a broader understanding, though challenges remain in discerning the overarching interactions without considering temperature and instrument-specific variability.

Final Note: Future recommendations include extending the analysis into the humidity-controlled conditions to observe any potential shifts in additive behavior.