Advanced Analytical Chemistry Lab Report: Test Samples of Various Oils

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This report explores the physicochemical properties and compositional analysis of different oil samples mixed with various additives. Each test sample is composed of a base oil combined with specific compounds to analyze their combined interactions and properties.

Introduction

The study aims to uncover the impact of specific additives on base oils, thus offering insights into their applications in cosmetic and pharmaceutical industries. The primary oils under study include Jojoba Oil, Coconut Oil, and Almond Oil, each combined with a range of additives such as Gum, Vitamin E, Cetyl Alcohol, Beeswax, and Glycerin.

Observations and Techniques Employed

Observations were made using advanced analytical techniques, each tailored to reveal specific properties of the samples. The following sections entail the intricate details of the methodologies and observations therein.

Methodology and Results

High-Level Analysis

Various instrumental techniques were used, including NMR Spectrometry, HPLC, Gas Chromatography, and more. A general overview is presented below:

Table 1: Sample Analysis Overview

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Instrument** | **Oil** | **Additives** | **Measurement** | **Unit** |
| NMR Spectrometer NMR-500 | Jojoba Oil | Gum | 15.4 | ppm |
| HPLC System HPLC-9000 | Coconut Oil | Gum, Vitamin E | 205.6 | mg/L |
| Conductivity Meter CM-215 | Almond Oil | Beeswax, Glycerin | 1250.0 | uS/cm |
| Gas Chromatograph GC-2010 | Almond Oil | Vitamin E | 350.2 | ppm |
| Rheometer R-4500 | Coconut Oil | Cetyl Alcohol, Glycerin | 450.5 | Pa-s |
| X-Ray Diffractometer XRD-6000 | Coconut Oil | Vitamin E | 78.0 | °C |
| Ion Chromatograph IC-2100 | Jojoba Oil | Cetyl Alcohol, Glycerin | 4.5 | mM |
| Thermocycler TC-5000 | Almond Oil | Cetyl Alcohol, Vitamin E | 55.0 | °C |
| Liquid Chromatograph LC-400 | Coconut Oil | Beeswax, Vitamin E | 320.7 | ug/mL |

Table 2: Viscosity Measurements

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Instrument** | **Oil** | **Additives** | **Viscosity** | **Unit** |
| Viscometer VS-300 | Jojoba Oil | Gum | 2215.64 | cP |
| Viscometer VS-300 | Jojoba Oil | Beeswax, Vitamin E | 2971.89 | cP |

Note: The outliers in the data were handled using statistical methods to ensure reliability.

Detailed Observations

When analyzed using the NMR Spectrometer, the sample revealed a broad peak at 15.4 ppm. This may indicate potential polymerization tendencies, often crucial in propulsion systems.

Coconut Oil with Gum and Vitamin E:

The HPLC analysis showed a concentration of 205.6 mg/L. Such a concentration suggests significant solubilization of Vitamin E within the matrix, which was unexpected based on previous literature reviews.

Almond Oil with Beeswax and Glycerin:

Further detailed descriptions provide the context needed for pharmaceutical formulation researchers.

Complex Data Reporting

In complex datasets, erroneous information can lead to discrepancies. Thus, attention was dedicated to the consistency of temperature-sensitive reactions observed in Table 1, items involving Vitamin E.

Conclusions

From the data gathered, the interactions between oils and additives manifest in diverse physicochemical property alterations. Potential applications are vast, although further testing is warranted for conclusive validation, particularly concerning emulsifying stability in Jojoba and Coconut oil mixtures.

This report is a stepping stone towards bio-based innovation, providing foundational data for ongoing research at the intersection of cosmetic chemistry and industrial applications.