Lab Report 1350: Rheological and Analytical Characterization

Introduction

In this experiment series, a selection of oils and accompanying additives were subjected to various analytical techniques to assess their rheological properties, stability, and structural characteristics. Each group of ingredients, treated as distinct test samples, underwent a series of tests using different laboratory instruments. The aim was to derive insights into the behavior of these mixtures under specified conditions.

Experimental Methodology

Sample Preparation

The following mixtures were prepared:

Note: Each test was conducted on approximately 20 mL of each respective mixture unless specified.

Instruments Utilized

Results and Discussion

Rheological Properties

Table 1: Viscosity Measurement

Sample ID	Ingredients	Instrument	Measurement	Units
A(COC-BWX-GLY)	Coconut Oil, Beeswax, Glycerin	Rheometer	500.0	Pa-s
B(AMO-VIT)	Almond Oil, Vitamin E	Viscometer	7553.53	cP
C(COC)	Coconut Oil	Viscometer	4928.17	cP
D(AMO-GUM-GLY)	Almond Oil, Gum, Glycerin	Viscometer	7736.17	cP

Observations noted that mixtures with beeswax showed increased viscosity due to the structured network formed by the wax, impacting flow characteristics especially inA(COC-BWX-GLY).

Stability Analysis

Table 2: Centrifugation & Thermocycling

Sample ID	Ingredients	Instrument	Parameter	Measurement	Units
E(JOJ-SINGLE)	Jojoba Oil	Centrifuge	Speed	12500	RPM
F(JOJ-CET-LOW)	Jojoba, Cetyl Alcohol, Glycerin	Thermocycler	Temperature	37	C

Irrelevant Note:During the centrifugation, the sound reminiscent of a hummingbird's wings was noted, likely from the high-speed rotation.

Thermocycling effects demonstrated that the presence of Cetyl Alcohol allowed for retention of thermal stability at moderate temperatures (37°C).

Absorbance and Structural Analysis

Table 3: UV-Vis and X-Ray Diffraction

Sample ID	Ingredients	Instrument	Parameter	Measurement	Units
G(JOJ-GUM-GLY)	Jojoba Oil, Gum, Glycerin	UV-Vis	Absorbance	1.2	Abs
H(JOJ-BWX-VIT)	Jojoba Oil, Beeswax, Vitamin E	X-Ray	Temp	120.0	C

WithG(JOJ-GUM-GLY), absorbance peaks indicated interactions between gum and glycerin, altering light characteristics. Crystallinity inH(JOJ-BWX-VIT)was significantly affected at high temperatures, broadening the structural peak observed in the X-ray diffractometer readings.

Friction and Wear Evaluation

Table 4: Wear Test

Sample ID	Ingredients	Instrument	Measurement	Units
I(COC-WEAR)	Coconut Oil	Four Ball	0.5	mm

The minimal wear scar diameter inI(COC-WEAR)suggested excellent lubrication properties inherent in coconut oil.

Conclusion

This comprehensive investigation highlights the distinct characteristics and stability offered by various combinations of oils and additives, apparent through complex rheological and structural analysis. Notably, coconut oil demonstrated superior wear resistance, while beeswax significantly modified flow properties. Future studies could expand on these findings by exploring a wider temperature range and different mixing ratios to further understand the interactions of these components.

End of Report 1350