OPTICAL ACTIVITY AND FARADAY EFFECT IN SOME MINERAL AND VEGETABLE OILS.

BY

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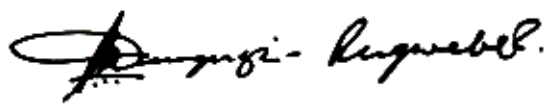
DECLARATION

The work embodied in this thesis is my original work and has never been submitted for any degree any where else.



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APPROVAL

This is to certify that the following study of Ericam R. R. Mucunguzi-Rugwebe has been carried out under the title of:

Optical Activity and Faraday Effect in some Mineral and Vegetable Oils.

It is now ready for submission for examination with my due approval.

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DEDICATION

I dedicate this work to my late grandmother **Mariamu Musenero Kanagaijwa Adyeri** who believed in the **LORD JESUS** and whose financial and moral support paved the way to this academic apex.

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ABSTRACT.

This Thesis presents results of a study of Optical Activity and Faraday Effect (OAFE) in some mineral and vegetable oils in the temperature range of $6°C$ to $45°C$ and magnetic field up to 140mT. Intrinsic birefringences responsible for Optical Activity were found in vegetable oils with impurities and all mineral oils. The results of Optical Activity in both types of oils obeyed the equation

$$\phi = A + \alpha_w \tag{0.1}$$

where α_w is the angle at which minimum irradiance I_{min} occurs in water and other substances which are optically inactive, ϕ is the rotation angle in the medium and A is a rotation due to impurity concentration. The results show that, the more the impurity concentration is in the vegetable oil, the greater the rotation angle. The rotation angle is almost directly proportional to impurity concentration.

When static magnetic field was applied to mineral oils and vegetable oil with impurities, the rotation angle obeyed the equation

$$\phi = MKL + VHL \tag{0.2}$$

where M is the intensity of magnetisation of the medium, K the Kundt's constant (rad/m), L path length in metres, V the Verdet's constant in $radT^{-1}m^{-1}$ and H is the magnetic field intensity in Am^{-1}.

Heavy diesel oils like red diesel, Esso diesel and Fina diesel No.1 rotate more the vibration plane and therefore possess more intrinsic birefringences than light diesel such as Nors Hydro AS diesel and petrol. In vegetable oils free from impurities

induced birefringences caused eigen azimuth rotation that was different from oil to oil. The results satisfied the equation

$$\phi = VHL \tag{0.3}$$

It was found that the quality of mineral and vegetable oil detoriorates with duration, the longer it stays the worse the quality.

The results of salinity, oil fraction component in salt-water and salt-water fraction component in oil obey the equation

$$\phi = R + Sm + Tm^2 \tag{0.4}$$

where R, S, and T are constants and m is the fraction component.

The method of OAFE was used to detect small salt-water fraction component in mineral oils down to 0.1% and oil fraction components in salt-water down to 5ppm.

The rotation angles in oils exhibited an inverse temperature-dependence.

Industrial applications of this method are presented especially in quality determination of (i) vegetable and mineral oils and (ii) detecting mineral oil fraction component in salt-water and salt-water fraction component in mineral oils down to 5ppm and 0.1% respectively.