THE EXTRACTION AND CHARACTERIZATION OF VERNONIA OIL FROM *VERNONIA GALAMENSIS* SEEDS AND ITS CONVERSION INTO DIBASIC ACIDS AND SOME ADHESIVE RESINS

BY

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This thesis is my original work and has not been presented for a degree in any other University.

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This thesis has been submitted for examination with our approval as University Supervisors.

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ABSTRACT

Vernonia galamensis is an oilseed crop with interesting chemical groups, having potential of being an important industrial crop, which would easily be grown in semi-arid areas. Extraction and subsequent oxidation was performed on the seeds.

Vernonia galamensis seeds contain lipase enzyme which was inactivated before extraction, by the use of three methods: passing steam through the seeds, oven heating and autoclaving. It was found that autoclaving was the better of the three. Solvent extraction yielded oil which was purified by the use of activated charcoal then hot-filtered using the aid of Celite (80-240 mesh). Degumming was done by stirring the oil with distilled water in the ratio of 21:1 (v/v) at 50°C for 1 hour. Centrifugation for about 3 hours was done and separation effected by decantation.

The extracted oil was shown to contain the epoxide ring by use of the picric acid method, and the percentage oxirane (3.954). Other physical properties include the saponification value (172.183); the unsaponifiable matter (4.172); the acid value (2.675); the iodine number (86.400); and the viscosity (109.974cps).

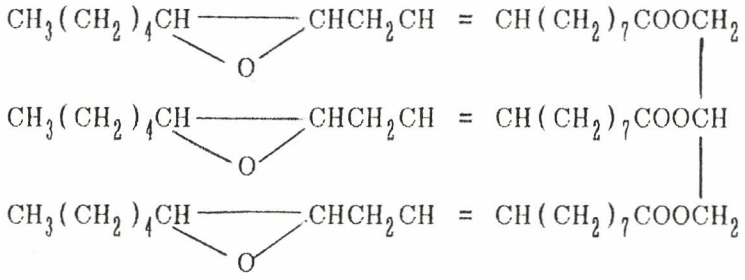
Refluxing the oil with acetic acid for 8 hours followed by hydrolysis with boiling alcoholic potassium hydroxide, subsequent acidification and extraction, yielded crystals of 12,13-dihydroxy-9-oleic acid.

$$CH_3(CH_2)_4CH(OH)CH(OH)CH_2CH = CH(CH_2)_7COOH$$

12,13-dihydroxyoctadec-9-enoic acid

The oxidation of this dihydroxyoleic acid using potassium permanganate yielded octanedioic acid and hexanoic acid. Another oxidation using lead tetraacetate produced an unsaturated aldehyde, which gave a deep orange 2,4-dinitrophenylhydrazone, while oxidation by the use of periodate-permanganate reagent yielded nonanedioic acid.

Vernonia oil is known to be a naturally occurring epoxidized oil existing as a triglyceride (trivernolin), possessing unsaturation.



trivernolin

GC analysis of the oil indicates that trivernolin is the major component triglyceride of vernonia oil from *Vernonia galamensis*, accounting for about 80% of the total oil content.

The reaction of the oil with diaminobutane yielded an interesting resin which had some rubbery-sticky characteristics. The possibility that this could form an adhesive formulation were considered. Phenol-formaldehyde resins were modified using vernonia oil. Instead of the brittle translucent plastic substance, a yellow-green oft plastic was obtained.

Vernonia oil is apparently rare in nature by bearing natural epoxy groups in high concentration, in addition to unsaturation. If the crop is commercially cultivated it could significantly boost the library of important chemicals, and provide a new source of compounds. As a renewable resource, vernonia oil appears to have an important future.