acid can be achieved at lower levels of *trans*-isomer and stearic acid content (Tables IV, V and VI) than that when the AOCS nickel catalyst is used (Table VII). Thus, for example, hydrogenated oil containing 2.7% linolenic acid, 103.4 IV and 8.8% *trans*-isomer content was obtained with gold catalyst in comparison with 4.9% linolenic acid, 103.3 IV and 11% *trans*-isomer content using a standard Ni catalyst (Tables IV and VII). This is an important conclusion. In addition, gold catalysts produced nearly colorless oil free of traces of gold. In fact, a decrease in color from 1 red, 20 yellow to 1 red, 7 yellow was observed as a result of hydrogenating canola oil (Method Ce 13b-45 [15] using a 133.33 mm [5¼"] cell). This color reduction occurs very early in the reaction (at very low hydrogenation levels), probably due to the rapid hydrogenation of pigments.

The catalyst activity and selectivity of the gold catalysts as well as the product characteristics are unaffected by the reuse of the catalyst (Table VI). Furthermore, the catalyst's high stability and easy separation from the oil suggest that it may be suitable for use in a continuous hydrogenation system such as that described by Koritala et al. (17). Multiple reuse could offset the high initial cost of these catalysts. *Supported gold catalysts may be suitable for the stabilization* of high-linolenic oils by the rapid reduction of linolenic acid, thus producing oils with greatly improved stability toward oxidation, polymerization and flavor reversion. This may give frying fats of excellent quality.

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# Kernel Oils of Seven Plant Species of Zaire

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## ABSTRACT

Kernels of *Pentaclethra macrophylla, Allanblackia floribunda, Panda oleosa, Treculoa africana, Desplatzia dewevrei, Garcinia kola* and *Milletia laurentii* were found to contain respectively 45.9, 67.6, 50.5, 11.8, 20.4, 2.1 and 22.9% oil (% dry matter). Gas liquid chromatography showed the major fatty acids of the kernel oils were as follows: *P. macrophylla,* 18:1 (31.3%) and 18:2 (40.4%); *A. floribunda,* 18:0 (55.9%) and 18:1 (43.3%); *P. oleosa,* 16:0 (32.0%), 18:1 (30.2%) and 18:2 (29.2%); *T. africana,* 16:0 (25.7%), 18:1 (32.7%) and 18:2 (25.8%); *D. dewevrei,* 16:0 (37.8%), 18:1 (18.1%) and 18:2 (35.0%); *G. kola,* 16:0 (19.0%), 18:1 (38.4%) and 18:2 (23.7%), and *M. laurentii,* 18:1 (44.9%) and 18:2 (17.6%).

## INTRODUCTION

The palm tree, *Elaeis guineensis,* and the groundnut, *Arachis hypogaea,* are the most important sources of edible and commercial oils in Zaire. However, the oils of many wild plants have a potential economic value. Kernels of some wild plants from Zaire have been analyzed for oil content, fatty acid composition and characteristics by Adriaens (1, 2), Kabele Ngiefu (3, 4, 5), Vieux (6, 7), Meara (8) and Hilditch (9).

In the work reported here, kernel oils of 7 plant species were extracted and their fatty acid compositions determined in order to select the species with the best commercial value. The following species were analyzed: *Pentaclethra macrophylla* (Mimosaceae); *Allanblackia floribunda* (Guttiferaceae); *Panda oleosa* (Pandaceae); *Treculia africana* (Moraceae); *Desplatzia dewevrei* (Tiliaceae); *Garcinia kola* (Guttiferaceae) and *Milletia laurentii* (Papilionaceae). These plants, which grow wild in Yangambi (Zaire), were recommended by the National Institute of Agricultural Research (Yangambi, Zaire).

## MATERIALS AND METHODS

The dried, finely ground kernels were extracted quantitatively with petroleum ether (b.p. 40-60 C) in a Soxhlet apparatus. The lipids, extracted with a mixture of chloroform:methanol (2:1, v/v) as described by Folch (10), were fractionated by thin-layer chromatography (TLC) on silica gel G using as a solvent system petroleum ether (b.p. 40-60 C):ethyl ether:acetic acid (80:20:1, v/v/v) (11). Lipid components were identified by co-chromatography with pure compounds and by comparison of their Rf values. Lipids appeared under ultra-violet light with a 0.0012% solution of Rhodamine 6G (12). Fatty acid methyl esters were prepared with a mixture of $H_2SO_4$:methanol:benzene (0.06:2:1, v/v/v) at 70 C for 2 hr (13). Methyl esters were separated on a Varian Model 3700 gas chromatograph equipped with a flame ionization detector and stainless steel columns. The columns were packed with 10% diethyleneglycol succinate (DEGS) on 80-100 mesh chromosorb W. Nitrogen was used as a carrier gas. The peak areas were measured by the triangulation method and were identified by comparing their retention times with those of a known standard.

## RESULTS AND DISCUSSION

The results are summarized in Table I.

The oil content varies from 2.1% in *Garcinia kola* to 67.6% in *Allanblackia floribunda.*

The low lipid content of *Garcinia kola* eliminates its value as a lipid source. On the other hand, kernel oils of *Panda oleosa, Treculia africana* and *Desplatzia dewevrei* could be used as edible oil sources because of their relatively high percentage of unsaturated fatty acids, in par-

TABLE I

Fatty Acid Composition of Kernel Oils

| Name | Oil Content % | Component fatty acid composition, wt. % | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 12:0 | 14:0 | 16:0 | 16:1 | 18:0 | 18:1 | 18:2 | 18:3 | 20:0 | 20:1 | 22:0 | 24:0 |
| *Pentaclethra macrophylla* | 45.9 | | 0.2 | 3.7 | | 2.3 | 31.3 | 40.4 | | 2.5 | 2.3 | 8.5 | 8.8 |
| *Allanblackia floribunda* | 67.6 | | | 0.8 | | 55.9 | 43.3 | | | | | | |
| *Panda oleosa* | 50.5 | | 1.5 | 32.0 | | 7.1 | 30.2 | 29.2 | | | | | |
| *Treculia africana* | 11.8 | | | 25.7 | 1.6 | 14.2 | 32.7 | 25.8 | | | | | |
| *Desplatzia dewevrei* | 20.4 | | 0.2 | 37.8 | | 7.4 | 18.1 | 35.0 | | 1.5 | | | |
| *Garcinia kola* | 2.1 | 1.3 | 1.3 | 19.0 | | 13.1 | 38.4 | 23.7 | 3.2 | | | | |
| *Milletia laurentii* | 22.9 | | 0.1 | 10.5 | | 2.9 | 44.9 | 17.6 | | 1.8 | 9.9 | 10.1 | 2.2 |

ticular of linoleic acid. It is noteworthy that the seeds of these species are grilled and eaten by local people. *Milletia laurentii* is a beautiful tree whose black wood is used in Zaire in the fabrication of high quality furniture, and its kernel oil may be classed among those with high oleic acid content, as can the kernel oil of *Pentaclethra macrophylla.* For this reason, it is supposed that these oils could be used as food sources, though the kernels of these 2 species are not eaten locally.

*Allanblackia floribunda* kernel oil has a high stearic acid content and could be used in soap factories, stearin manufacturing and many other industries using stearic acid.

The presence of an important triglyceride fraction in all oils analyzed was revealed by fractionation by TLC.

This work does not claim to be a complete study of the oils analyzed. Further work should be undertaken to determine other important characteristics such as their toxicity, triglyceride composition and physical and chemical constants.

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