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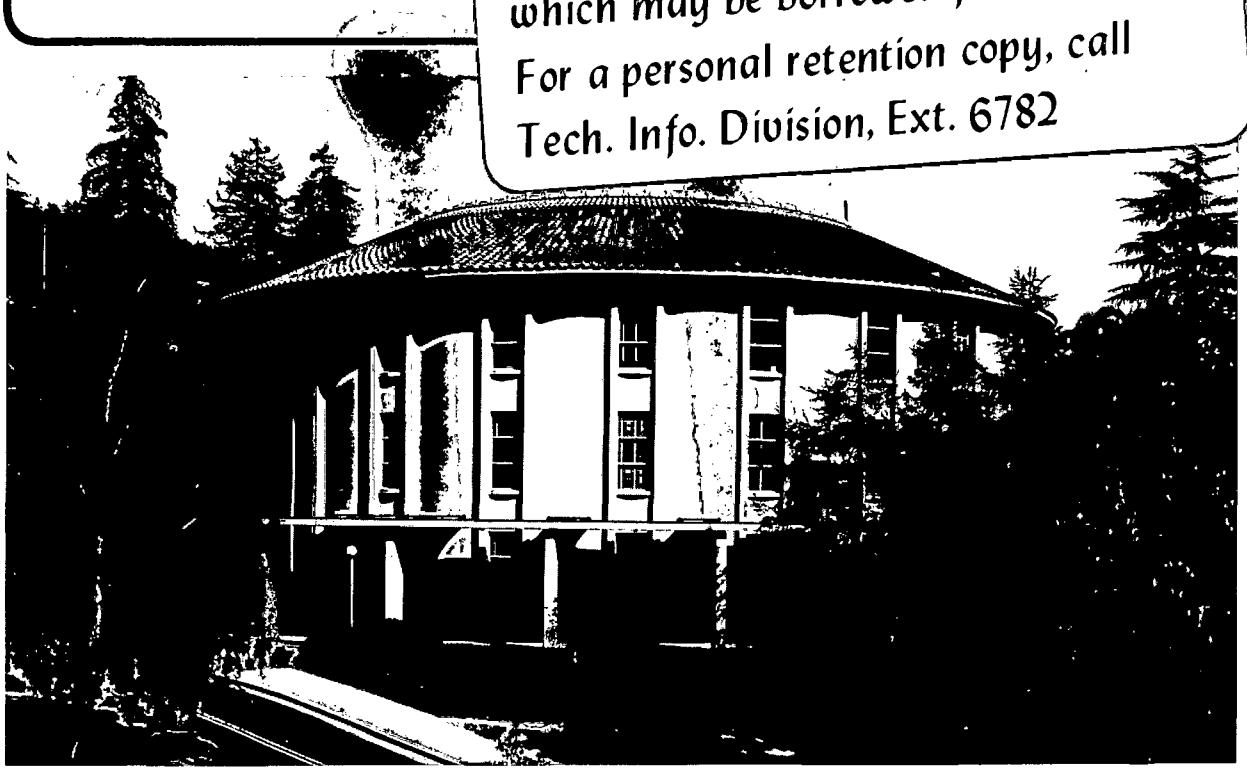

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LATEX-PRODUCING PLANTS FROM RWANDA

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ABSTRACT

Calvin suggested that latex-producing plants other than *Hevea Brasiliensis* should be investigated as source of hydrocarbons.[1] Some plants of this type exist in Rwanda, both wild and ornamental. The purpose of this paper is to present a review of these plants and discuss their potentialities as economic crops.

INTRODUCTION

Many alternative extraction techniques have been described for hydrocarbon plant composition studies.[2,3,4] Some of us[5,6] have performed previously extractions and made chemical analysis on the extractables from *Euphorbia lathyris*. We have applied the same extraction techniques on nine new species of hydrocarbon-producing plants from Rwanda.

EXPERIMENTAL PROCEDURES

Extraction. The extractions have been performed on sun dried material. Grinding was performed with an electric mill. Before extraction the material was heated at 60°C in an oven to remove moisture.

The extractions were done in a Soxhlet apparatus for a total number of

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100 cycles in 8 hours. The first seven extractions with heptane followed by methyl alcohol gave the data in Table 1. Another series of extractions was done with acetone-benzene and methyl aclohol, respectively. All benzene extracts were less than 0.2% of the dry weight and are not mentioned in Table 2 which gives the results of the second extraction series.

Heat values and the C,H,O ratios of the extracts are presented in Tables 3 and 4. The increase in extractable material from heptane to acetone is compensated by the loss in heat values.

Sugar Content of Methyl Alcohol Extract. Methyl alcohol extracts have been separated in water-soluble and ether-soluble fractions. A small quantity of residue could not be dissolved in either of the two solvents.

Sugar tests were performed on the water-soluble fraction after freeze drying of the sample. The naphthol method was used[7] and the results presented in Table 5.

Protein Evaluation in the Residue. Table 6 presents the protein content of the residues after acetone-benzene and methyl alcohol extraction. These values were deduced, assuming that on the average one nitrogen atom corresponds to 6.25 carbon atoms in protein.[8]

Euphorbia pulcherima and *Thevetia Nerifolia* contain the most protein. The nutritive values of the residues can also be compared to usual cattle food. The toxic compounds which might be present can be removed in the drying process, as observed with *Euphorbia lathyris*.[9]

Cracking Pattern of Some Heptane Extracts. W. O. Haag, *et al*. have made a study of the cracking pattern of extracts from *Euphorbia lathyris* using the zeolite catalyst at the Mobil Corporation research laboratories. We have applied the method they suggested to compare aromatic fractions from the cracking and the results we can expect from our samples are given in Table 7. We have taken into account the experimental results on *Euphorbia lathyris*.

CONCLUSION

The purpose of this work was to compare some latex plants from Rwanda with Euphorbia lathyris as possible hydrocarbon crops. A first series of rough data has been obtained. More statistical work must be done to determine the average of extractable material for the different samples examined.

For a more complete comparison with Euphorbia lathyris, further chemical analysis of the extracts should be performed as well as a determination of the agronomic yield of the species from Rwanda. Then a more economic value assignment to these plants as energy crops can be made.

Nevertheless, work of this type is really challenging for developing countries such as Rwanda where the natural environment resources are sometimes considered as uninteresting as they do not appear to fit the tradiational resources for well settled industries.

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Table 1. Heptane-Methyl Alcohol (MeOH) Extraction

Species	Name	Part	Label	Heptane Extract %	MeOH Extract %
Euphorbiacea	Euphorbia tirucalli	Bark	E.T.B.	9.7	23.1
	Synadenium Grantii	Stems	S.G.S.	10.2	16.5
		Leaves	S.G.L.	8.8	4.3
	Euphorbia Pulcherima	Stems	E.P.S.	3.0	10.4
		Leaves	E.P.L.	10.0	16.6
Moracea	Thevetia Nerifolia	Stems	T.N.S.	2.0	17.7
		Leaves	T.N.L.	6.2	
Asclepiadacea	Sarcostema viminale	Stems	S.V.S.	4.9	9.5
		Roots	S.V.R.	4.2	5.8

Table 2. Acetone-Benzene-Methyl Alcohol (MeOH) Extraction

Species	Name	Part	Acetone Extract %	MeOH Extract %
Euphorbiacea	Euphorbia tirucalli	Bark	17.2	11.9
	Synadenium Grantii	Stems	15.8	9.0
		Leaves	10.7	5.3
	Euphorbia pulcherima	Stems	5.7	9.3
		Leaves	13.8	14.6
Moracea	Thevetia Nerifolia	Stems	5.4	15.2
		Leaves	7.6	14.4
Asclepiadacea	Sarcostema viminale	Stems	7.3	6.4
		Roots	6.6	4.2
			8-9	

Table 3. Heat Values and C,H,O Ratios of Heptane-Methyl Alcohol (MeOH) Extracts

Sample	Part	Heptane Extract		MeOH Extract	
		Heat Value kBTU	Formula	Heat Value kBTU	Formula
E. tirucalli	Bark	17.59	$CH_{1.72}O_{0.07}$	6.67	$CH_{2.04}O_{0.85}$
Syn. Grantii	Stems	16.66	$CH_{1.67}O_{0.10}$	6.91	$CH_{1.57}O_{0.74}$
	Leaves	17.11	$CH_{1.72}O_{0.09}$	8.67	$CH_{1.72}O_{0.76}$
E. Pulcherima	Stems	17.14	$CH_{1.72}O_{0.09}$	6.55	$CH_{2.11}O0.61$
	Leaves	17.85	$CH_{1.73})0.06$	7.44	$CH_{1.81}O_{0.65}$
Thevetia Nerifolia	Stems	16.57	$CH_{1.70}O_{0.07}$	6.26	$CH_{2.16}O_{0.91}$
	Leaves	17.04	$CH_{1.69}O_{0.08}$	6.45	$CH_{2.23}O_{0.99}$
Sarcostema viminale	Stems	16.81	$CH_{1.72}O_{0.09}$	6.71	$CH_{1.92}O_{0.78}$
	Leaves	17.04	$CH_{1.42}O_{0.07}$	7.91	$CH_{1.65}O_{0.64}$

Table 4. Heat Values and C,H,O Ratios of Acetone, (Benzene), Methyl Alcohol (MeOH) Extracts

Sample	Part	Acetone Extract Heat Value kBTU	Acetone Extract Formula	MeOH Extract Heat Value kBTU	MeOH Extract Formula
E. tirucalli	Bark	14.34	$CH_{1.6}O_{0.13}$	5.91	$CH_{1.96}O_{0.07}$
Syn. Grantii	Stems	13.83	$CH_{1.6}O_{0.23}$	5.87	$CH_{1.98}O_{0.82}$
	Leaves	15.75	$CH_{1.72}O_{0.16}$	7.45	$CH_{1.94}O_{0.68}$
E. pulcherima	Stems	13.74	$CH_{1.79}O_{0.23}$		
	Leaves	15.76	$CH_{1.77}O_{0.14}$	6.45	$CH_{1.92}O_{0.81}$
Thevetia Nerifolia	Stems	15.55	$CH_{1.79}O_{0.25}$	6.55	$CH_{2.22}O_{0.99}$
	Leaves	14.79	$CH_{1.72}O_{0.20}$	6.18	$CH_{2.15}O_{0.95}$
Sarcostema viminale	Stems	14.52	$CH_{1.72}O_{0.20}$	5.71	$CH_{1.97}O_{0.79}$
	Roots	13.78	$CH_{1.66}O_{0.14}$	6.33	$CH_{1.73}O_{0.69}$

Table 5. Methyl Alcohol Extract Fractionation and Sugar Test

Sample	Water-Soluble Fraction, % w	Ether-Soluble Fraction, % w	% Sugars, Naphthol Method, % w
E.T.B.	15.6	1.7	15
S.G.S.	10.9	1.8	9
S.G.L.	3.1	0.7	2
E.P.S.	7.8	0.9	6
E.P.L.	15.8	2.1	13
T.N.S.	17.3	0.7	17
T.N.L.	12.8	2.1	8
S.V.S.	3.8	0.9	2
S.V.R.	3.9	0.6	2

Table 6. Protein Content of Residues

Sample	% N, Residue	Protein Estimation % Dry Weight
E.T.B.	0.45	2
S.G.S.	1.32	6.2
S.G.L.	0.89	4.7
E.P.S.	1.2	6.4
E.P.L.	4.15	18.6
T.N.S.	1.14	5.7
T.N.L.	3.23	15.8
S.V.S.	0.81	4.4
S.V.R.	0.52	2.9

Table 7. Cracking Pattern, Percent Aromatics

Sample	Percent	H/C	$(H/C)_{eff}$	Percent Aromatics
E.T.B.	9.7	1.72	1.58	39
S.G.S.	10.2	1.67	1.47	46
S.G.L.	8.8	1.72	1.54	41
E.P.L.	10	1.73	1.61	38
E. lathyris		1.75	1.47	46

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