Kesom Oil—A Natural Source of Aliphatic Aldehydes

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Among the common household herbs and plants grown by Malaysians are *Cymbopogon citratus* (DC) Strapf. (Gramineae and *Pandanus amaryllifolius* Roxb. (Pandanaceae). The two plants which are known by their local names as "serai makan" and "pandan" are grown in nearly every Malay compound, in either urban or rural areas. Both plants are used for flavouring and indispensable in traditional food preparations.

A few other less common herbs and plants are occasionally used as flavouring ingredients; we cite here one example, hitherto not examined before, *Polygonum minus* Huds. (Polygonaceae).[1] The herb is popularly known as "Kesom" or "Senahun" and its uses are more localised within the various states of the Peninsular or East Malaysia. The entire herb is strongly aromatic. In order to use the herb as a flavouring ingredient, the leaves are cut into small pieces and are subsequently dispersed into foods or noodles. Sometimes the leaves are blended with other common spices and the mixture used as a stuffing ingredient for traditional foods.[2]

The recent investigation of the plant habitats and the chemical analysis of the essential oils obtained from the leaves and stems provided some new findings that could prove highly useful to the flavour and fragrance industry. In this report the habitats of *Polygonum minus* Huds. and the chemical composition of leaf and stem oils are presented, and the possible relevance of Kesom oil as a new product is discussed.

Experimental

Ten samples of Kesom herbs taken from four different sources were used in this study. Sample sources 1, 2 and 3 were obtained from the three mountainous regions in Malaysia, Cameron Highlands (CH), Fraser's Hills (FH),. Genting Highlands (GH), respectively, while sample source 4 is from the Malay kampungs near the Universiti Kebangsaan Malaysia (UKM) campus. The fresh leaves and stems were cut into small pieces and subjected to a conventional steam distillation for about 1.5 hours to obtain the essential oil. All the distillations were done near the sample source, except for samples taken from source 4, which were distilled at the Department of Chemistry at UKM.

The Kesom oil was subsequently fractionated through a silica gel column using hexane, benzene, chloroform and ethanol as eluants and each fraction was analysed by combined GC-MS. Tentative identification of the individual components was performed by comparing the retention indices of the individual peaks in the gas chromatograms with that of reference samples. The identity of each component was subsequently confirmed through the analysis of the mass spectral data. IR, UV and NMR spectra of the neat oil and the four fractions were used to supplement the identifications.

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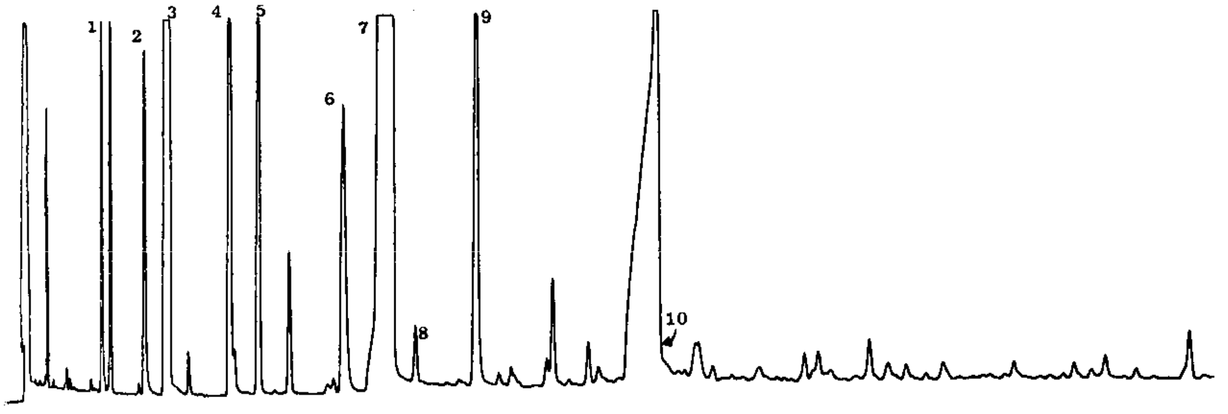

Figure 1. A gas chromatogram of Kesom leaf oil, 10m x 0.25mm fused silica capillary column coated with SE-30; 70°C-200°C at 4°C/min; helium as carrier gas

Results

The identified chemical components of Kesom oil (CH sample) are presented in Table I, together with a corresponding gas chromatogram shown in figure 1. All the identified components make up 83.87% of the leaf oil and 68.64% of the stem oil.

Discussion

Fresh Kesom leaves yield about 0.3-0.4% of a colourless oil [CH sample: Density (27°C) = 0.831 gms/ml; Refractive Index (27°C) = 1.4816]. The stem, being less aromatic, yields only 0.05-0.1% of oil.

The aliphatic aldehydes (nonanal, decanal, undecanal, dodecanal and tetradecanal) form the major components of Kesom oil, with decanal and dodecanal as the two dominant aldehydes. All five aliphatic aldehydes make up about 76.59% of the leaf oil and 56.17% of the stem oil. The corresponding aliphatic alcohols are also present (nonanol, decanol, undecanol and dodecanol) and they comprise 7.10% of the leaf oil and 12.47% of the stem oil. In addition, β-caryophyllene (0.18%) was the only sesquiterpene characterized in the leaf oil. An infra-red spectrum of the neat oil is nearly identical to that of the spectrum of pure dodecanal.

We studied the variations of the two dominant aldehydes, decanal and dodecanal, present in the leaf oils that have been distilled from leaves obtained from the three mountainous regions in Malaysia—CH (1600m height), FH (1350m height), GH (1500m height)—and also from a sample grown under normal heights above sea level (in this case, samples grown by the Malays in kampungs near the UKM campus). The three mountainous regions are popular holiday resorts in Malaysia while the CH region is also a highly developed agricultural area. In each of the areas, the herb grows unattended on wet soil. Unlike those grown in the mountainous regions which in full maturity can attain a height of 1.5m, herbs grown in the kampungs seldom reach a height of more than 0-5 m; one possible reason is that the herb is constantly harvested for sale as a flavouring ingredient in the local market.

Typical variations of the percentages of decanal and dodecanal among the four samples are shown in Table II. The present results indicated that the Kesom herb favours a wet soil and a cool climate (15°-24°) for proper growth in order for the essential oil to become rich in decanal and dodecanal. The leaf oil sample from Cameron Highlands (CH) is an example of this type of climate as can be seen from its chemical composition; i.e., of the two dominant aldehydes, it is the highest found thus far. It is possible that the herb is of a different chemical variety altogether.

It may be possible that Kesom oil can be used as a new product for the flavour and fragrance industry. Furthermore, the oil is a natural source of aliphatic aldehydes, of which there are not many in the market today. If the botanical and agricultural aspects of *Polygonum minus* are fully studied, the industry will gain a lot. At present the herb is only grown by Malay individuals on small plots ready for immediate consumption or for sale to the local market. It should be mentioned however, that the Malaysian government has identified essential oil crops as priority crops under the 1986 Fifth Industrial Master Plan.[3] Before the implementation of this new IMP, the priority crops were rubber, oil palm and cocoa and did not include essential oil crops.

Table II. Variations of the Two Major Aldehydes in Kesom Oil

Sample Source	Percentage		
	Decanal	Dodecanal	Total
CH			
leaf	24.36	48.28	72.54
stem	5.69	47.27	52.96
GH			
leaf	20.21	36.42	56.63
FH			
leaf	17.69	40.85	58.54
UKM			
leaf	20.10	37.83	57.93

Table I. The Chemical Components of Kesom Oil (*Polygonum minus* Huds.)

Peak No.	Component	Retention Index I_K	Percentage Leaf	Percentage Stem
1	Nonanal	1076	0.86	0.08
2	1-Nonanol	1143	0.76	0.58
3	Decanal	1170	24.36	5.69
4	1-Decanol	1248	2.49	3.95
5	Undecanal	1280	1.77	1.38
6	1-Undecanol	1355	1.41	2.43
7	Dodecanal	1388	48.18	47.27
8	β-Caryophyllene	1438	0.18	-
9	1-Dodecanol	1457	2.44	5.51
10	Tetradecanal	1587	1.42	1.75

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