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Fatty Acid Composition of the Dugong Oil*

By

Hideo Tsuyuki** and Shingo Itoh**

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The dugong, Halicore dugong, inhabits ~~in~~ the shallow part of the sea along the north-east coast of Africa and north coast of Australia in the Indian Ocean and around the islands of Indonesia, Philippines, Taiwan, Ryukyu, Amamioshima in the Pacific Ocean, and lives mainly on marine algae.[1] Because the meat of the dugong is tasty, it has been caught in a large number so far and considerably decreased in number at present, being designated as one of the natural monuments in Japan.

Owing to the favour of Dr. Shoji Nishiwaki, Professor at the Marine Laboratory, University of Tokyo, the author was able to obtain

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some dugong oil. Reported here is an analysis on the general properties of it and the fatty acid composition by gas-liquid chromatography. It seems that few studies have been carried out on the dugong oil.

Method of Experiment

Sample Tested The dugong used as a sample was the one caught at Ikema of Miyakojima on 25 October 1965 and being refrigerated at 0°C. As the dugong does not have subcutaneous fat which the whale and the seal have, the oil was extracted from part of ordinary flesh by means of stewing and refined through precipitaion (sedimentation). The sample oil of 23g was obtained from a flesh lump of 5kg. The general 1036
properties are shown in Table 1.

Preparation of Fatty Acid Methyl Ester The method by Sano and others[2,3] was followed here. That is, the sample oil of 5g. was solved into the n-hexane of 50ml, being added by the anhydrous methanol of 100ml and the methanol solution of N/2 caustic potash of 10ml. After the solution was stirred with a magnetic stirrer giving nitrogen at the room temperature for 1.5 hours and added by the semi-saturated salt water of 30ml, then extraction was made four times with every addition of n-hexane of 50ml. The n-hexane extracted liquid was cleaned by semi-saturated salt water once, and further rinsed by water a couple of times, then dehydration was made with anhydrous sulfate of soda, the solvent being removed. Furthermore in order to eliminate impurities such as coloured substance, cholesterine and so on, the extraction was liquified with the addition of n-hexane of five times

as much and passed through the column of 10mm in inside diameter within which silica gel of 3g. was packed. Then the column was treated with the n-hexane liquid of 100ml which included 2 % ethyl ether, the solution liquid being obtained. The solvent was removed in the flow of nitrogen under decreased pressure and the colourless fatty acid methyl ester of 4.0g. was obtained, which was used for the analysis of the fatty acid composition.

Gas-Liquid Chromatography The gas-liquid chromatograph apparatus used for the analysis was of GC-1C type made by Shimadzu Seisakusho, and the conditions are shown in Table 2. The peak area was calculated by multiplication of a modification factor based on palmitic acid.

Results and Considerations

From the results of gas-liquid chromatography conducted under the conditions shown in Table 2 it was estimated that 18 kinds of fatty acid would exist: C_8, C_{10}, C_{12}, C_{14}, C_{15}, C_{16}, C_{17}, C_{18}, C_{20} of saturated fatty acids and C_{12} monoenoic acid, C_{14} monoenoic acid, C_{14} dienoic acid, C_{16} monoenoic acid, C_{16} dienoic acid, C_{18} monoenoic acid, C_{18} dienoic acid, C_{18} trienoic acid and C_{20} tetraenoic acid of unsaturated fatty acids.

Identification of these fatty acids was reduced from the comparison with a standard substance and the linear relationship between the number of double bond of carbon and the logarithm of the maintained period in hours.[4,5)]

Next the composition ratio of these fatty acids was found by

the half value width method[6] and tabulated in Table 3. As clearly shown in this table, the fatty acid involved in the largest quantities in the dugong oil was C_{18} monoenoic acid of 41.3 per cent and the one in the second was C_{16} saturated acid of 23.0 per cent. The sum of these two kinds of fatty acid is to occupy such a ratio of a little less than 65 %. Furthermore, the ratio of saturated fatty acid was 38.4 % and that of unsaturated fatty acid 61.3 %, which showed a comparatively higher composition of saturated acids.

It is an interesting fact that the dugong, the algae eating marine mammal does not have subcutaneous fat compared with other flesh eating marine mammal. And it also seems peculiar that the ratio of oil extraction was so low as 0.46 %.

Summary

1. Investigated were the general properties and the fatty acid composition of the dugong oil.

2. The fatty acid of dugong oil was found to be composed of C_8, C_{10}, C_{12}, C_{14}, C_{15}, C_{16}, C_{17}, C_{18} and C_{20} of saturated fatty acids and C_{12} monoenoic acid, C_{14} monoenoic acid, C_{14} dienoic acid, C_{16} monoenoic acid, C_{16} dienoic acid, C_{18} monoenoic acid, C_{18} dienoic acid, C_{18} trienoic acid and C_{20} tetraenoic acid of unsaturated acids.

3. The main constituents of the dugong oil are C_{18} monoenoic acid (41.3 %) and C_{16} saturated acid (23.0 %).

This study was conducted owing to the Individual Research Fund

of the Ministry of Education of the year of 1966.

At the end, the author would like to express his gratitude to Dr. Shoji Nishiwaki, Professor at the Marine Laboratory, University of Tokyo for the offer of the test sample.

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Tables

Table 1. Properties of the Dugong oil.

Appearance (at 30°C)	Yellowish orange liquid
Refractive index (at 40°C)	1.4546
Acid value	2.8
Iodine value (Wijs)	45.8
Saponification value	210.8
Unsaponifiable matter (%)	0.45

Table 2. Gas-liquid chromatograph conditions.

Column	Diethylene glycol succinate (DEGS) 25% on Shimalite, 30-60 mesh, 4 mm (in diameter) × 2.25m. Temperature : 215°C.
Carrier gas	N_2, 78 ml/min.
Detector	Shimadzu Hydrogen Flame Ionization Detector FID-1B.
Chart speed	10 mm/min.

Table 3. Fatty acid composition of the Dugong oil.

Fatty acids detected	Weight per cent
C-8	trace
C-10	0.1
C-12	0.2
C-12-1	trace
C-14	9.8
C-14-1	0.8
C-14-2	0.9
C-15	0.4
C-16	23.0
C-16-1	7.7
C-16-2	1.6
C-17	1.2
C-18	2.3
C-18-1	41.3
C-18-2	3.4
C-18-3	4.1
C-20	1.7
C-20-4	1.5

Table 4. A comparison of the saturated and unsaturated fatty acids of the Dugong oil.

Fatty acids	Weight per cent		
	Saturated	Unsaturated	Total
C-8	trace	—	trace
C-10	0.1	—	0.1
C-12	0.2	trace	0.2
C-14	9.8	1.7(-2, -4H)	11.5
C-15	0.4	—	0.4
C-16	23.0	9.3(-2, -4H)	32.3
C-17	1.2	—	1.2
C-18	2.3	48.8(-2, -4, -6H)	51.1
C-20	1.7	1.5(-8H)	3.2
total	38.7	61.3	100.0