Original Paper

Study on the Composition and Industrial Evaluation of Chinese Oil Seeds II
—Teaseed Oil and Rice Bran Oil—

by Yasuhiko Takeshita and Tian Ren Lin***

Synopsis: By analysing the ethyl-ether extracted lipid of oil seeds planted in China, the authors discovered that erucic acid component of industrially extracted teaseed oil had been caused by contamination of rapeseed oil, but minor component of C-20 and C-22 fatty acids were essential in Chinese tea seed oil.

Japanese sasanqua and camellia seeds were also collected and compared with Chinese tea seed about minor component fatty acids. Chinese tea seed oil was similar to Japanese camellia oil rather than Japanese tea seed oil or sasanqua oil.

Chinese rice bran and industrial crude oil samples, collected at east-north, middle-1 and -2 regions of China, were compared with Japanese rice bran. The range of oil contents was wide from 14 to 17%, and each oil content was less than 20% for that of Japanese rice bran. However the fatty acid composition of the oil was found to be the same as that of Japanese rice bran oil.

1. Introduction

In the preceding paper[1], the authors reported the compositions and industrial values of Chinese oilseeds and their oils, comparing with those grown or produced in other countries, especially in Japan. About the composition of industrially produced teaseed oil in Funan province, the authors discovered considerable quantitity of C-22, F-1 (erucic) fatty acid, at the step of former report. However, in this report one of the authors collected by himself tea seed planted in Funan province, and confirmed that main part of erucic acid in the industrially extracted teaseed oil owed to the contaminant of rapeseed oil at the oil extracting process, except the minor quantity of C-20 and C-22 acids.

The sterols in the USM of teaseed oil were investigated by T. Matsumoto et al.[3], and so the authors compared merely the whole USM with camellia oil etc. of Japan, and discovered some speciality.

The authors took some rice bran or its oil samples in east-north and middle China, and then analysed about oil and moisture contents or fatty acid compositions, and compared them with south Japanese rice bran or its oil[4~6]. The oil contents of them showed remarkable differences, the minimum 14% and the maximum 17%.

2. Experimentals

2.1 Materials

The authors collected by themselves almost every analysing sample in planted area, and some crude oil samples were presented by several oil mills.

As the oilseeds for analysis, Chinese teaseed planted in Funan province especially in Changsha, Japanese sasanqua and camellia seeds planted in Tokyo and Izu islands, were col-

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lected.

The rice bran samples were produced in Jilin, Anhoi and Chansu of China, and for the sake of contrast, the rice bran and rice bran crude oil were taken in south Japan, Fukuoka prefecture.

2.2 Methods

The oilseeds were treated with diethyl ether, and each lipid extracted from them was esterified with the mixture of sulfuric acidic methanol and benzene (1: 60: 30 by volume). The lipid was boiled for 2.5 hours under reflux equipped. Produced methyl esters were analysed by GLC, Shimazu GC-7AG with C-R1A Integrator. EGA or OV-17 columns were used for fatty acid ester or USM, and column temperature was 190°C for fatty acid ester. For USM detecting, column temp. 260°C and injection temp. 310°C were adopted. Carrier gas nitrogen was supplied at the rate of 80 ml/min and hydrogen gas pressure was 0.6 kg/cm^2 for FID. Air pressure was 0.5 kg/cm^2.

The USM was extracted with diethyl ether from saponified lipids by the standard analytical method of JOCS.

Figs. 1 and **2** show the tea seeds and camellia seed which were collected by one of the authors.

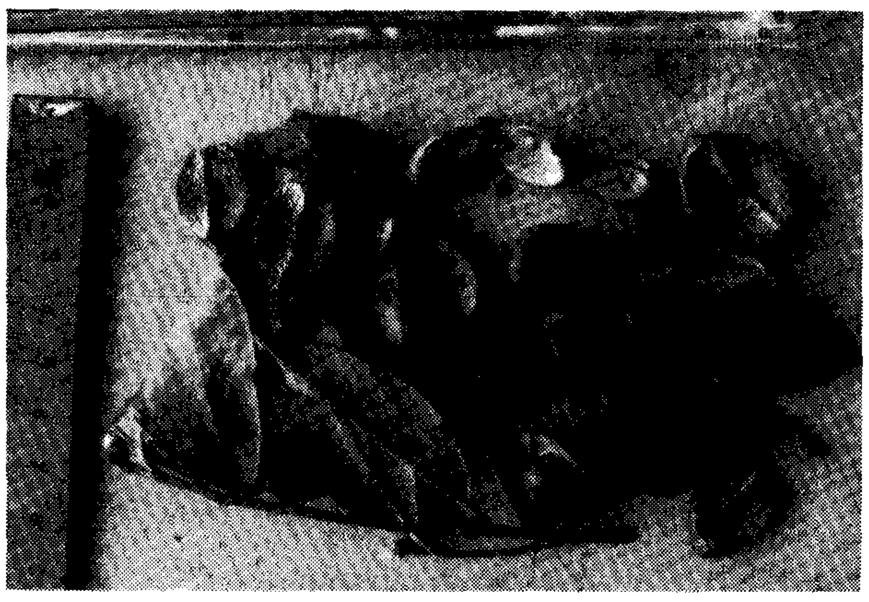


Fig. 1 Tea seed in Changsha

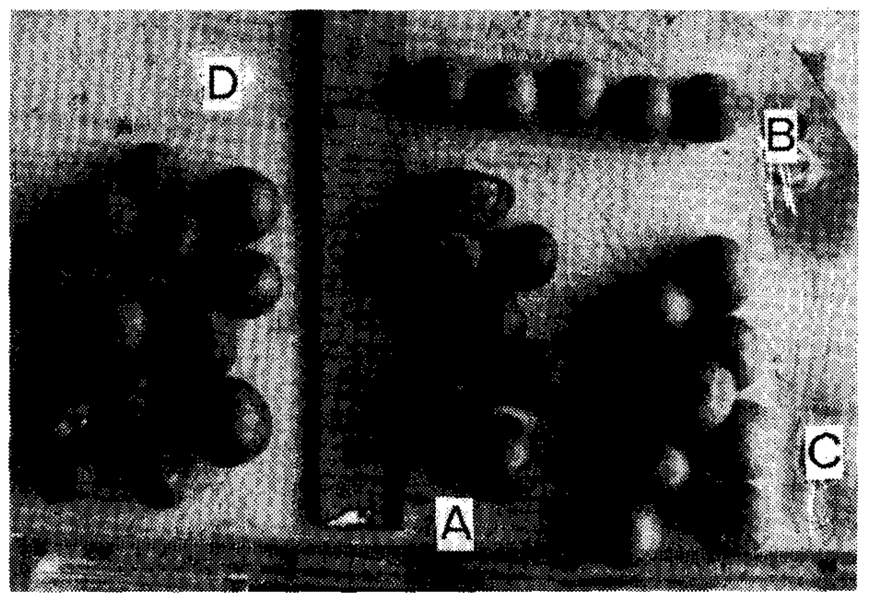


Fig. 2 Tea seeds (A, C china, B Japan) Cemellia seed (D) in Japan

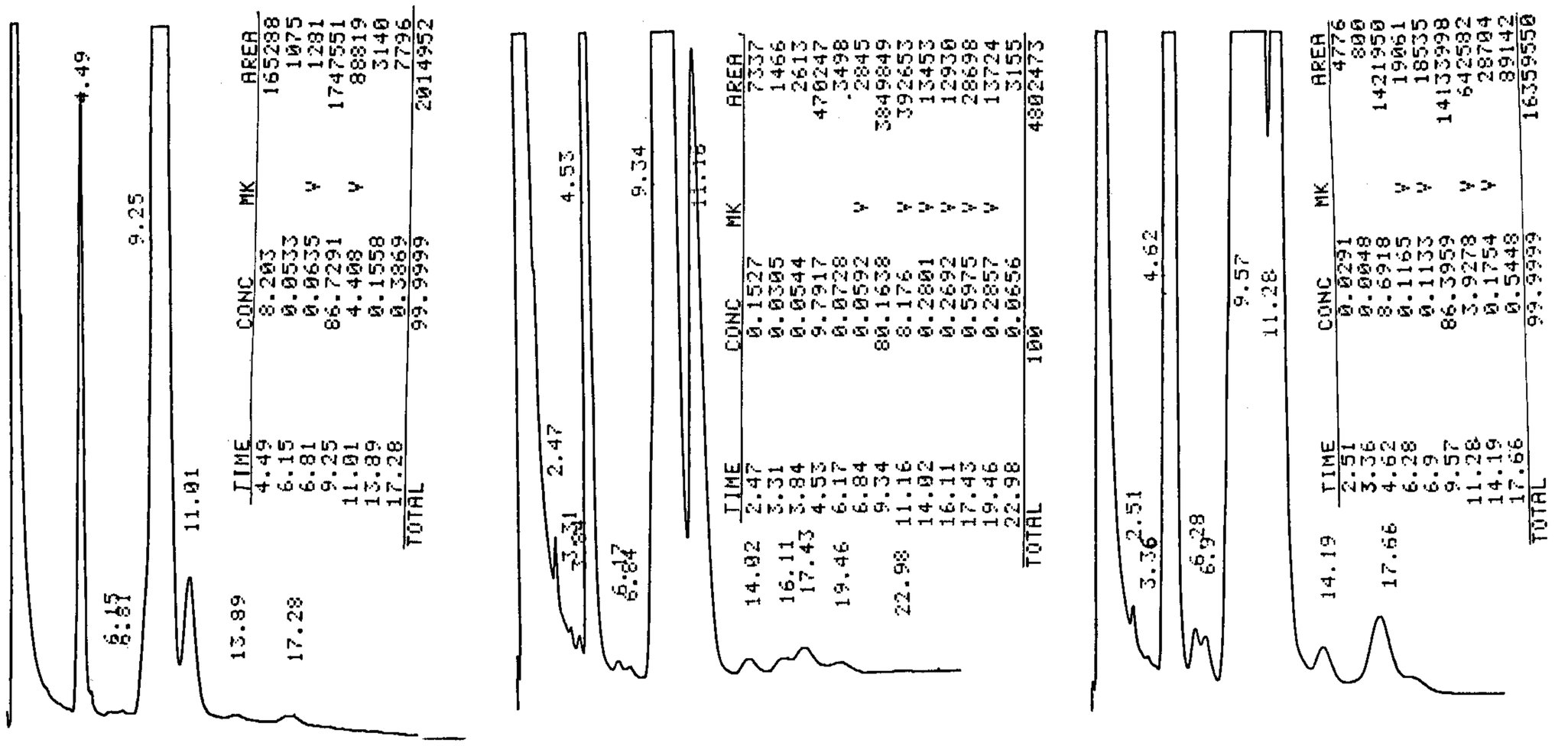
3. Results and Discussion

3.1 Tea seed oil

The lipids of collected tea seeds, rice bran or their oils were adopted to GLC, and the obtained charts were shown in the next figures. **Fig. 3** concerns teaseed in Changsha, collected at the suverb of Changsha by Takeshita himself, Japanese sasanqua seed which had single red flower, planted in Tokyo, and Japanese camellia seed in Izu island. These results are summarised in **Table 1**.

Chinese teaseed oil has the similar fatty acid composition of Japanese camellia seed oil, rather than sasanqua seed oil in Japan.

The composition of Chinese teaseed oil is different from that of Japanese one. In the preceding report[1], 2.7% erucic acid in an industrial tea seed crude oil was discovered, however the present study about field collected tea seed at planting area strictly comfirms that Chinese tea seed oil contains only 0.4% of erucic acid, and the remained 2.3% of it in the former report[1] may be the contaminant at the step of oil milling after its harbest.



3-1 Chinese teaseed in Changsha **3-2** Japanese sasanqua in Tokyo **3-3** Japanese camellia seed in Izu

Fig. 3 GLC Charts of Tea seed Oils etc.

Table 1 Fatty acid composition of teaseed, sasanqua & camellia lipids

	C-14,	C-16,	C-18-0,	-1,	-2,	-3,	C-20-1,	C-22	
T	0	8.2		86.7	4.4		0.2	0.4	
C	0	8.7		86.4	3.9		0.5	—	
S	0.2	9.8		80.0	8.2		0.6	0.3	

T: Changsha teaseed, C: Japanese camellia-seed, S: Sasanqua Japan.

Table 2 Rice bran Analysis

	Samples	Moist.	Oil cont.	A.V.	Planted Area
A	China, North East	9%	17%	49	Jilin
B	Mid. 1	9	14	13	Anhoi
C	Mid. 2	10	16	20	Chansu
D	Indust.(oil)	—	—	5	Anhoi
E	Jap. Indust.	11	20	18	Fukuoka, Kyushu

Therefore, Chinese tea seed oil is supposed to be excellent edible oil like Japanese camellia oil.

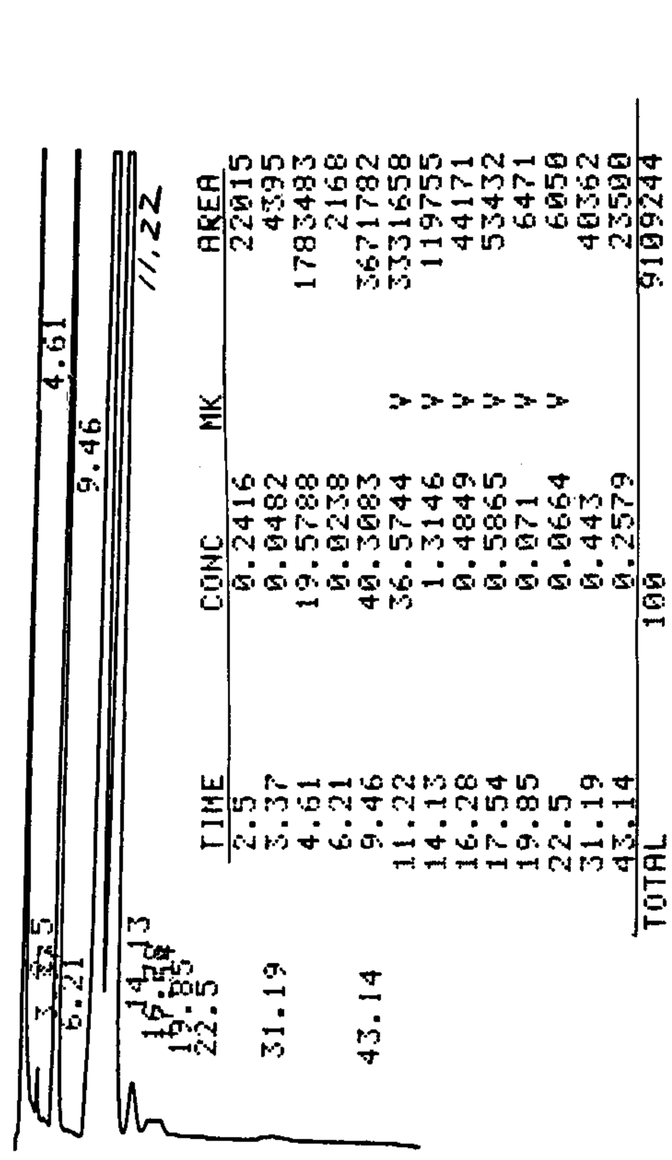
3.2 Rice bran oil

The moisture, oil content and its acid value of bran and oil were tested, and the results are shown in **Table 2**.

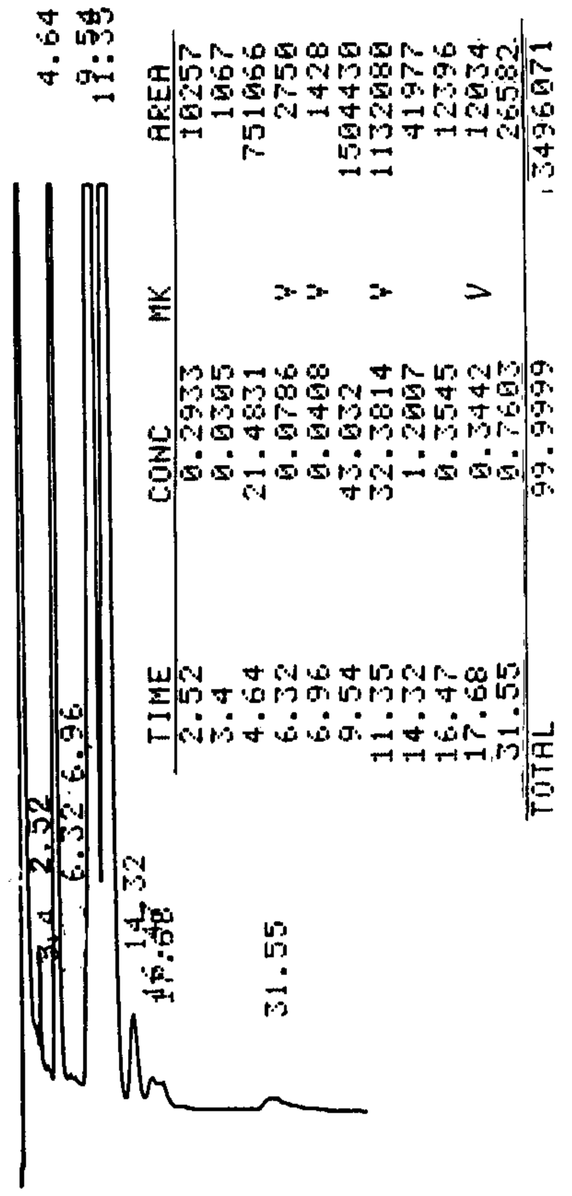
It is confirmed that Chinese rice bran has less oil content than Japanese rice bran about 4 or 5%, and the grain size is somewhat small, for an example, 60 mesh pass, 80%. The polishing ratio of Chinese rice mill system will be larger than that of Japanese process, and the rice mill system will be European type. The GLC patterns of Chinese rice bran lipids compared with that of Japanese ones are shown in **Figure 4**.

The summary of these patterns is shown in **Table 3.**

In **Table 3**, from the A to D items are Chinese bran oil, and the item E is Japanese bran oil for control. Each pattern was emphasized for minor component fatty acid, and as the result, ordinary fatty acids scaled out. However, it can be reached the conclusion that the fatty acid compositions of all Chinese rice bran oils are similar to Japanese one, though the



4-A



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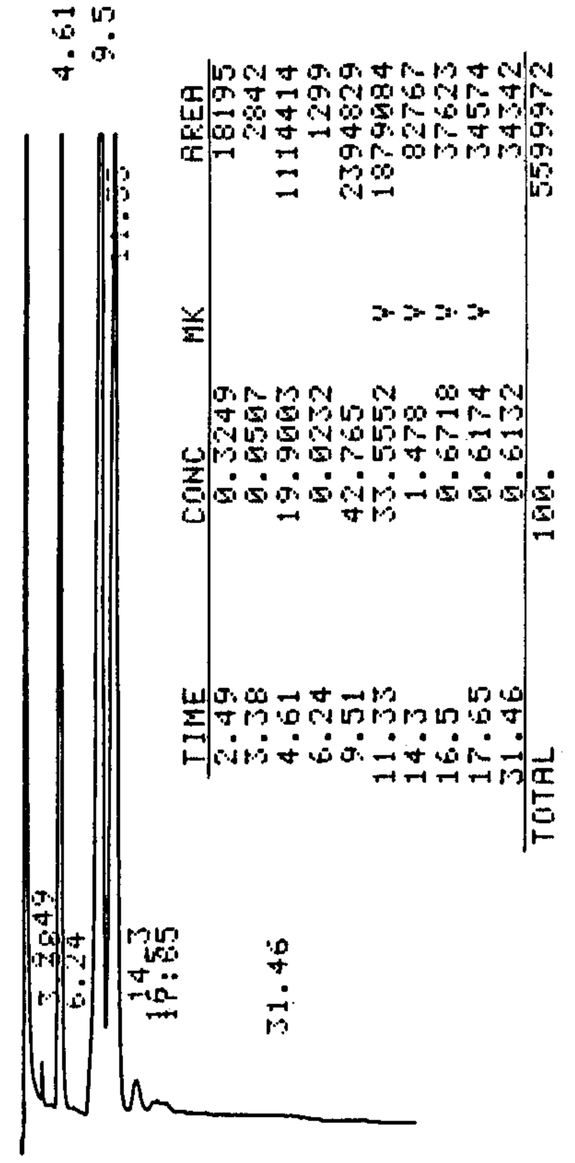

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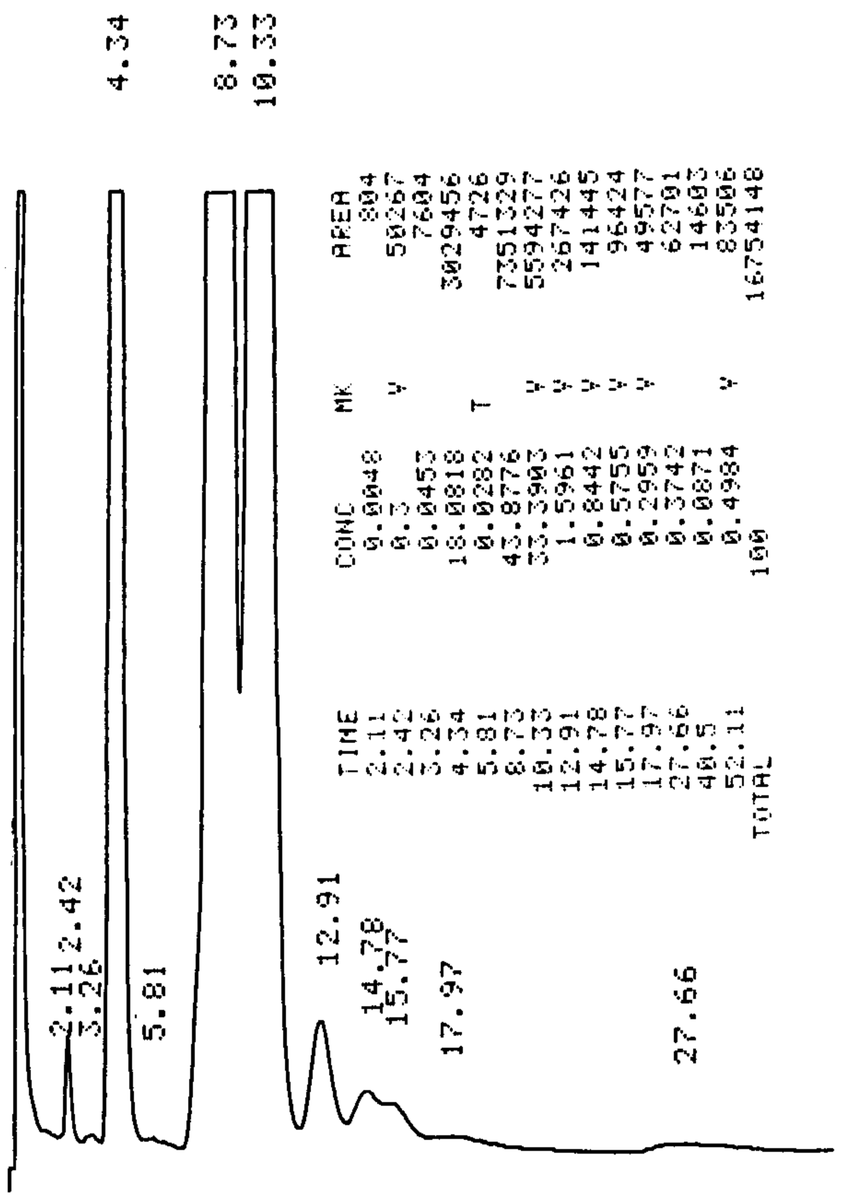
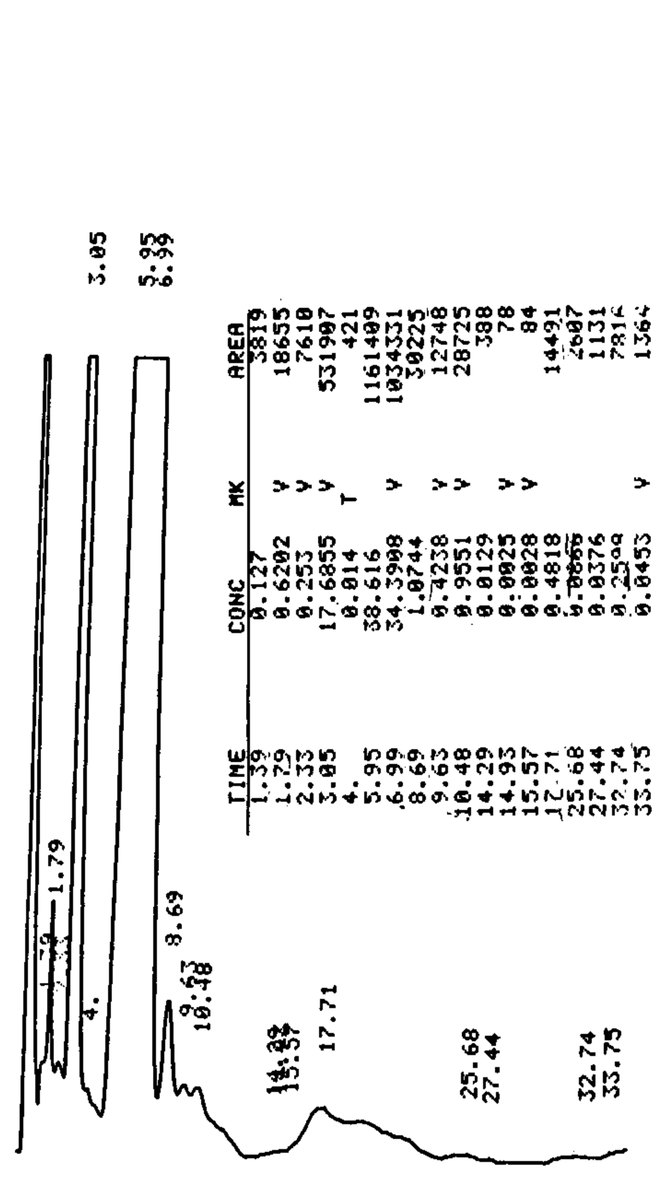


4-D



4-E

Fig. 4 GLC Charts of Rice bran lipids

Table 3 Fatty acid composition of Rice bran lipids by GLC*

	C–14, 16–0,		18–0, –1, –2, –3,		20–0, –1,		22–0, –1,	24–0, –1
A	0.2	19.6	40.3	36.6	1.3	0.5	0.6	0.4
B	0.3	21.5	43.0	32.4	1.2	0.4	0.3	0.8
C	0.3	19.9	42.8	33.6	1.5	0.7	0.6	0.6
D	0.3	18.1	43.9	33.4	1.6	0.8	0.6	0.4
E	0.3	17.4	41.0	35.0	1.2	0.4	0.4	0.4

* OV 17 column was used, because EGA, authors applied ordinarily for fatty acids, was not arranged.

south Chinese long grain rice bran sample was not collected. One of the authors confirmed previously about the long rice in Pakistan[6]. In the present report, the USM was not discussed, because it was already discussed in the preceding reports, and the authors had discovered that the difference of the USM composition by means of GLC pattern had been small.

4. Conclusions

Chinese teaseed oil was analysed after collecting the seed at the planted field in Funan province, and was confirmed about the contents of the minor component fatty acid which was not perfectly cleared in the preceding reports.

Rice bran and its lipids in north east and middle China were collected and analysed. As the result, it was found that the fatty acid compositions of them were similar to that of Japanese rice bran lipid.

Chinese teaseed oil and rice bran oil are valuable as edible vegitable oil after refining.

Acknowledgements

The authors keenly thank Japan and China governments. They gave to the authors a good chance of investigation about the domestic oilseeds. The authors also thank several oil mills in Japan and China Republics.
(Received, Sept. 19, 1986)

References

1) Yasuhiko Takeshita and Tian Ren Lin, "Study on the Composition and Industrial Evaluation of Chinese Oil Seeds I". —Rice Bran Oil and Teaseed Oil—, Transact. of Kokushikan Univ. Faculty of Engineering, **19**. 1 (1986).
2) Y. Takeshita. Tian Ren lin, "Development of Oil Industry in China". Transactions of Kokushikan Univ. Faculty of Engineering, **19**. 89 (1986).
3) J. Am. Oil Chem. Soc. **62**. (8), 1170 (1985).
4) Chinese government booklet for Japan (Industrial) (1984)
5) Y. Takeshita, Kokushikan Univ. **16**, 217 (1983); **14**, 86 (1981)
6) ibid., **18**, 29 (1985).
7) Y. Takeshita, "Recent Advances in Cereal Oil Processing Technology" ibid. **17**, 80 (1984): **18**, 29 (1985).
8) A. E. Bailey, Industrial Oils and Fats Products. 3rd ed., Interscience Pub., New York (1970). p. 211.
9) Tian Ren lin. "Cereals Lipid", Chinese Pub. Beijing (1983)
10) M. Tsujimoto, "Japanese Vegetable Oils", Maruzen, Tokyo (1909), p. 394
11) M. Tsujimoto, Transactions of Tokyo Engineering Colledge **4**, 77 (1910)
12) M. Tsujimoto, Tokoshi, (National Chem. Lab. Indust. Report) **4**, 54 (1910)
13) M. Tsujimoto, National Forestry Lab. Report, **5**, 182 (1910)

14) S. Ueno and S. Ueda, J. Soc. Chem. Ind. Japan **41**, 326B (1938)
15) T. Tsuchiya, "The Handbook of Oil Chemistry", Revised ed. Sangyo-Tosho, Tokyo, (1949), p. 304
16) H. N. Griffiths, T. P. Hilditch and E. C. Jones, J. Soc. Chem. Ind. 53. 13T, 75T (1934)
17) A. H. Weerakoon, Thesis, University of Liverpool, (1952)
18) T. P. Hilditch, "The Chemical Constitution of natural Fats", 3rd ed., Wiley, New York. (1956), p. 235
19) E. W. Eckey, "Vegetable Fats and Oils", Reinhold, New York, (1954)
20) R. T. Holman, W. O. Landberg and T. Malkin, "Progress in the Chemistry of Fats and other Lipid", vol. **1**, **2**, **3**, Pergamon, New York (1952. '54, '55)
21) Lane, J. Soc. Chem. Ind., 1083 (1901)
22) T. Itoh, T. Tamura & T. Matsumoto, J. Am. Oil Chem. Soc. **50**, 122 (1973)
23) T. Tamura et al., Yukagaku, (J.JOCS) **30**, (5) 307: (9) 505 (1981)

中国産油糧種子の研究　第2報

——米ヌカ油と茶実油の組成と工業的評価——

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要旨　前報で中部中国産油糧種子の油脂工業化学的な検討をしたが，ここでは東北地区の米ヌカ等と日本南部，九州産米ヌカとも比較して，米ヌカの粒度，油分の差はあるが，油脂の脂肪酸組成は揚子江以北の米ヌカとGLCで類似のパタンを示し，いずれもJaponica種の稲の子実に由来するものと認めた。

茶実油の微量成分脂肪酸の一つとして22C, F-1脂肪酸の存在について前報で検討したが，著者が現地で採取した種子を今回比較分析の結果，20C, 22C等の脂肪酸はそれぞれ0.5%程度は存在するが，前報茶実原油でこの酸が2%以上も検出されたのは製油工程などで混入した十字花植物の種子に影響されたものと認めた。湖南省産茶実は花が山茶花に似ているが，油の組成は日本の茶油よりもツバキ油に近いことを見出し，茶実油，米ヌカ油ともに食用植物油資源として優れていると評価した。

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