# RESULTS AND DISCUSSION

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## Physical and Chemical Properties of Soybean Oils :

The effect of some technological and physical treatments either on soybean oil or seeds (washing the oil with hot water, roasting the seeds and soaking the seeds in boiling water) on some physical and chemical properties of soybean oils were studied and the results are illustrated in Table (1).

### A- Refractive Index :

From the results in Table (1), it could be noticed that the refractive index (25°C) was somewhat affected with the physical treatments as it was 1.4739 for crude soybean oil, treatment 1; 1.4736 for washing Soybean oil with hot water and 1.4731 for oil from roasted seeds. Soybean oil obtained from soaked seeds in boiling water,(treatment 4) had a lower value being 1.4721. This could be due to decreasing amount of di- and tri-unsaturated fatty acid glycerides.

### B- Acid value :

Data presented in Table (1) indicated that the acid value of crude Soybean oil was 0.98, while it was 1.32, 1.09 and 1.17 for oil washed with hot water, oil from roasted seeds and that from soaked seeds in boiling water respectively.

Table (1) : Physical and chemical properties of Soybean oils.

| Treatments / Oil properties | Treatment (1) | Treatment (2) | Treatment (3) | Treatment (4) |
|---|---|---|---|---|
| Refractive index (25°C) | 1.4739 | 1.4736 | 1.4731 | 1.4721 |
| Acid value | 0.98 | 1.32 | 1.09 | 1.17 |
| Acidity (oleic %) | 0.48 | 0.66 | 0.55 | 0.59 |
| Peroxide value (mEq/K) | 3.72 | 10.10 | 3.67 | 3.53 |
| Iodine value (Hanus) | 134.5 | 133.4 | 132.2 | 131.9 |
| Unsaponifiable matter % | 0.73 | 0.66 | 0.76 | 2.2 |

Treatment (1) : Control (crude Soybean oil).

Treatment (2) : Soybean oil washed with hot water 90°C (Degumming).

Treatment (3) : Soybean oil extracted from roasted seeds.

Treatment (4) : Soybean oil extracted from soaked seeds in boiled water

Acidity calculated as oleic acid was 0.48, 0.66, 0.55 and 0.59 % for the four treatments respectively. Lower acidity indicates that no hydrolysis occurred for the oils obtained.

C- Peroxide Value :

The peroxide value of oils obtained from treatment 1, 3 and 4 showed slight difference as it was 3.72, 3.67 and 3.53 respectively. Oil washed with hot water (treatment 2) obtained a high value of 10.10, which migth be due to the effect of hot water on oil and formation of peroxides.

D- Iodine Value :

The iodine values of oils obtained from the four treatments showed slight decrease as they were 134.5, 133.4, 132.2 and 131.9 respectively. Data obtained agreed with those reported by Collins and Sedgwick (1959); A.O.C.S. (1960); Itoh et al.(1973) and Smouse (1979).

E- Unsaponifiable Matter :

The unsaponifiable matter percent showed low values between oils obtained from the first three treatments as they were 0.73, 0.66 and 0.76 respectively. However, oil obtained from treatment (4) had a high value of 2.2 %,which might be due to increase of hydrocarbon or sterol compounds. Results obtained nearly agreed with those mentioned by the A.O.C.S. (1946) and El-Tahawi (1982).

Table (2) : Relative percentages of fatty acids (F.A) of Soybean oils.

| Components | Treatment (1) | Treatment (2) | Treatment (3) | Treatment (4) |
|---|---|---|---|---|
| Total Satd. F.A. | 16.35 | 15.51 | 16.16 | 14.00 |
| T. mono-unsatd. F.A. | 16.13 | 17.37 | 18.20 | 23.94 |
| T. di-unsatd. F.A. | 63.02 | 62.77 | 60.87 | 58.67 |
| T. tri-unsatd. F.A. | 4.50 | 4.34 | 4.77 | 3.39 |
| Total unsatd. F.A. | 83.65 | 84.48 | 83.84 | 86.00 |

Treatment (1) : Control (Crude Soybean oil).

Treatment (2) : Soybean oil washed with hot water 90°C

Treatment (3) : Soybean oil extracted from roasted seeds.

Treatment (4) : Soybean oil extracted from soaked seeds in boiled water.

Table (3) : Relative percentages of Fatty acids components of Soybean oils.

| Component | | Treatment (1) | Treatment (2) | Treatment (3) | Treatment (4) |
|---|---|---|---|---|---|
| **Saturated fatty acids** | | | | | |
| - Caprylic | $C_8$ | - | 0.10 | 0.14 | - |
| - Capric | $C_{10}$ | - | - | 0.12 | - |
| | $C_{11}$ | - | - | 0.10 | - |
| - Lauric | $C_{12}$ | - | - | 0.10 | - |
| | $C_{13}$ | 0.45 | - | 0.08 | - |
| - Myristic | $C_{14}$ | - | - | 0.14 | - |
| - Palmitic | $C_{16}$ | 13.20 | 12.98 | 12.73 | 11.09 |
| - Stearic | $C_{18}$ | 2.70 | 2.43 | 2.75 | 2.91 |
| **Unsaturated fatty acids** | | | | | |
| - Palmitoleic | $C_{16:1}$ | - | - | - | 0.97 |
| - Heptadecenoic | $C_{17:1}$ | - | - | - | 5.45 |
| - Oleic | $C_{18:1}$ | 16.13 | 17.37 | 18.20 | 17.52 |
| - Linoleic | $C_{18:2}$ | 63.02 | 62.77 | 60.87 | 58.67 |
| - Linolenic | $C_{18:3}$ | 4.50 | 4.34 | 4.77 | 3.39 |

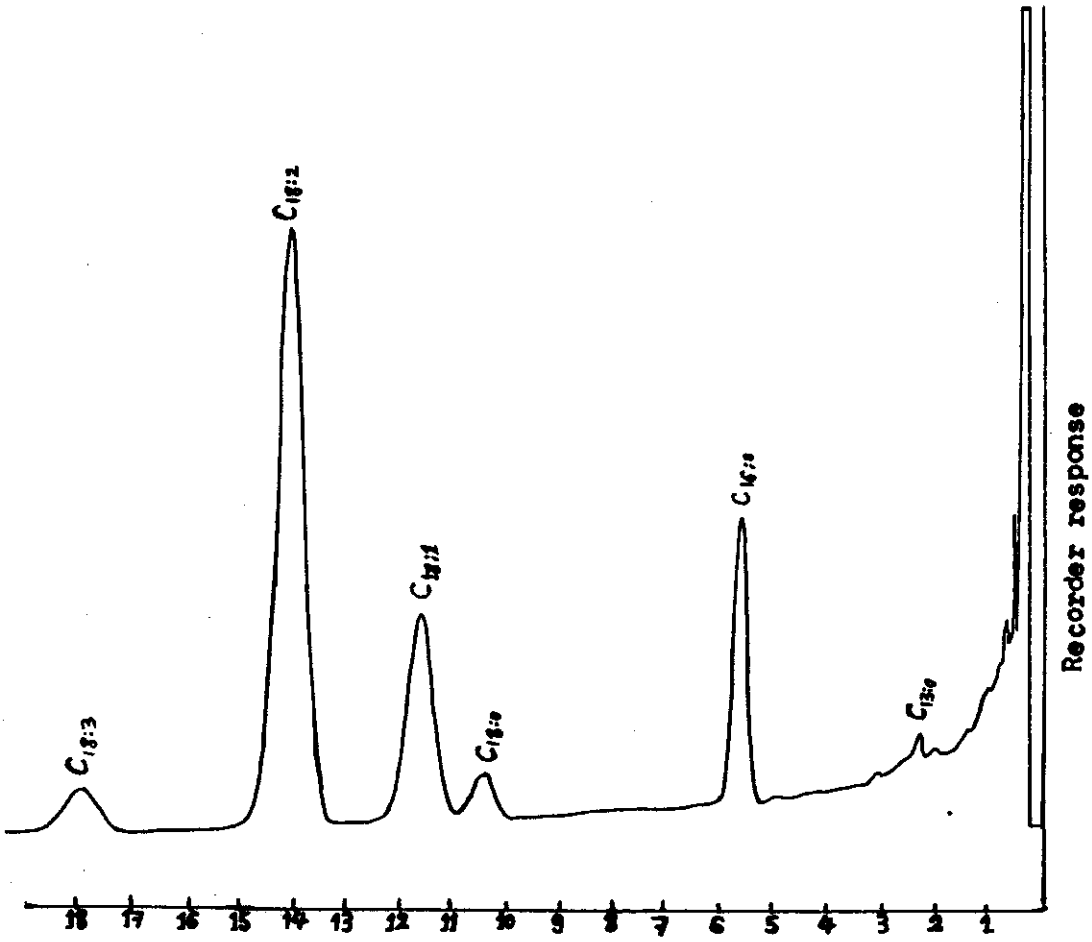


Fig. 1 : G.L.C. of fatty acid methyl esters of crude Soybean oil.

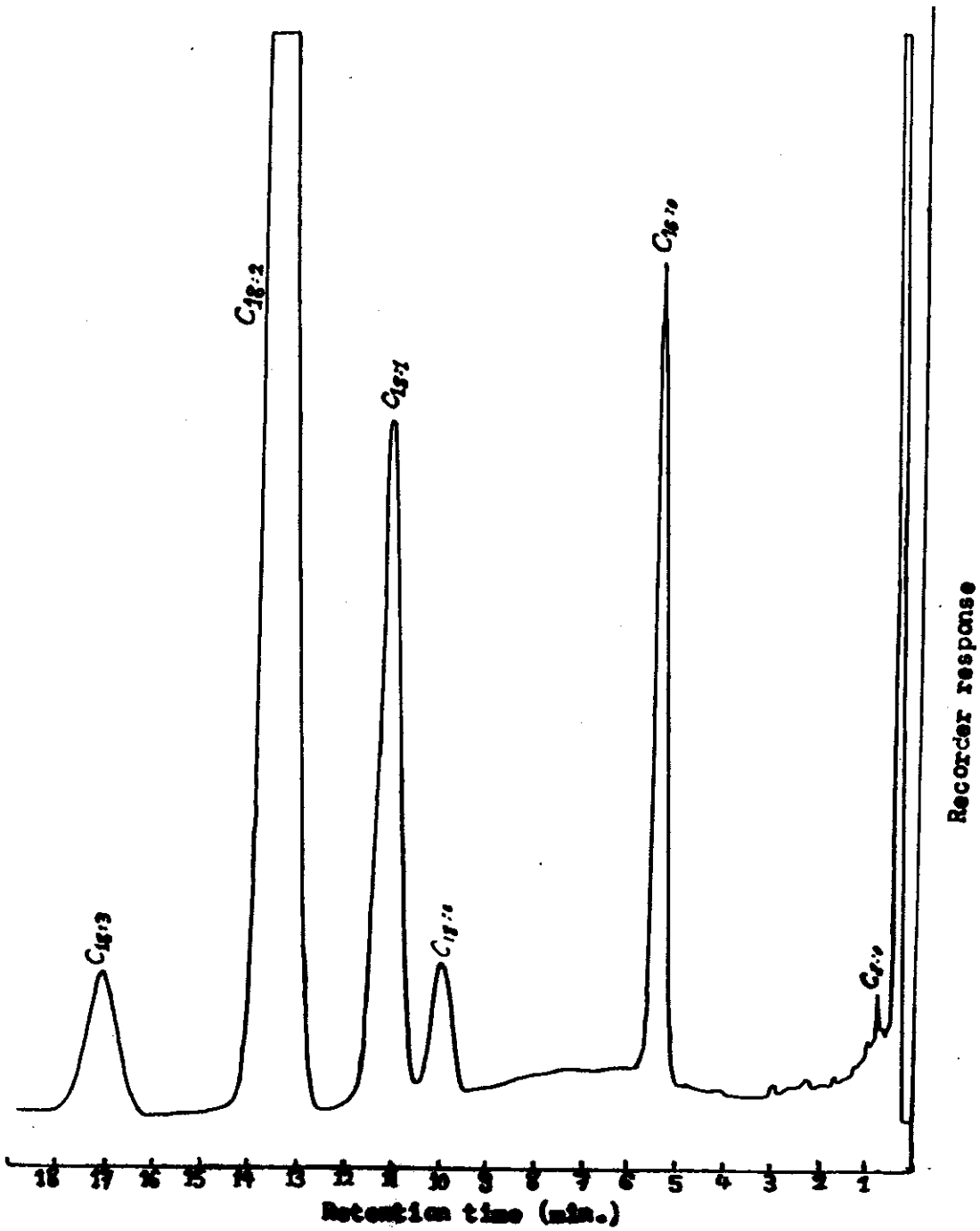


Fig. 2 : G.L.C. of fatty acid methyl esters of degummed Soybean oil.

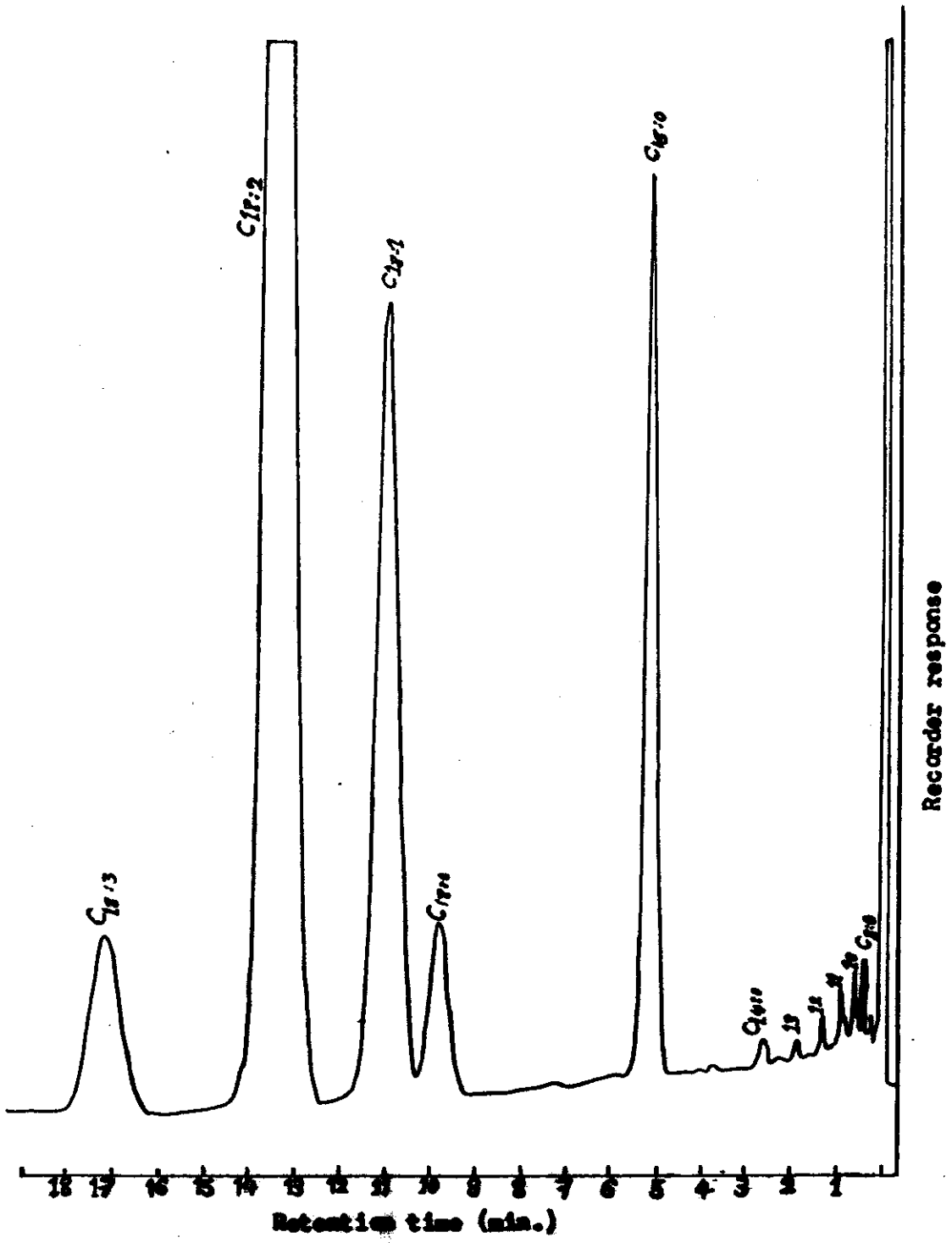


Fig. 3 : G.L.C. of fatty acid methyl esters of roasted Soybean seeds oil.

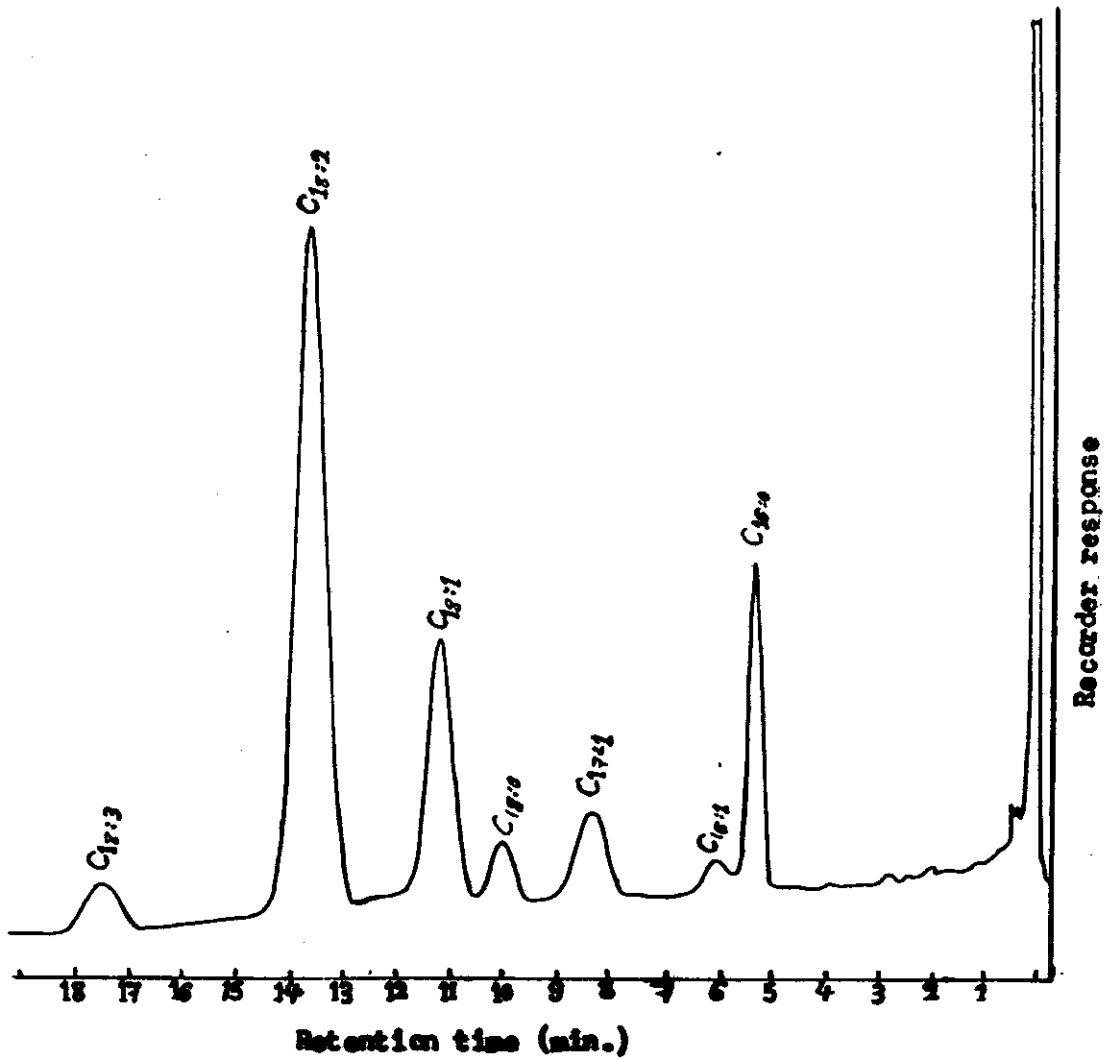


Fig. 4 : G.L.C. of fatty acid methyl esters of oil of soaked Soybean seeds in boiling water.

It can be concluded that palmitic acid which represented the major saturated fatty acid, and linoleic acid as the major unsaturated fatty acid showed a gradual decrease among all treatments.

It is clear that physical and technological treatments for either Soybean oil or seeds had affected the fatty acids composition and their percentages.

Polar and Non-polar Fractions and Squalene Content of Soybean Oils:

Total hydrocarbons (non-polar fraction) content in unsaponofiable matter of Soybean oils under investigation were separated by column chromatography, where eluting with petroleum ether, collected and weighed.

Results are shown in Table (4). It could be observed that total hydrocarbons of oil of treatment (4) showed a higher percentage, 74.45 %, while unsaponifiable matter of oils obtained from treatments 1, 2 and 3 contained 28.08, 16.86 and 14.12 % hydrocarbons respectively.

Total hydrocarbons calculated and expressed as percentages of oil were 0.20, 0.11, 0.11 and 1.64 % in the four treatments respectively.

Results obtained agreed with that reported by Hoffman et al.(1962), who found that total hydrocarbons in unsaponifiable matter from crude Soybean oil ranged from 15 to 30 %, while Hoffman et al.(1964) reported that the unsaponifiables of crude Soybean oil had 15 % hydrocarbons.

The unsaturated hydrocarbons as squalene in Soybean oils of the four treatments were 15.86, 23.38, 20.77 and Zero mg/100 gm. oil respectively as shown in Table (4).

These results showed that oil of treatment (4) was rich in unsaponifiable matters and hydrocarbons, while squalene was not detected. Meanwhile, oil of the 2nd treatment had the highest value of squalene content.

Table (4) : Polar and non-polar fractions % and squalene content of unsaponifiable matter of Soybean oils.

| | Treat-ment (1) | Treat-ment (2) | Treat-ment (3) | Treat-ment (4) |
|---|---|---|---|---|
| • % unsaponifiable matter | 0.73 | 0.66 | 0.76 | 2.20 |
| • % total hydrocarbons (Non-polar fraction) | | | | |
| -in unsap. matter | 28.08 | 16.87 | 14.12 | 74.45 |
| -in oil | 0.20 | 0.11 | 0.11 | 1.64 |
| • Squalene (mg/100 gm oil) | 15.86 | 23.38 | 20.77 | 00.00 |
| • % Squalene/total hydro-carbons | 7.93 | 21.25 | 18.88 | 00.00 |
| /Unsap. | 2.22 | 3.58 | 2.66 | 00.00 |
| • % Polar fraction | | | | |
| - in unsap. matter | 71.91 | 83.13 | 85.88 | 25.54 |
| - In oil | 0.52 | 0.55 | 0.65 | 0.56 |

Treatment (1) : Control (Crude Soybean oil)

Treatment (2) : Soybean oil washed with hot water 90°C

Treatment (3) : Soybean oil extracted from roasted seeds.

Treatment (4) : Soybean oil extracted from soaked seeds in boiled water

Squalene content of crude Soybean oil nearly agreed with that mentioned by Erickson et al.(1980), 14 mg/100 gm. oil.

The polar compounds in the unsaponifiable matter of Soybean oils, which consisted mainly of tocopherols and sterols, eluted with diethyl ether were collected and determined. Also in the same table, the polar fraction of oil of treatment (4) showed a lower percentage in the unsaponifiable matter of only 25.54 %, while those of treatment 1,2 and 3 were 71.91 %, 83.13 % and 85.88 % respectively. The percentage of this fraction calculated and expressed as percentage of oil were 0.52 %, 0.55 %, 0.65 % and 0.56 % for the four treatments respectively.

Identification of Unsaponifiable Matter Compounds by G.L.C. :

The unsaponifiable matter of Soybean oils under investigation were identified using Gas Chromatographic technique. The components were identified and the relative percentage of each unsaponifiable matter compound was calculated. The results were illustrated in Tables (5,6) and Figs. (5-8).

The unsaponifiable matter of crude Soybean oil (control) contained 43.61 % hydrocarbons, where $C_{27}$ as a major compound, amounted to 25.52 %, while squalene compound was detected in a moderate amount of 7.67 %. These results differ from those reported by Evans et al.(1964) who found that squalene was the major component of the hydrocarbons fraction. On the other hand, results in Table (6) showed that other hydrocarbon compounds namely $C_{22}$ , $C_{23}$ , $C_{25}$ , $C_{29}$ , $C_{31}$ and $C_{32}$ were identified in minor concentrations. Their relative percentages were 1.65 %, 1.68 %, 1.91 %, 2.01 %, 0.75 % and 0.75 % respectively.

It is evident from Tables (5,6) and Figs.(5-8) that all treatments under investigation induced remarkable changes in the hydrocarbon compounds of Soybean oil. Treatments 2 and 3 showed a significant decrease in hydrocarbons of their oils obtained, however the rate of decrease was higher in treatment 3 than in treatment 2 as it decreased to 20.75 and 34.43 % respectively. Total hydrocarbons showed a high value in oil of treatment 4, as it increased to 86.71 %.

Table (5) : Relative percentage of unsaponifiable matters of Soybean oil by G.L.C.

| Components | Treatment (1) | Treatment (2) | Treatment (3) | Treatment (4) |
|---|---|---|---|---|
| Total hydrocarbons | 43.61 | 34.34 | 20.75 | 86.71 |
| $\gamma$ -tocopherol | 3.27 | 3.50 | 4.40 | 0.66 |
| Total sterols | 53.11 | 62.06 | 74.84 | 12.61 |

Treatment (1) : Control (Crude Soybean oil).

Treatment (2) : Soybean oil washed with hot water 90°C

Treatment (3) : Soybean oil extracted from roasted seeds

Treatment (4) : Soybean oil extracted from soaked seeds in boiled water.

Table (6) : Relative percentage of unsapenifiable matter components of Soybean oils by G.L.C.

| Peak No. | Components | R.R.T ** | Treatments | | | |
|---|---|---|---|---|---|---|
| | | | (1) | (2) | (3) | (4) |
| 1 | $C_{20}$ n- eicosane * | 0.0200 | - | - | - | - |
| 2 | $C_{22}$ n- docosane * | 0.0507 | 1.65 | - | - | 20.41 |
| 3 | $C_{23}$ n- tricosane | 0.0803 | 1.68 | - | 0.20 | 20.41 |
| 4 | $C_{24}$ n- tetracosane | 0.1004 | - | - | 0.13 | - |
| 5 | $C_{25}$ n- pentacosane | 0.1205 | 1.91 | - | - | 11.62 |
| 6 | $C_{27}$ n- heptacosane | 0.1511 | 25.52 | 2.65 | 1.73 | 21.58 |
| 7 | $C_{28}$ n- octacosane * | 0.1712 | - | - | 0.38 | 4.23 |
| 8 | $C_{29}$ n- nonacosane * | 0.1902 | 2.01 | 0.64 | - | 3.65 |
| 9 | $C_{30}$ Squalene * | 0.2209 | 7.67 | 29.18 | 16.58 | - |
| 10 | $C_{31}$ n- hentricontane | 0.2410 | 0.75 | - | - | 1.83 |
| 11 | Unknown (1) | 0.2809 | - | - | - | 0.66 |
| 12 | Unknown (2) | 0.3125 | 1.66 | 1.43 | 0.94 | 1.66 |
| 13 | $C_{32}$ n-dotriacontane * | 0.4217 | 0.75 | 0.53 | 0.79 | 0.66 |
| 14 | $\delta$ -tocopherol | 0.5132 | 3.27 | 3.50 | 4.40 | 0.66 |
| 15 | Cholesterol * | 0.6332 | 0.45 | 0.27 | 0.51 | 0.83 |
| 16 | Campesterol * | 0.8234 | 8.30 | 8.22 | 11.42 | 1.99 |
| 17 | Stigmasterol * | 0.8816 | 4.83 | 5.57 | 8.25 | 0.83 |
| 18 | B-sitosterol * | 1.0000 | 34.40 | 39.73 | 46.20 | 8.96 |
| 19 | Unknown (3) | 1.1428 | 2.11 | 3.18 | 3.60 | - |
| 20 | $\Delta^7$ - Avenasterol | 1.3636 | 3.62 | 4.24 | 4.96 | - |
| 21 | Unknown (4) | 1.4690 | - | 0.85 | 0.38 | - |
| 22 | Unknown (5) | 1.6428 | - | - | 0.42 | - |

* Standard compounds injected.
** Relative retention time for B-sitosterol was given a value of 1.00.

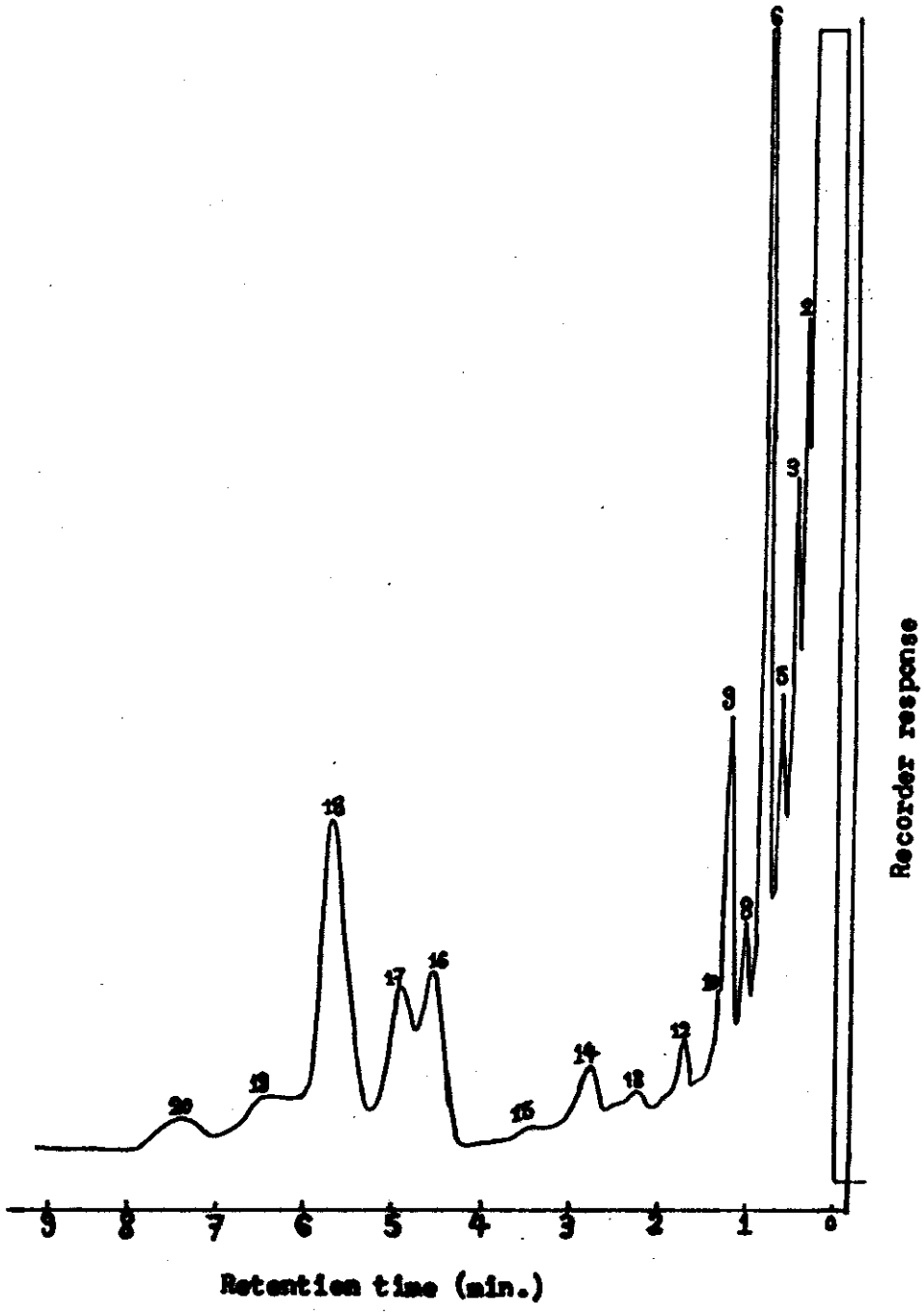


Fig. 5 : G.L.C. of unsaponifiable matters of crude Soybean oil.

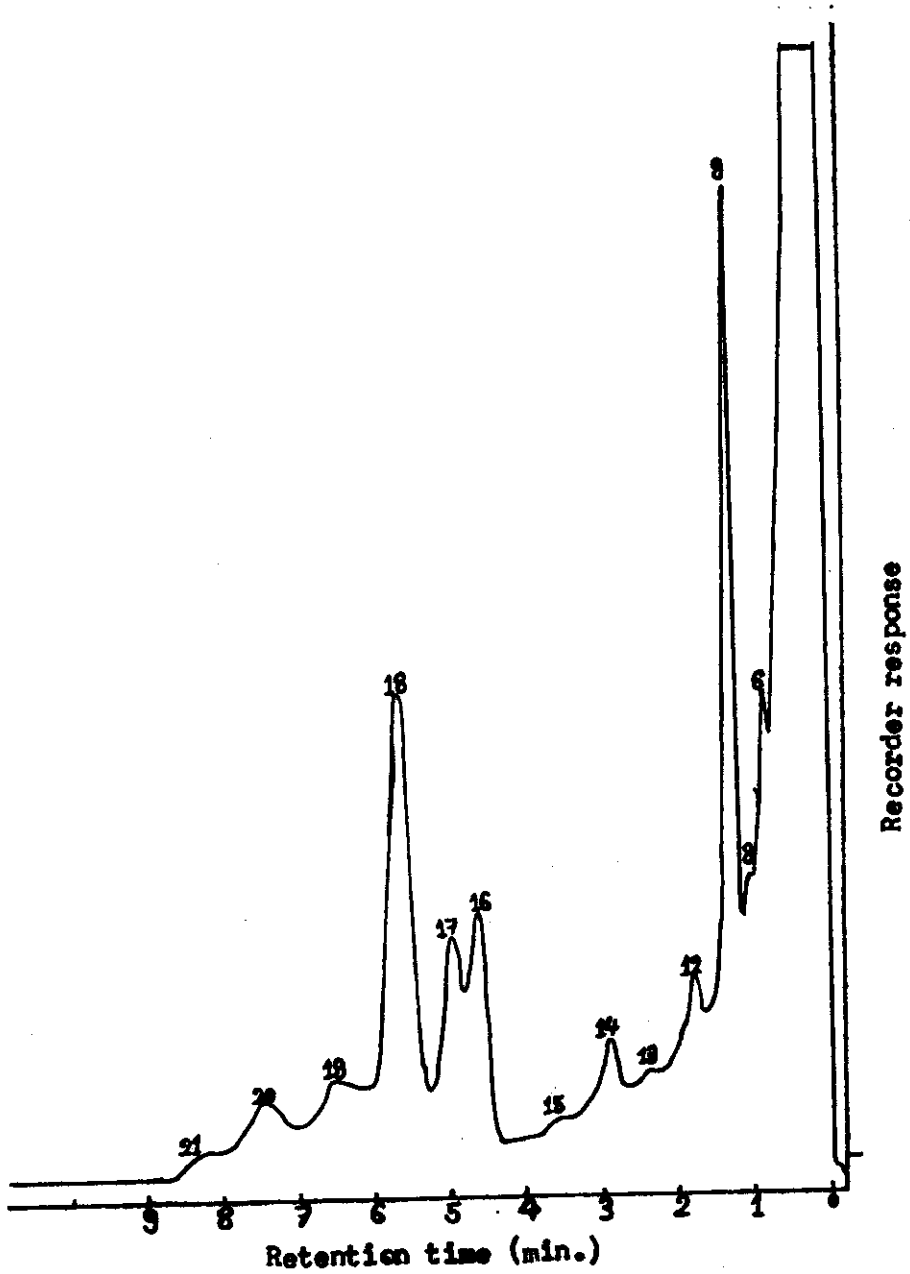


Fig. 6 : G.L.C. of unsaponifiable matters of degummed Soybean oil.

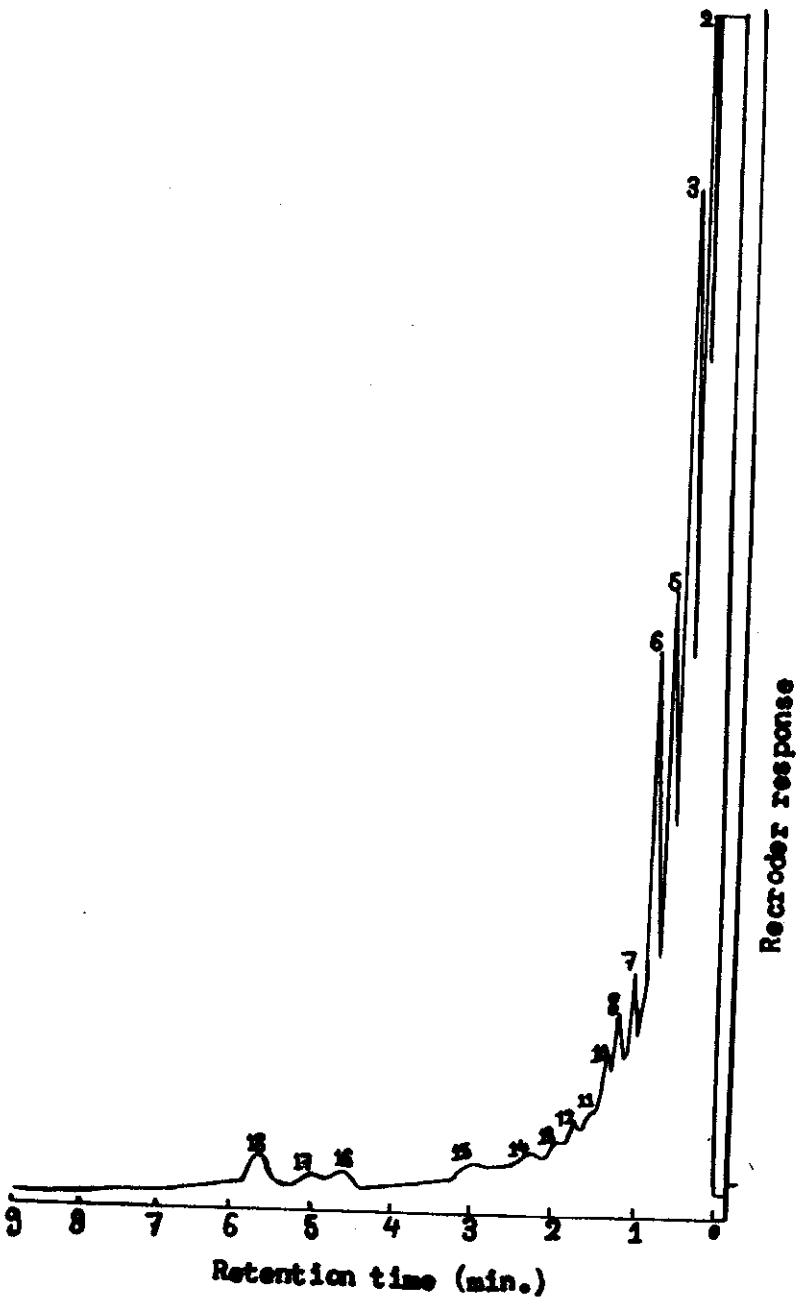


Fig. 8 : G.L.C. of unsaponifiable matters of oil of soaked Soybean seeds in boiling water.

The major hydrocarbon compound ($C_{27}$) was 25.52, 2.65, 1.73 and 21.58 % in oils of the four treatments respectively. The lower values were those of oils of treatments 2 and 3, however the lowest value was that of oil of the third treatment. Moreover, treatments 2 and 3 increased the relative percentage of squalene compound to 29.18 % and 16.58 % respectively. In oil extracted from treatment 4, squalene was not detected, however, $C_{22}$, $C_{23}$ and $C_{25}$ hydrocarbon compounds increased to 20.41, 20.41 and 11.62% respectively. On the other hand, $C_{28}$ was detected only in oils of treatments 3 and 4, however its relative percentage was higher in treatment 4.

The unsaponifiable matter of oils of the four treatments contained 3.27 %, 3.50 %, 4.40 % and 0.66% δ-tocopherol respectively. As shown in Table (5) oil of the last treatment obtained the lowest value.

The unsaponifiable matter of crude Soybean oil contained 53.11 % sterols, were fractionated to different six sterol compounds. B-sitosterol which represented the predominant sterol compound, emounted to 34.40 %, while campesterol was found in a moderate content of 8.30 %. On the other hand, cholesterol, stigmasterol, unknown (3) and $\Delta^7$-avenasterol were minor compounds. Data obtained agree with those of Itoh et al(1973) and Weihrauch and Gardner (1978) who mentioned that Soybean oil sterols were fractionated to only six sterols (B-sitosterol, campesterol, stigmasterol, $\Delta^5$-avenasterol, $\Delta^7$-avenasterol and $\Delta^7$-stigmasterol) and chomesterol was not

Table (7) : The relative percentage of the volatile compounds of Soybean oils.

| No. | Components | R.T. Cm. | Log R.T | Treatments | | | |
|---|---|---|---|---|---|---|---|
| | | | | (1) | (2) | (3) | (4) |
| 1 | Pentanal** | 0.3 | 2.47 | - | - | 80.91 | 7.52 |
| 2 | Hex-2-enal* | 0.5 | 2.69 | 82.03 | 3.89 | 0.80 | 84.38 |
| 3 | 2-pentenone * | 0.6 | 2.78 | - | - | - | - |
| 4 | 2-propanol * | 0.6 | 2.78 | - | - | - | - |
| 5 | Hexanal * | 0.7 | 2.85 | - | 73.74 | 18.27 | - |
| 6 | 2-octanol * | 1.0 | 3.00 | 1.56 | 0.14 | - | 0.22 |
| 7 | Nonanol * | 1.4 | 3.15 | - | - | - | - |
| 8 | Heptanal * | 2.3 | 3.36 | 7.03 | - | - | 7.86 |
| 9 | Unknown (1) | 3.3 | 3.52 | - | 22.26 | - | - |
| 10 | Octanal * | 5.2 | 3.71 | 9.37 | - | - | - |
| 11 | Nonanal * | 13.8 | 4.31 | - | - | - | - |

Treatment (1) : Crude Soybean oil

Treatment (2) : Soybean oil washed with hot water 90°C

Treatment (3) : Soybean oil extracted from roasted seeds

Treatment (4) : Soybean oil extracted from soaked seeds in boiling water.

* Standard compounds injected

** The compound was identified according to the method of Eisner et al.(1963) using log R.T. against number of carbon atoms.

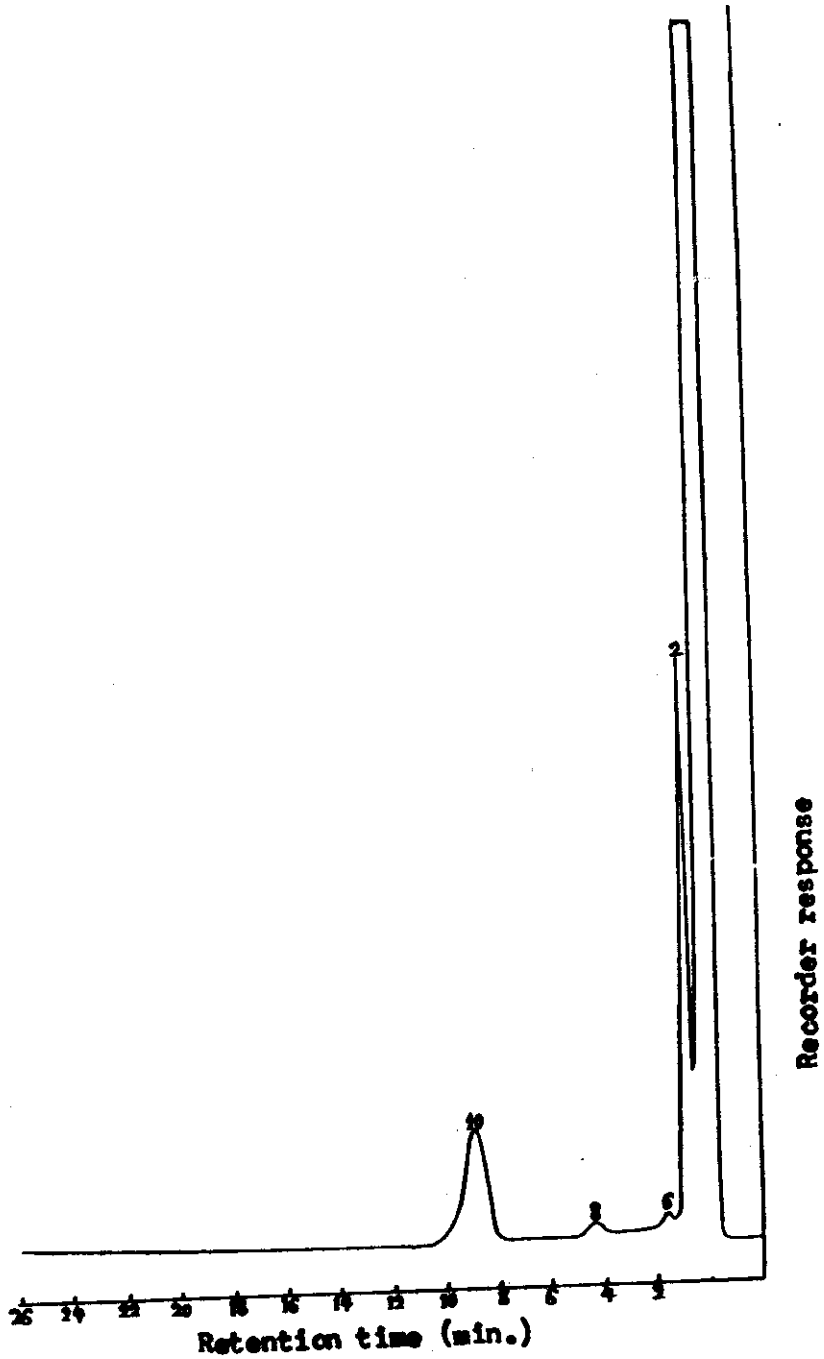


Fig. 9 : G.L.C. Head space of volatile compounds of crude Soybean oil.

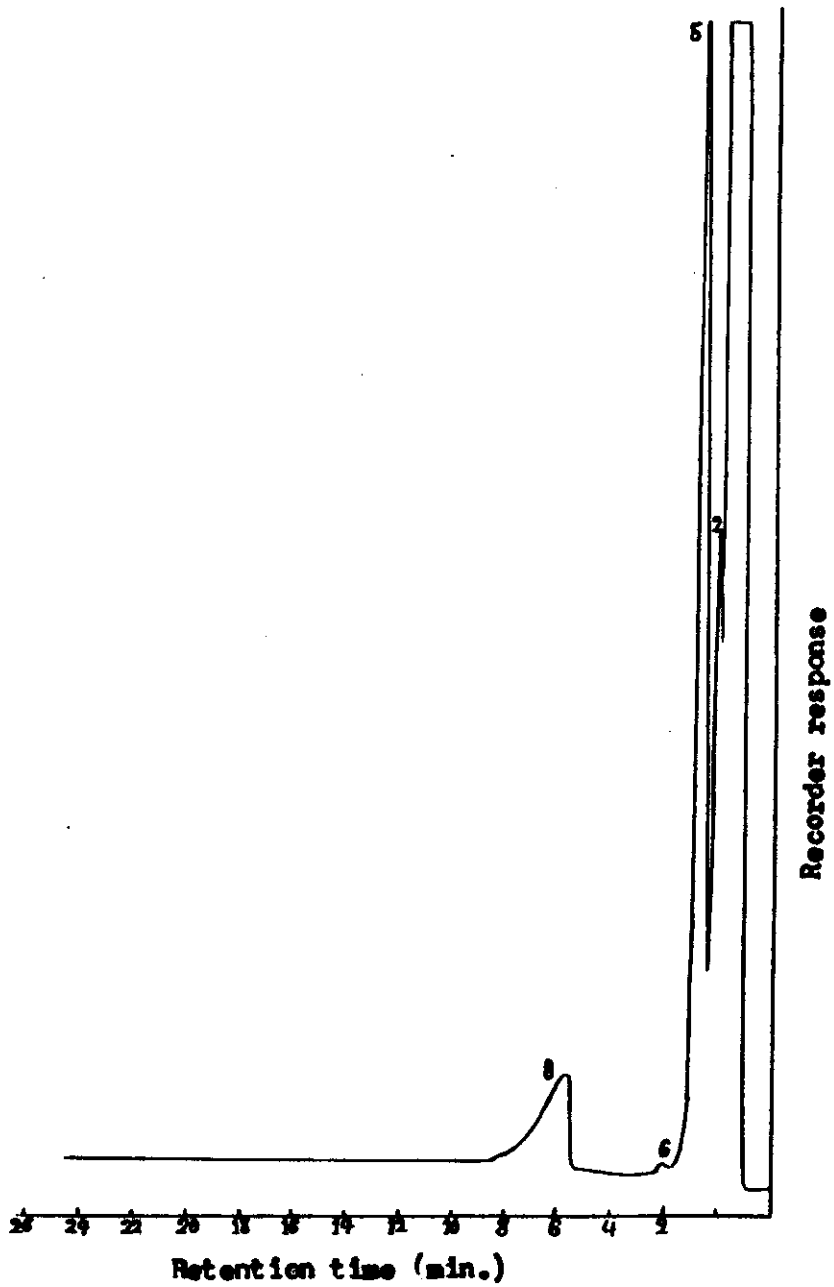


Fig. 10 : G.L.C. Head space of volatile compounds of degummed Soybean oil.

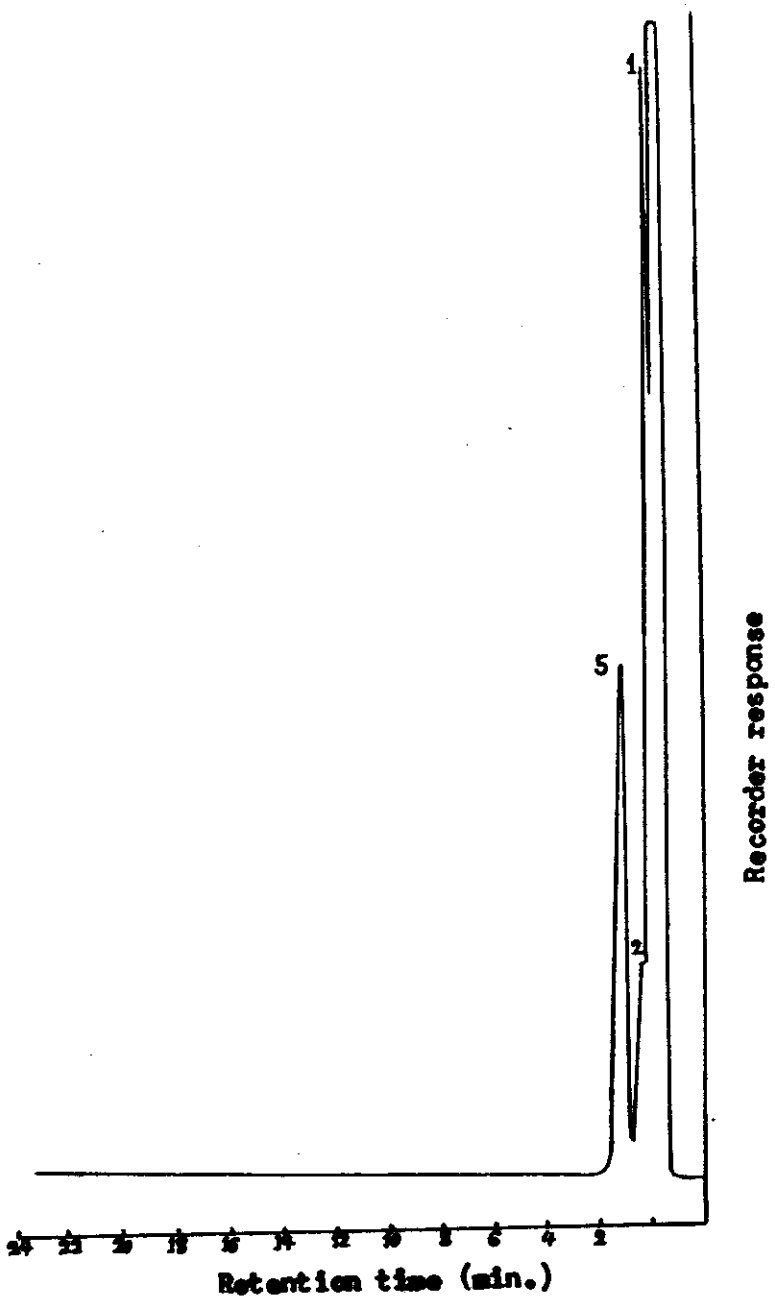


Fig. 11 : G.L.C. Head space of volatile compounds of roasted Soybean seeds oil.

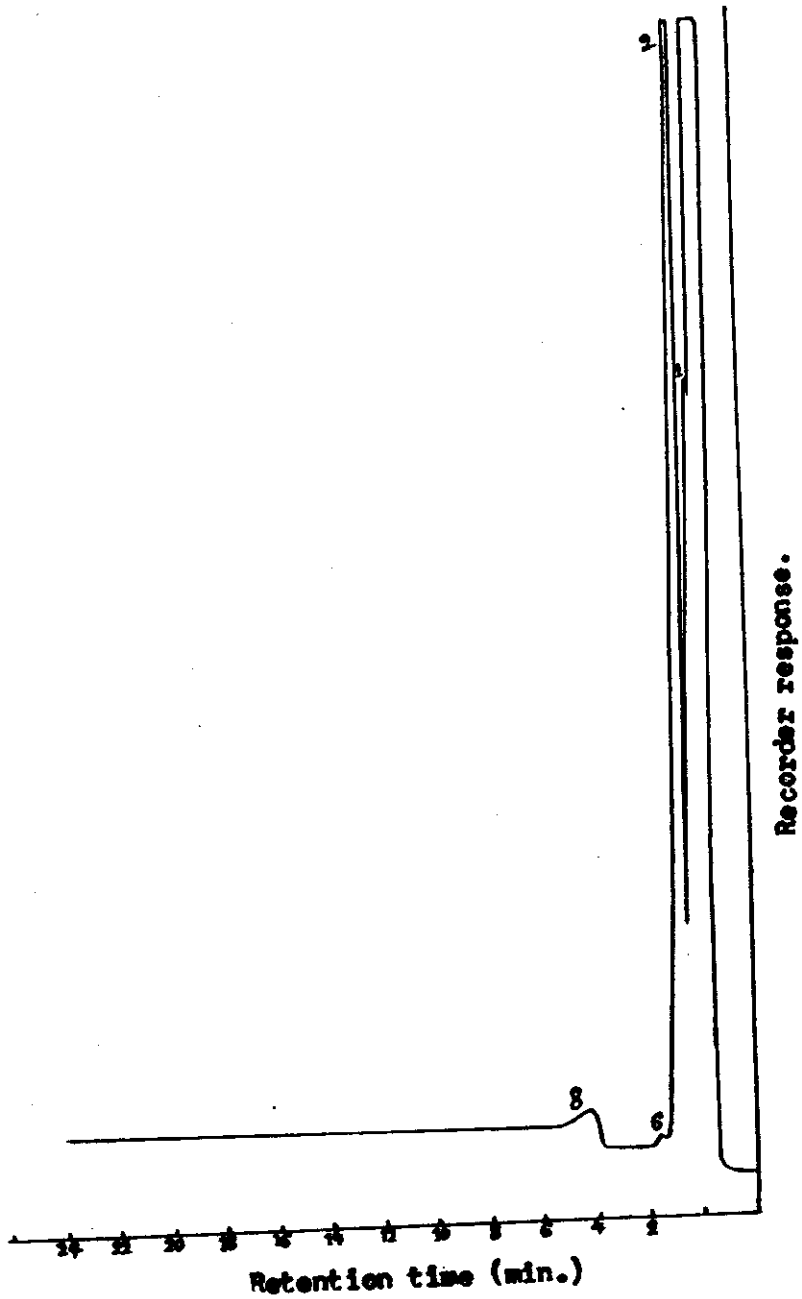


Fig. 12 : G.L.C. Head space of volatile compounds of oil of soaked Soybean seeds in boiling water.

Soaking Soybean seeds in boiling water gave oil of four volatile compounds where the major compound was hex-2-enal representing 84.38 %. The other three compounds were pentanal, 2-octanol and heptanal at percentages of 7.52, 0.22 and 7.86 % respectively. However pentanal was not identified in treatments (1) and (2) while heptanal was not detected in treatments (2) and (3).

Therefore, it could be concluded that technological treatments, had great effect on the volatile compounds present in Soybean seed oils.

Stability of Soybean Oils :

Soybean oils of the four treatments were incubated at 63°C ± 0.5 for stability evaluation.

During incubation the conventional determination of peroxide value was studied.

The changes in peroxide value (mEq/Kg.oil of Soybean oils; Table (8) and Fig.(13) showed crude Soybean oil had 9 days induction period.

Washing Soybean oil with hot water or degumming gave the lowest stability, as the shortest induction period was 5 days, which agreed with that of Baruffaledi et al.(1980) who found that degummed Soybean oil had a lower induction period of 11.9 days than that for crude Soybean oil of 15.2 days.

Roasted seeds oil showed the longest induction period, followed by that from soaked seeds in boiling water, as their induction periods were 12 and 10 days respectively. In other words, both oils of treatments 3 and 4 were the most stable against autoxidation as they were considered superior in preventing the formation of peroxides. These results indicate that stability of Soybean oils under investigation was affected by the used technological treatments, more stable oils were obtained with heat treatment of seeds, which agreed with that found by Rice et al.(1981) who mentioned that oxidative stability of oil from heat-treated beans was increased as determined by the swift stability test.

Table (8) : Changes in peroxide value of Soybean oils during incubation at 63° C (mEq/ Kg. oil).

| Period in days | Peroxide value | | | |
|---|---|---|---|---|
| | Treatment (1) | Treatment (2) | Treatment (3) | Treatment (4) |
| 0 | 5.77 | 11.01 | 5.22 | 7.05 |
| 1 | 7.22 | 13.46 | 6.83 | 8.81 |
| 3 | 8.66 | 15.29 | 10.24 | 10.57 |
| 5 | 12.99 | 20.58 | 13.65 | 14.10 |
| 7 | 15.88 | 48.93 | 14.67 | 17.62 |
| 9 | 33.22 | 67.29 | 18.57 | 19.05 |
| 11 | 36.73 | 91.75 | 19.94 | 29.64 |
| 13 | 52.62 | 105.91 | 30.84 | 56.01 |
| 15 | 85.99 | 139.99 | 50.52 | 87.25 |
| 17 | 99.29 | 154.35 | 55.52 | 90.64 |
| 19 | 116.60 | 183.04 | 69.16 | 108.02 |
| 21 | 140.62 | 196.98 | 96.02 | 124.68 |
| 23 | 160.18 | 209.19 | 113.18 | 140.84 |
| 25 | 177.24 | 219.81 | 124.52 | 153.21 |
| 27 | 187.13 | 230.18 | 140.26 | 162.98 |
| 29 | 195.23 | 214.04 | 165.96 | 184.12 |
| 31 | 208.13 | 160.02 | 182.22 | 191.24 |
| 33 | 190.28 | 140.52 | 182.12 | 172.15 |
| 35 | 153.84 | - | 124.66 | 143.92 |
| Stability in days at 63° C | Induction periods (days) | | | |
| | 9 | 5 | 12 | 10 |

1- Crude Soybean oil.
2- Soybean oil washed with hot water 90°C.
3- Soybean extracted from roasted seeds.
4- Soybean oil extracted from soaked seeds in boilingwater.

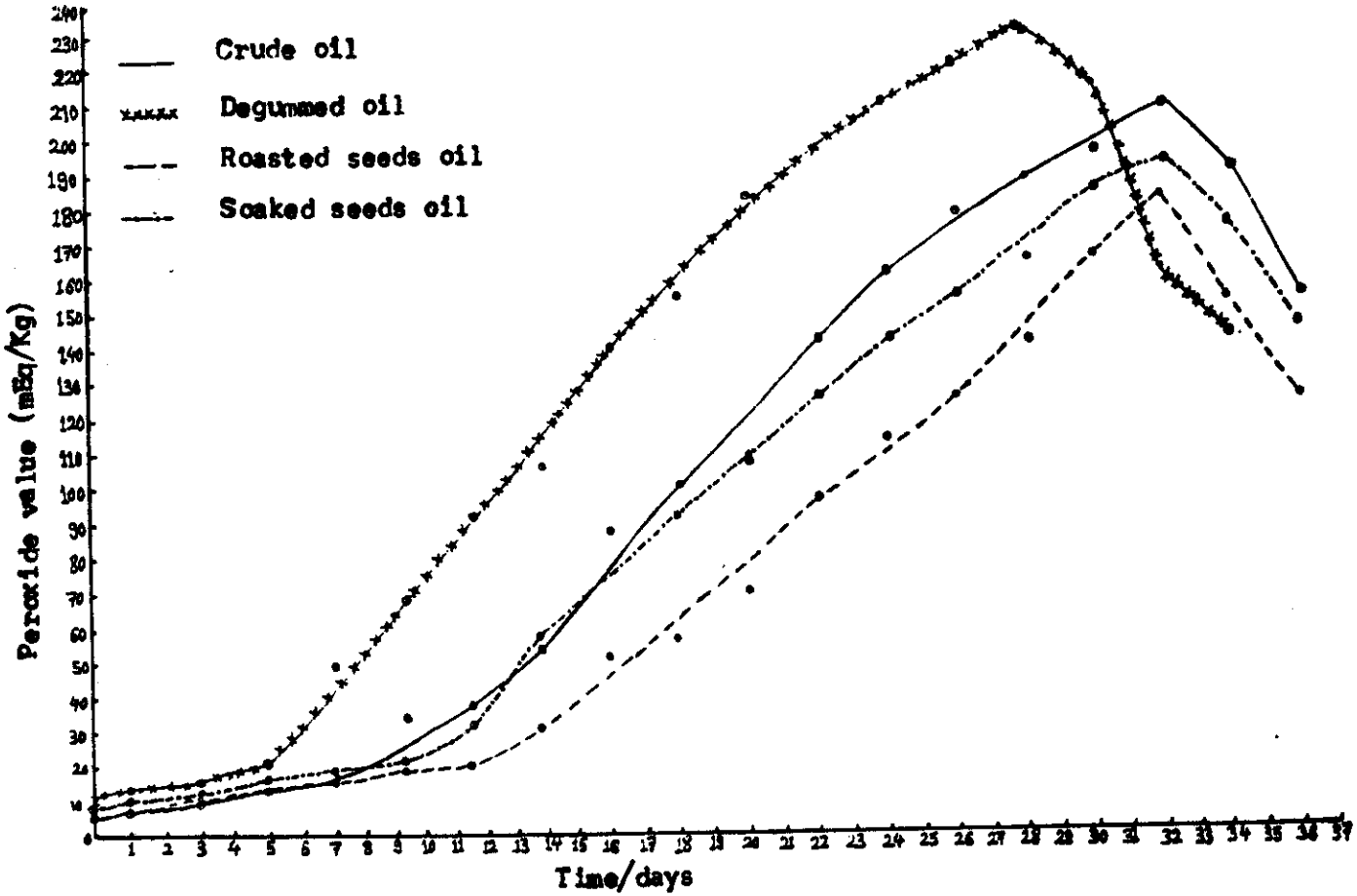


Fig. 13 : Peroxide value of Soybean oils during incubation at 63° C.

# S U M M A R Y

This study was conducted on soybean seeds (Clark variety which exposed to some technological treatments being, crude soybean oil; oil washed with hot water(90°C); roasting the seeds 120°C/2 h. and soaking the seeds in boiling water/½ h. in order to improve soybean oil quality.

The data obtained in this investigation could be summarized as follows: -

1- The physical and chemical properties of control ; degummed oil; roasted seeds oil and the oil from soaked seeds in boiling water were determined, the refractive indeces were: 1.4739; 1.4736; 1.4731 and 1.4721 respectively. The acid values were 0.98; 1.32; 1.09 and 1.17 respectively. Peroxide value was low in all treatments as it ranged from 3.53 meq./kg. to 3.72 except degummed oil, where it was 10.10 meq./kg. oil. Iodine values were 134.5 ; 133.4; 132.2 and 131.9. And unsaponifiable matter % ranged from 0.66 to 2.2%, where the maximum value was in oil produced from soaked seeds in boiling water.

2- The fatty acid composition of soybean oils was studied by G.L.C. and the relative percentage of total saturated fatty acids ranged from 14.00 % to 16.35, however, the predominant fatty acid was palmitic,which

was 11.09 % - 13.20 % in all treatments. Stearic ranged from 2.43 % to 2.91 % , while unsaturated fatty acids ranged from 83.65% to 86.00. The principal fatty acid was linoleic as it ranged from 58.67% to 63.02 % while oleic ranged from 10.13% to 18.20% and linolenic from 3.39% to 4.77%. In treatment, 4 (soaked seeds oil) palmitoleic and heptadecenoic were detected, their relative percentages were 0.97% and 5.45% respectively.

3- The unsaponifiable matter constituents were fractionated using column chromatographic, neutral aluminum oxide for non polar and polar fractions. The highest percentage of non polar fraction in the case of the oil from soaked seeds in boiling water was 74.45%, while it was 28.08%; 16.87% and 14.12% in crude soybean oil ; degummed oil and roasted seeds oil. Total unsaturated hydrocarbons as squalene was determined, its concentration was 15.86 mg./100 g. oil in crude soybean oil , while degummed oil and roasted seeds oil contain 23.38 and 20.77 mg./100 g. oil, it was not detected in the case of oil from soaked seeds in boiling water.

4- The unsaponifiable matter of soybean oils were identified by G.L.C. and the unsaponifiable in crude soybean oil contained 43.61% hydrocarbons, $C_{27}$ was a major hydrocarbon compound, which amounted to 25.52%, while squalene compound was 7.67%. Other hydrocarbon compounds $C_{22}$;$C_{23}$;

$C_{25}$; $C_{29}$; $C_{31}$ and $C_{32}$ were detected and their relative percentages were 1.65%; 1.68%; 1.91%; 2.01; 0.75% and 0.75 % respectively. The relative percentage of hydrocarbons decreased from 43.61% in crude oil to 37.43% and 20.75% in both degummed oil and roasted seed oil respectively, while total hydrocarbons increased in case of soaked seeds oil in boiling water, it increased to 86.71%. The relative percentage of $C_{27}$ decreased from 25.52% in crude oil to 2.65%; 1.73% and 21.58 % in degummed oil; roasted seeds oil and soaked seeds oil respectively. Moreover degummed oil and roasted seeds oil increased the relative percentage of squalene to 29.18 % and 16.58%, while it was not detected in the case of soaked seeds oil in boiling water. $C_{22}$; $C_{23}$ and $C_{25}$ hydrocarbon compounds, increased to 20.41%, 20.41% and 11.62% respectively for soaked seeds oil. $C_{28}$ was detected only in oil of roasted and soaked seeds. The relative percentage of $\delta$-tocopherol was 3.27 % ; 3.50; 4.40 % and 0.66 respectively.

The unsaponifiable of crude oil contained 53.11 % sterols, fractionated to B-sitosterol, the major sterol compound, it was 34.40% of unsaponifiable; campesterol was found in a moderate content 8.30%; while cholesterol, stigmasterol, unknown and $\Delta^7$-avenasterol were found also. Degummed oil and roasted seeds oil showed increase of total sterol

from 53.11 % in the crude oil to 62.06 % and 74.84 respectively, while in oil of soaked seeds it decreased to 12.61%. B-sitosterol increased to 39.73% and 46.20% for degummed oil and roasted seeds oil, while it decreased to 8.96% in oil of soaked seeds in boiling water.

5- GLC headspace analysis of volatile compounds of soybean oils were carried out. In crude oil hex-2-enal octanal, heptanal and 2-octanol were identified where their relative percentages were 82.03%,9.37%,7.03% and 1.56% respectively. The volatile components in degummed oil were also identified to hexanal, which was the major compound (73.74%). The unknown was found in a moderate percentage of 22.26%, while hex-2-enal was identified in a lower percentage of 3.89% and 2-octanol amounted to 0.14%. The oil of roasted seeds contained only pentanal,hexanal, and hex-2-enal with relative percentages 80.91%, 18.27% and 0.80% respectively. In oil obtained from soaked seeds, the major compound was hex-2-enal which reached 84.38 %, while heptanal, pentanal and 2-octanol amounted to 7.86, 7.52 and 0.22% respectively.

6- The stability of soybean oils was evaluated by the oven test at 63°C. The longest induction period was detected in case of roasted soybean seeds oil as it was 12 days, while the shortest induction period was observed in case of degummed soybean oil. Moreover crude soybean oil and the oil from soaked seeds in boiling water had an induction period of 9 and 10 days respectively.