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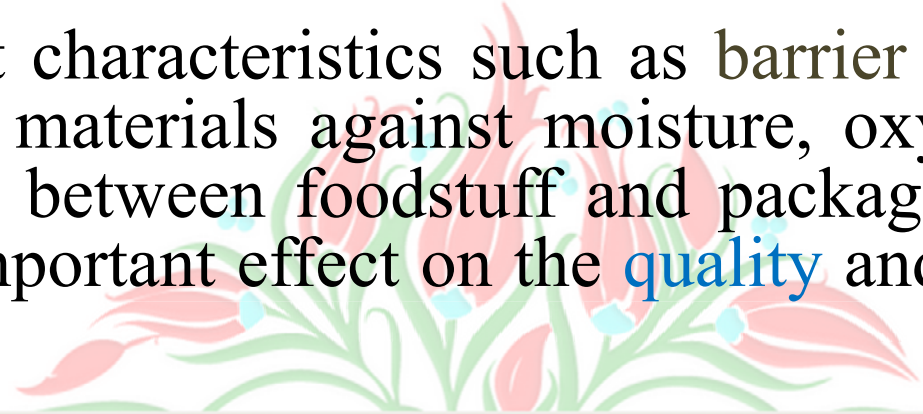


Study on effect of PET pieces and storage conditions on fatty acids profile and some quality factors of common oils in Iran





Packaging of oils

- Oils have a crucial role in humans' diet. Different kinds of oil have various uses in food industry, among them **canola** and **sunflower** are used extensively for cooking. The mixed oil is considered as one of the current oils in Iran's market.
 - The materials which are used for packaging have a large variety. **Glassy**, **metals** and **different kinds of plastics** are used in oil packaging. Such as polyethylene terephthalate (PET) and High Density Polyethylene (HDPE)
 - Significant characteristics such as barrier properties of packaging materials against moisture, oxygen and the **interaction** between foodstuff and packaging materials have an important effect on the **quality** and **shelf life** of oils.
- 




This Study About:

The effects of **PET plastic pieces** and **various storage conditions** on **fatty acids profile** and some of the **quality factors** such as:

- ❖ Peroxide value
- ❖ Free fatty acids
- ❖ Iodine value
- ❖ induction period

before and after 20 and 60 days of storage at 25 and 45°C with present or absence of these pieces in three type of common oils in Iran's market.



Materials

Oils:



- ☀ Sunflower
- ☀ Canola

- ☀ Mixed oil (contains different percent of Sunflower, soy bean and cotton seed oil depend on factory formulation)

PET Bottles:



Methods



PET Bottles

After measuring a specific surface on the bottles, they were cut to 14 pieces with the same size (1*6cm).

The pieces were placed in glass vessels, the glass vessels were poured with oil

The glass vessels that contain tests pieces were stored at 25 °C

The glass vessels that contain tests pieces were stored at 45°C

For 20 days

For 60 days

For 20 days

For 60 days



Methods

For determination profile of fatty acids

Agilent Gas Chromatograph System,
Agilent Technologies 6890N

- Equipped with flame ionisation (FID)
- The detector temperature was 250 °C
- The carrier gas Helium 0.7ml/min
- HP88 column
- Temperature of the column has ramped from 170 °C to 190 °C in 5 minutes and 0.5 °C per minute and remains in this temperature for 20 minutes
- The pressure was 10 PSI



Methods



Quality factor	Test methods
Induction period (h)	By Rancimat instrument AOCS with standard number Cd 12b-92
Iodine value (IV)	AOCS with standard number Cd 1c-85
Peroxide value (meq/kg)	AOCS with standard number Cd 8-53
Free Fatty acids (%)	AOCS with standard





Results

✿ At composition of fatty acids some small changes in the amount of saturated and unsaturated fatty acids in mentioned oils were observed.

✿ Changes in quality factors during different conditions of storage.





Fatty acids profiles

The effect of Time and Temperature:

Amount of poly unsaturated fatty acids like linoleic acid has decreased and the amount of mono unsaturated and saturated fatty acids like oleic acid, and palmitic acid has increased.

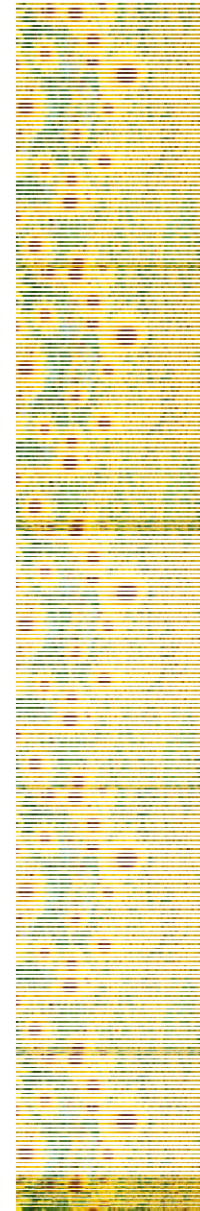
On cleaving 2 cis double bonds and convert them to single double bond and no double bonds caused mentioned alteration.

presence or absent of plastic pieces has no significant effect on fatty acids profile.

Since all of the samples were stored in a dark place and in sealed container the effects of light and oxygen parameters in all specimens

Profile of fatty acid in sunflower oil in different condition of storage

of	Original* oil	Storage condition							
		20 days Without PET pieces**		20 days With PET pieces***		60 days Without PET pieces		60 days With PET pieces	
		25 °C	45 °C	25 °C	45 °C	25 °C	45 °C	25 °C	45 °C
0	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.08	0.08
0	7.55	7.93	8.02	8.06	7.98	7.81	7.85	8.08	8.07
1	0	0.09	0.08	0.09	0.09	0.08	0	0.08	0.08
0	0.05	0.05	0.05	0.05	0.05	0.04	0	0.05	0.05
0	2.97	4.03	4.10	4.03	3.93	3.62	3.63	3.94	4.01
1	0	0.04	0.06	0	0.03	0	0.02	0	0
0	23.37	24.95	24.96	25.23	24.69	24.32	24.10	24.95	25.15
1	1.73	1.07	1.15	1.00	1.23	1.63	1.90	1.11	1.19
2	0.26	0.33	0.35	0.36	0.35	0.24	0.21	0.35	0.35
2	61.76	57.94	57.94	57.87	58.20	59.33	59.42	58.25	57.83
0	0.16	0.30	0.30	0.31	0.29	0.22	0.21	0.2	0.30
3	0	0.18	0.18	0.09	0.18	0.15	0.15	0.14	0.16
0	1.67	1.98	1.94	1.97	1.97	1.87	1.87	1.96	1.93



file of fatty acid in mixed oil in different condition of storage

Storage condition									
of d	Original oil	20 days Without PET pieces**		20 days With PET pieces***		60 days Without PET pieces		60 days With PET pieces	
		25°C	45°C	25°C	45°C	25°C	45°C	25°C	45°C
	0.11	0.12	0.12	0.11	0.12	0.11	0.12	0.11	0.12
	9.43	9.65	9.62	9.65	9.77	9.4221	9.77	9.60	9.63
	0.07	0.10	0.10	0.09	0.10	0.08	0	0.09	0.10
	0.04	0.06	0.06	0.06	0.06	0.04	0	0.06	0.06
	3.33	4.00	4.03	4.05	3.96	3.41	3.63	4.04	4.06
1	0	0.07	0.05	0	0	0	0	0.12	0.05
	23.80	24.85	24.83	24.70	24.74	24.25	24.55	24.79	24.86
	1.75	1.25	1.18	1.27	1.29	1.64	1.47	1.25	1.20
2	0.25	0.34	0.30	0.33	0.34	0.25	0.15	0.34	0.30
	58.00	55.56	55.54	55.53	55.55	57.50	57.93	55.54	55.56
	0.20	0.30	0.31	0.35	0.31	0.21	0.17	0.31	0.31
3	0.18	0.24	0.28	0.24	0.25	0.20	0	0.243	0.24
	2.42	2.64	2.70	2.677	2.69	2.47	2.32	2.68	2.67



Profile of fatty acid in canola oil in different condition of storage


Storage condition									
Types of fatty acid	Original oil	20 days Without PET pieces**		20 days With PET pieces***		60 days Without PET pieces		60 days With PET pieces	
		25 °C	45 °C	25 °C	45 °C	25 °C	45 °C	25 °C	45 °C
		C14:0	0.07	0.06	0.06	0.06	0.06	0.06	0.06
C16:0	5.07	5.02	4.95	5.10	5.09	4.92	4.85	5.06	5.00
C16:1	0.19	0.19	0.18	0.18	0.18	0.17	0.17	0.18	0.17
C17:0	0.04	0.49	0.049	0.04	0.04	0.03	0.03	0.04	0
C18:0	2.03	2.06	2.05	2.04	2.03	1.86	1.74	2.04	2.08
T-C18:1	0.13	0.126	0.12	0.11	0.12	0.10	0.09	0.12	0.12
C18:1	56.01	55.85	55.91	55.61	55.59	55.59	56.07	56.08	55.85
Iso-									
C18:1	3.47	3.45	3.27	3.54	3.54	4.10	4.21	3.50	3.39
T-C18:2	0.10	0.10	0.10	0.10	0.11	0.07	0.07	0.10	0.10
C18:2	20.94	20.85	20.84	21.06	21.10	21.22	21.33	20.83	20.87
C20:0	0.55	0.57	0	0.57	0.57	0.45	0.43	0.57	0.58
T-C18:3	0.56	0.6	0.60	0.60	0.58	0.52	0.51	0.57	0.59
C18:3	9.15	9.16	9.17	9.17	9.23	9.05	9.06	9.07	9.16
Iso-									
C18:3	0.05	0.04	0.05	0.06	0.05	0.04	0.03	0.05	0.05
Ga-									
C18:3	1.09	1.18	1.20	1.17	1.16	0.99	0.97	1.09	1.20
C22:0	0.29	0.29	0.30	0.30	0.31	0.17	0.15	0.30	0.30



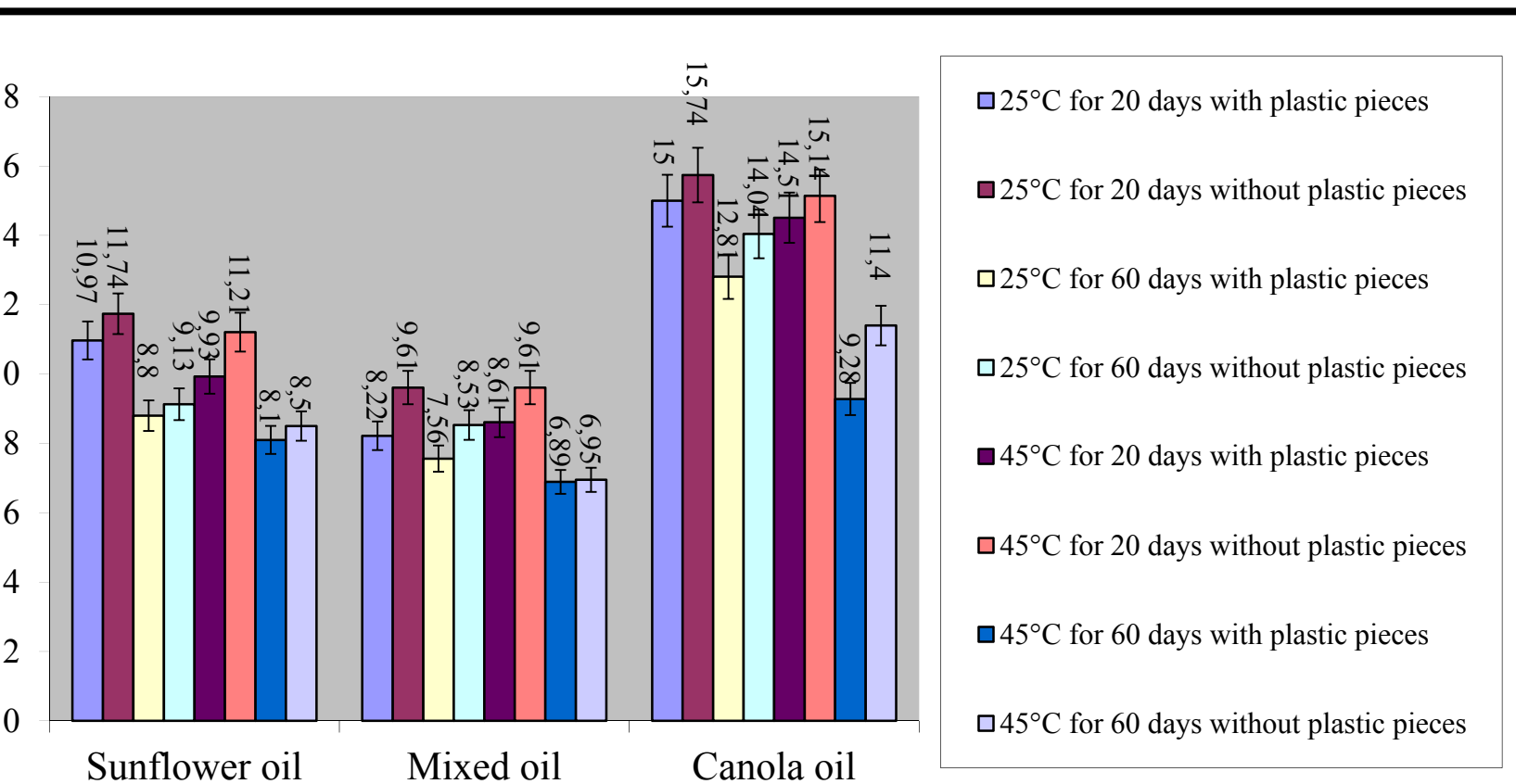
Induction Period

* Significant decrease ($P \leq 0.05$) were observed at induction period (IP) in the mentioned oils at 25 °C and 45 °C after 20 and 60 days and presence or absence of PET pieces .

* Among the oils, canola oil has maximum induction period that may be the reason that exist of oleic fatty acid (mono unsaturated) and the mixed oil has minimum induction period because the oil contains different types of fatty acids such poly unsaturated fatty acids.



The induction period of sunflower, mixed and canola oils during different storage conditions





Peroxide Value

At 25°C and 45°C and **presence or absence of PET pieces**, **sunflower** and **mixed** oils had increased significantly ($P \leq 0.05$) in peroxide value (PV) after 20 and 60 days, but in **canola** oil only time and temperature has affected significantly ($P \leq 0.05$) in peroxide value.

Relatively, the PVs were altered at **end of storage period**, and were increased as result of realizing **pro oxidant compounds** such as aldehydes from **plastic pieces** moreover it has stimulated by increasing **temperature**.

The effect of **PET packaging** on...



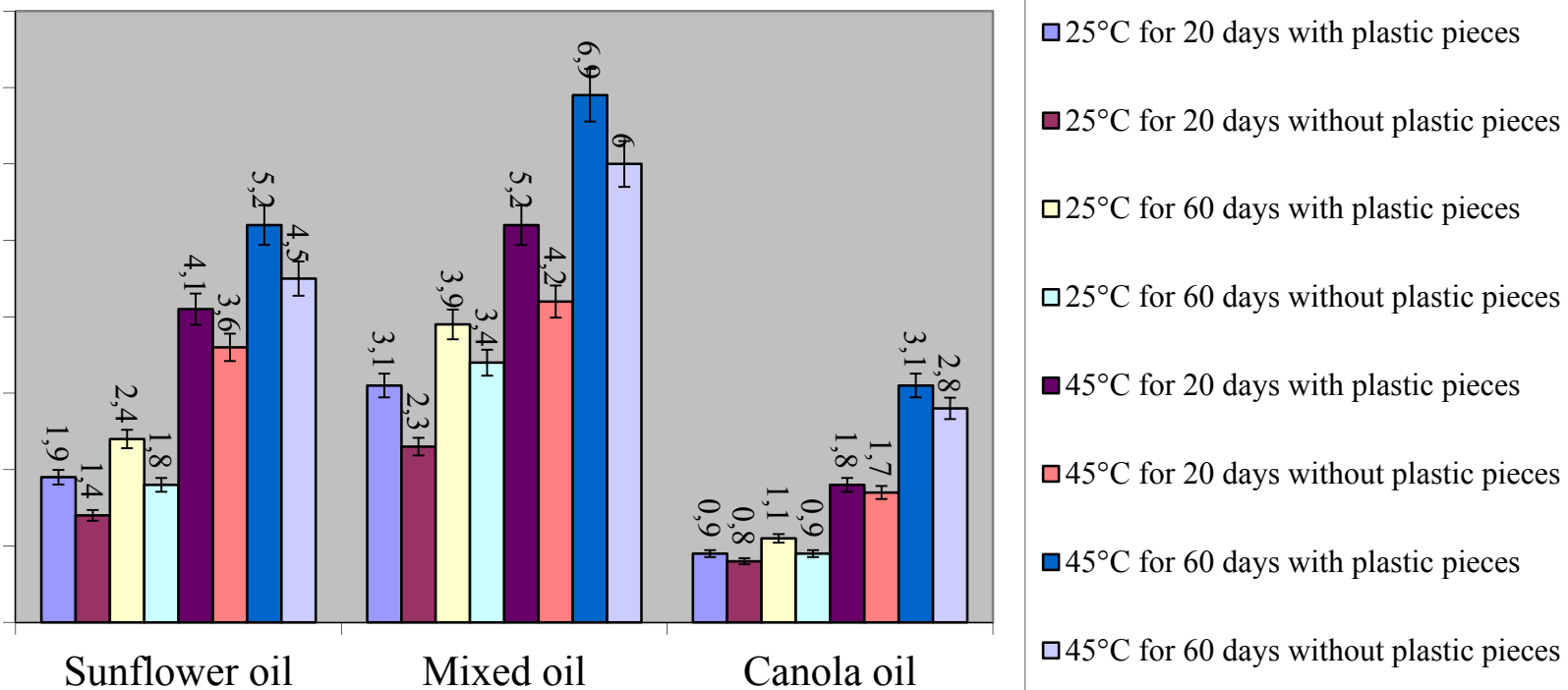
Peroxide Value



Mixed oil that contains several types of fatty acids; peroxide value was formed quickly for the reason that consists of poly unsaturated fatty acids

Peroxide value in sunflower and canola oil is formed lower than mixed oil due to the presence of high amount of natural antioxidants in sunflower oil and monounsaturated fatty acids like oleic acid in canola oil but, during storage and after decreasing efficiency of natural antioxidants, the amount of peroxide index increased in sunflower and canola oil in comparison with the initial

The amount of peroxide value of sunflower, mixed and canola oils during different storage conditions





Iodine Value

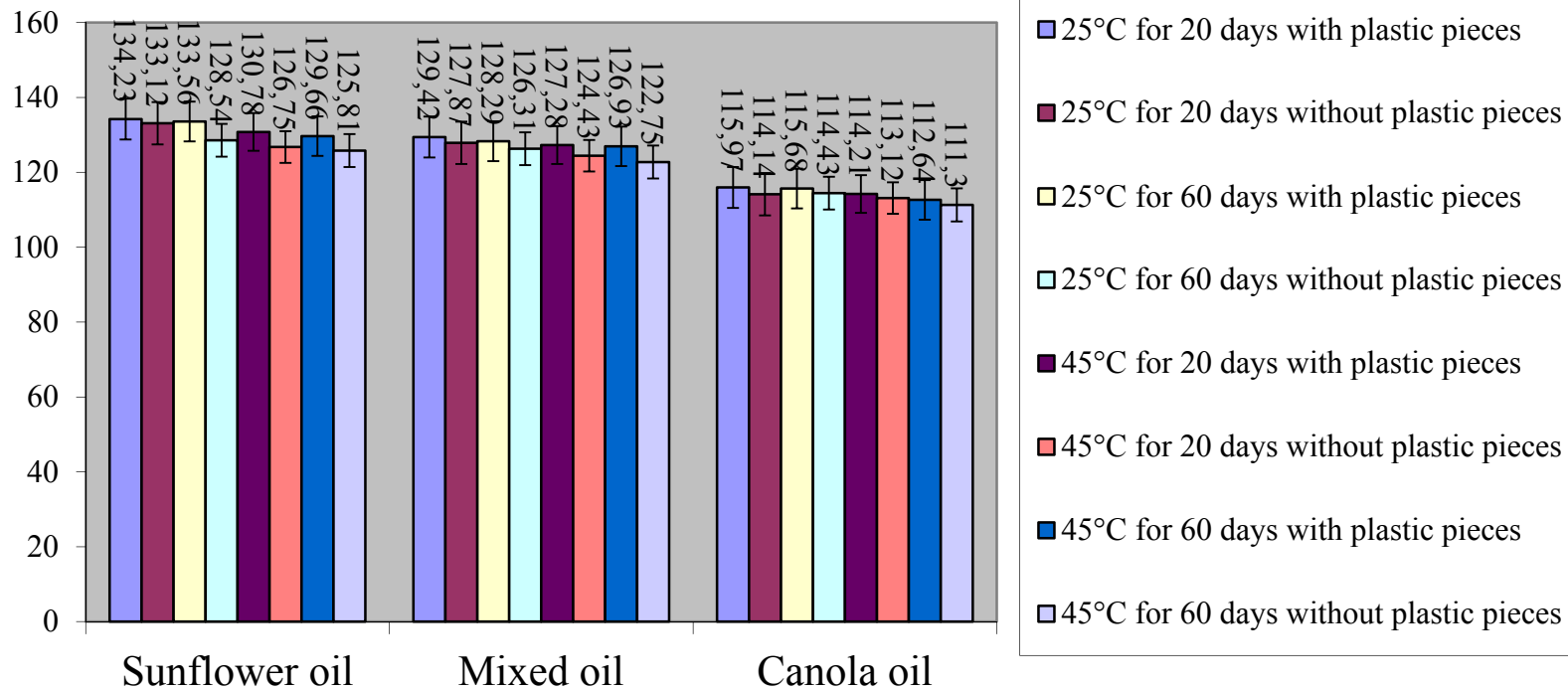
The amount of unsaturated fatty acids has direct effect on **IVs**.

The **IVs** in **sunflower** and **mixed oil** significantly declined ($P \leq 0.05$) after 60 days at 45°C and **presence or absence of PET pieces** as the result of changes in amounts of polyunsaturated fatty acids in the mixed and sunflower oil.

The slight changes in decreasing of



The amount of iodine value of sunflower, mixed and canola oils during different storage conditions





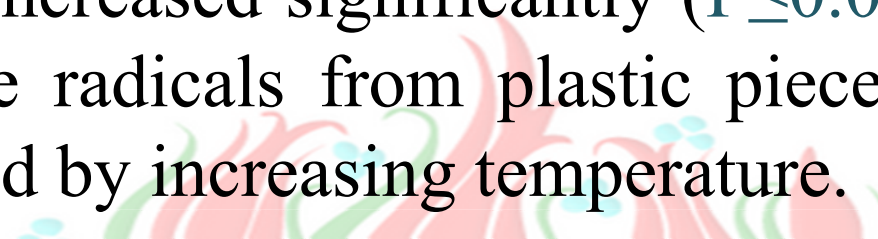
Free Fatty Acid



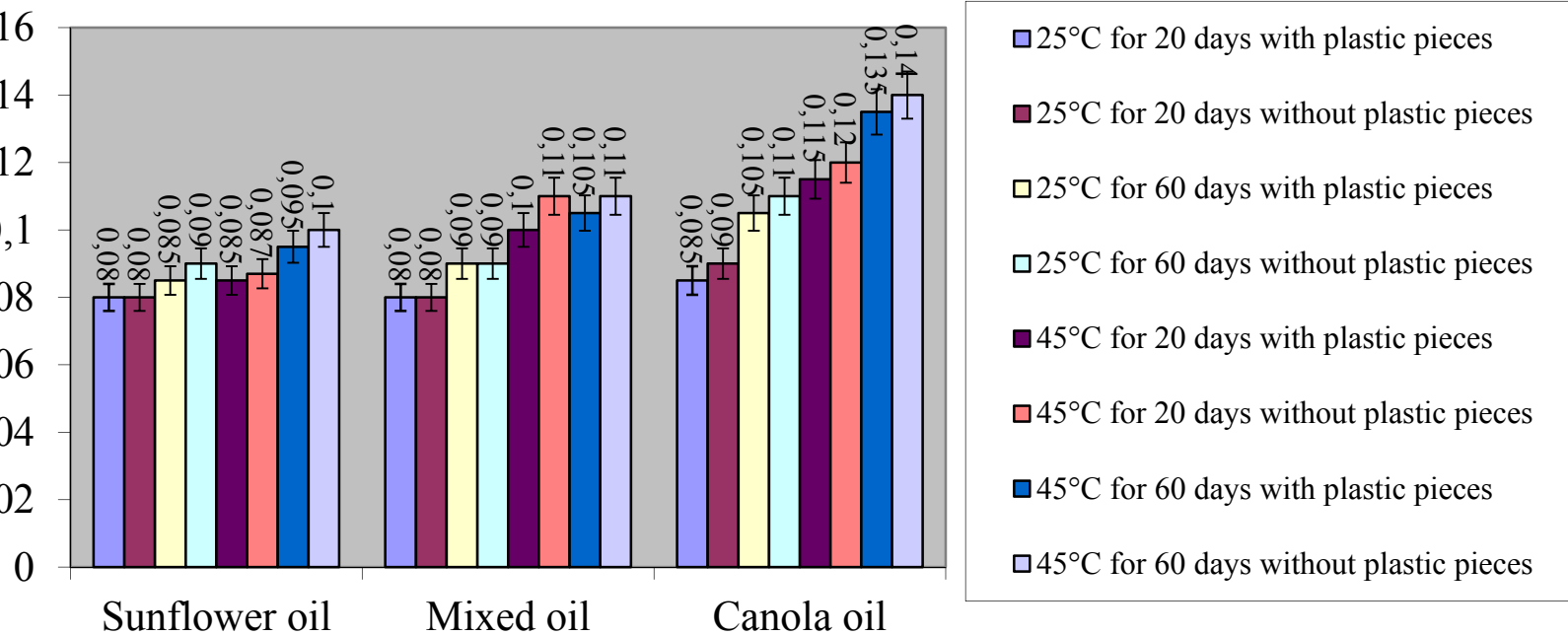
Partial hydrolysis of oils take place, thus free fatty acid content were increased.

There was a increased significantly ($P \leq 0.05$) in the **FFA%** among the **storage** at **25 °C** and **45 °C** for **20** and **30 days** in mentioned oils which showed the effect of temperature and time on forming free fatty acids.

At **presence or absence of the plastic pieces** in the oils **FFA%** had increased significantly ($P \leq 0.05$), as result of realizing free radicals from plastic pieces moreover, it was stimulated by increasing temperature.



Amount of free fatty acid of sunflower, mixed and canola oils during different storage conditions






From our Examination

Fatty acids profile, quality factors such as free fatty acids, peroxide value, induction period and iodine value, some result clearly emerged.

Increasing **storage time, temperature** and **presence of PET pieces** had effect on FFA%, PV, induction period and **Iodine value**.

The difference of this effect on the mentioned oil can be explained by the nature and initial **physical and chemical properties** of them.

The storage time and temperature have significant effect on oil's stability, thus according to result the quality of oil have been decreased after the storage at high temperature (45°C) for long time.





So For Protection From Deterioration . . .

✓ The oils which packed in **PET bottles** must be storage at a temperature lower than 25°C.

✓ Glass containers can be applied to the oil packaging due to better protection effect against oil deterioration than **PET packaging** containers.

✓ More studies must be done on packaging and shelf life of oils so the best storage



Thanks...





Questions...

