Grain Research Laboratory Technical Bulletin

Title	Effect of mineral oil on the measurement of fatty acid composition, chlorophyll and free fatty acid content in vegetable oils
Name and program	Dr. Véronique J. Barthet, Oilseeds

Summary

This study was conducted in order to determine whether the application of mineral oil to oilseeds has any effect on the measurement of the compounds assessed to predict vegetable oil quality. No negative effects on quality parameters were observed when mineral oil was applied at 0.02 or 0.2% w/w.

Goals and objectives

Application of food grade mineral oil can effectively suppress the dust during grain loading. The objective of this study was to determine the effects of mineral oil application at the recommended level by weight (0.02% w/w) and at 10 times higher than the recommended level (0.2% w/w) on the fatty acid composition, chlorophyll and free fatty acid content in canola oil.

Materials and methods

The following types of mineral oils were tested:

- paraffin, (CAS 8042-47-5, from Merck, Darmstadt, Germany) a food grade mineral oil containing only saturated alkanes
- Paraflex 8G, (Ref 659-0178, PetroCanada Lubricants, Mississauga, ON, Canada) a Canadian food grade mineral oil (mineral oil saturated alkanes)

Five types of vegetable oils were tested: one commercial vegetable oil (soybean oil), three expeller press canola oils and one commercial olive oil. These oils were chosen because they presented a range of quality components that could be affected by mineral oil. For example, commercial soybean oil has both low chlorophyll and free fatty acid contents with a high linoleic acid content (C18:2), expeller press canola oil has both high chlorophyll and a-linolenic acid contents (C18:3) with a range of free fatty acid contents and olive oil has high free fatty acid, moderate chlorophyll content and high oleic acid (C18:1) content.

Statistical analysis was conducted with SAS Enterprise Guide (Version 7.15). Analyses of variance were conducted using the mineral oil treatment as the independent variable and chlorophyll, free fatty acid, and fatty acid composition as the dependent variables.

Results

When spayed on oilseeds, mineral oils are co-extracted with the oil during oilseeds crushing. Therefore, it was important to assess the effect of the mineral oils on the analyses of parameters defining oilseeds crude oil quality, such as chlorophyll content, free fatty acid content and fatty acid composition. These analytes were determined in oils supplemented with the various mineral oils at 0.02% and 0.2% w/w levels.

Results were analyzed by statistical analyses (analysis of variance). The statistical analysis showed that the addition of 0.02 % or 0.2% w/w mineral oil to vegetable oils has no effect on the determination of

free fatty acid content, chlorophyll content, oleic acid, linoleic acid content, a-linolenic acid content, total saturates content, and iodine value of the oil.

Conclusion

The results of this study indicated that the application of mineral oil at the recommended concentration (0.02% w/w) or 10 times the recommended concentration (0.2% w/w) has no negative effects on any of the assessed quality parameters measured to evaluate oil quality.

References

1. International Organization for Standardization. (2015). Rapeseed – Determination of chlorophyll content—Spectrometric method (ISO 10519:2015).
2. International Organization for Standardization. (2017). Gas chromatography of fatty acid methyl esters—Part 2: Preparation of methyl esters of fatty acids (ISO 12966-2:2017).
3. International Organization for Standardization. (2014). Gas chromatography of fatty acid methyl esters—Part 1: Guidelines on modern gas chromatography of fatty acid methyl ester (ISO 12966-1:2014).
4. Ke *et al.* (1978). A titrimetric method for determination of free fatty acids in tissues and lipids with ternary solvents and m-cresol purple indicator. Analytica Chemica Acta, 99, 387-391.
5. American Oil Chemists' Society. (2017). Calculated Iodine Value (Cd 1c-85).

Appendix

Table 1 Summary statistic table - Effect of mineral oil in quality parameters

				Free fatty acids (%)		Chlorophyll content (mg/kg)		C18:1 amount (%)		C18:2 amount (%)		C18:3 amount (%)		Total saturates (%)		Iodine value (units)	
Oil type	**Mineral oil**	**Amount (%)**	**N Obs**	**Mean**	**Std Dev**	**Mean**	**Std Dev**	**Mean**	**Std Dev**	**Mean**	**Std Dev**	**Mean**	**Std Dev**	**Mean**	**Std Dev**	**Mean**	**Std Dev**
Expeller press canola oil 22-July	None	0.00	3	0.54	0.01	50.43	0.68	63.50	0.02	19.10	0.01	7.96	0.03	7.36	0.01	109.84	0.09
	Paraffin	0.02	3	0.59	0.01	53.16	2.11	64.78	0.06	18.00	0.05	7.98	0.01	7.11	0.01	109.14	0.14
		0.20	3	0.72	0.00	51.83	10.32	63.11	0.07	19.33	0.01	7.97	0.03	7.42	0.02	109.92	0.14
	Paraflex G8	0.02	3	0.61	0.04	50.48	0.33	64.99	0.35	18.04	0.09	7.99	0.01	7.07	0.06	109.32	0.39
		0.20	3	0.57	0.01	47.69	6.06	63.05	0.15	19.43	0.06	7.97	0.03	7.44	0.00	110.05	0.04
Expeller press canola oil 27-July	None	0.00	3	0.65	0.00	65.20	0.73	62.15	0.05	20.09	0.03	8.22	0.02	7.43	0.01	111.07	0.13
	Paraffin	0.02	3	0.73	0.02	67.00	0.86	63.39	0.02	19.03	0.01	8.25	0.00	7.19	0.00	110.43	0.01
		0.20	3	0.68	0.02	69.41	13.04	61.75	0.05	20.40	0.02	8.20	0.01	7.51	0.01	111.21	0.09
	Paraflex G8	0.02	3	0.64	0.08	66.77	1.05	63.34	0.03	19.03	0.01	8.24	0.00	7.18	0.01	110.35	0.07
		0.20	3	0.72	.	96.25	44.91	61.89	0.02	20.33	0.02	8.21	0.00	7.50	0.01	111.24	0.01
Expeller press canola oil 28-July	None	0.00	3	0.57	0.01	52.62	0.48	62.27	0.06	19.99	0.02	8.37	0.01	7.39	0.01	111.39	0.09
	Paraffin	0.02	3	0.60	0.00	53.74	0.86	63.38	0.02	18.93	0.00	8.40	0.00	7.13	0.00	110.60	0.03
		0.20	3	0.56	0.03	54.07	3.01	61.91	0.12	20.26	0.04	8.38	0.02	7.46	0.02	111.55	0.15
	Paraflex G8	0.02	3	0.68	.	52.93	0.07	63.34	0.05	18.96	0.01	8.40	0.01	7.14	0.01	110.62	0.09
		0.20	3	0.58	0.00	51.75	0.68	61.94	0.03	20.23	0.02	8.38	0.02	7.45	0.01	111.54	0.09

Table 1 Summary statistic table - Effect of mineral oil in quality parameters (continued)

				Free fatty acids (%)		Chlorophyll content (mg/kg)		C18:1 amount (%)		C18:2 amount (%)		C18:3 amount (%)		Total saturates (%)		Iodine value (units)	
Oil type	**Mineral oil**	**Amount (%)**	**N Obs**	**Mean**	**Std Dev**	**Mean**	**Std Dev**	**Mean**	**Std Dev**	**Mean**	**Std Dev**	**Mean**	**Std Dev**	**Mean**	**Std Dev**	**Mean**	**Std Dev**
Olive oil	None	0.00	3	0.28	0.02	6.73	0.03	74.59	0.00	8.61	0.02	0.93	0.00	14.15	0.02	82.68	0.03
	Paraffin	0.02	3	0.32	0.02	6.84	0.09	76.48	0.03	7.31	0.01	0.71	0.00	13.73	0.03	81.53	0.03
		0.20	3	0.31	0.03	6.58	0.05	74.94	0.03	8.57	0.03	0.92	0.00	13.84	0.00	82.90	0.02
	Paraflex G8	0.02	3	0.30	0.01	7.03	0.11	76.21	0.01	7.25	0.01	0.71	0.00	14.08	0.01	81.16	0.02
		0.20	3	0.27	0.00	6.69	0.07	74.64	0.04	8.68	0.02	0.94	0.01	14.01	0.01	82.89	0.02
Vegetable oil (Soybean oil)	None	0.00	3	0.06	0.01	0.00	0.00	22.43	0.03	53.05	0.08	8.02	0.01	15.42	0.02	132.48	0.15
	Paraffin	0.02	3	.	.	0.07	0.00	22.41	0.02	53.03	0.06	8.01	0.01	15.40	0.01	132.41	0.06
		0.20	3	0.03	0.01	0.02	0.04	22.44	0.02	53.04	0.03	8.02	0.01	15.40	0.00	132.43	0.05
		5.00	2	0.03	0.02	0.00	0.00	.	.	.	.	.	.	.	.	.	.
	Paraflex G8	0.02	4	0.05	0.02	0.04	0.04	22.42	0.02	53.03	0.02	8.01	0.01	15.40	0.02	132.41	0.03
		0.20	2	0.04	0.02	0.05	0.02	22.42	0.01	53.05	0.03	8.01	0.01	15.40	0.01	132.44	0.05
		5.00	2	0.01	0.00	0.02	0.02	.	.	.	.	.	.	.	.	.	.