Summary of Discussion Session E on Individual Oils

E.E. McGREGOR, Recorder, Canola Council of Canada, 433 Main St., Winnipeg, Manitoba, Canada

Discussion session chaired by R.A. Carr; the panel consisted of Messrs. J.L. Ayres, S.M. Barlow, E.J. Campbell, J.P. Cherry, D.E. Erickson, E. Fedeli, T.K. Mag, M. MacLellan, S. Muller, R.J.S. Ohlson, C. Ruckenstein and F.V.K. Young.

Questions were collected during the day in written form and were supplied to the speakers for their answers and discussion. Most of the questions posed were specific to the various oil types discussed with the exception of one common question asked of seven of the speakers:

(a) What is the average free fatty acid content of the crude oil in question at the time of shipment?

(b) What is the normal expected increase in free fatty acids during a sea voyage of two to five weeks?

(c) How does the overall stability of the oil in question compare with other oils?

The speakers each addressed this question, pointing out that few oils are shipped in the crude state. Values, therefore, for average free fatty acid contents were given for crude, degummed oils in most cases. The free fatty acid values supplied by the speakers for the various oils were: soybean oil, 0.5-1%; cottonseed oil, 0.5-1%; peanut oil, 2.0%; crude sunflower oil, 1.1%; palm kernel oil, 1.5%; coconut oil, 1%; canola oil, 0.2-0.6%; and crude palm oil, 3.5-3.6%. For most oils, the conditions during a sea voyage will have an effect upon the increase in free fatty acids in the oil. The cleanliness of the ship, moisture and temperature conditions may all influence quality of the delivered oils. Palm kernel oil and coconut oil which are shipped fully refined could possibly double their free fatty acid contents during a long voyage, but most other oils such as canola, sunflower, peanut, palm, cottonseed and soybean would probably suffer only slight increases under good shipping conditions. Cottonseed oil could have other problems such as darkening due to gossypol content.

A comparison of stability was not offered for all the oils. Palm oil contains trace levels of linolenic acid and is thus more stable than some other oils. Peanut oil under low moisture conditions compares well in stability to cottonseed and rapeseed oil, and sunflower oil is equal to or slightly more stable than soybean oil or cottonseed oil due to the presence of natural tocopherols. Palm kernel oil and coconut oil are probably the least stable of all because of the low molecular weight of their fatty acids and canola oil is at least equal to soybean oil in stability.

The rest of the questions posed were directed to the speakers who presented information about the specific oils in question.

Palm Oil

In the presentation by M. MacLellan, figures were given on retention of tocopherols and tocotrienols during processing. In one plant of Japanese design, tocopherols consistently increased at the bleaching stage. It was questioned whether this increase was due to decomposition of the compounds formed between tocopherol and linoleic acid or to very mild oxidation. This appears to be a function of both type of plant and the mode of operation of that plant. The increase is thought to be due to regeneration of degraded tocopherols, but research is still ongoing at the Palm Oil Research Institute of Malaysia into the subject.

An answer was provided on what filtration systems should be used on crude palm oil prior to refining to avoid plugging the centrifuge. From past experience prefiltration before refining generally consists of no more than a perforated plant strainer. If the contamination is serious, the problem should be dealt with at the extraction plant before the crude oil is shipped.

Sunflower Oil

A question was posed to Campbell concerning the differences in oil losses between two processes for refining and dewaxing of sunflower oil: (a) simultaneous cold refining and dewaxing; and (b) alkaline refining and then dewaxing. Campbell indicated that the losses will be equal with both processes.

Currently there is no one looking into the recuperation of waxes from the centrifugal dewaxing process, but it was suggested that a food grade wax could be obtained to be used for such purposes as in chocolate coatings or perhaps for wax for cheeses.

Cottonseed Oil

One of the main goals of the National Cottonseed Association is the reduction of gossypol in cottonseed. This will perhaps be achieved through plant breeding. A method for gossypol removal has been suggested by using alcohol treatment before the conventional extraction processes. Cherry indicated he had not had any practical experience with this technique but that the method is described in the *Journal of Food Science*.

An answer concerning a cold test for winterization of cottonseed oil was provided from the audience. When winterized, most tristearin will precipitate at 7 C. After filtration, the oil may be lowered in temperature to -5 C and it will still remain clear.

Soybean Oil

A question was posed to Erickson on what factor in his opinion contributes most to the problem of soybean oil flavor reversion. He felt that lipoxygenase is the major problem which results in the formation of new compounds which in turn contribute to flavor changes. Linolenic acid does not enter the picture, in his opinion.

In the late 1960s, soy oil suffered with flavor problems. As a process to remove the lipoxygenase, boiling is not considered to be the best. Erickson indicated that lipoxygenase content can be controlled with pressure cooking. However, although the oil is of better quality using this method, refining losses may be greater.

In many countries, legislation prevents the use of non-hydrogenated oils for deep frying. In the United States and Canada, however, no such legislation is in place. Most large restaurants and commercial establishments do use hydrogenated oils for deep frying. Household deep frying, however, is still primarily restricted to the use of liquid, non-hydrogenated, refined, bleached and deodorized oils.

Canola Oil

Mag discussed several questions put forward on canola oil. He pointed out that the main disadvantage with the presence of sulfur in crude rapeseed oil was its interference with hydrogenation. It could also have some effects on flavor and in the presence of trace metals, Fe and Ni, there could be large increases in color during deodorization. Since the development of canola varieties which are low in glucosinolates, and thus sulfur, there has not been the same problem with interference in hydrogenation. Compared to high glucosinolate rapeseed, canola contains approximately 65% less sulfur (3-7 ppm vs 20 ppm). Although the level is not zero, the reduction is significant, especially with respect to performance during hydrogenation. Any effects that occur can be countered by adding more catalyst.

Mag commented on a question concerning uses for canola lecithin. Currently, canola lecithin is added back to the meal in Canada. In other countries there have been reported uses of it for edible purposes but it has suffered due to flavor problems. Currently, soybean lecithin is readily available so the development of canola lecithin is not high priority.

Rapeseed Oil

Ohlson was asked to comment on the role of *trans*-fatty acids in rapeseed oil. He pointed out that the higher the level of *trans* present, the quicker recrystallization occurs. In other words, hydrogenated fats with higher *trans* levels have steeper SFI curves and their products thus have better mouth-melt characteristics. Hydrogenation techniques do not solve the problem of large crystal formation, however. Interesterification or the use of solvents can help out in this case.

Palm Kernel Oil and Coconut Oil

Young commented on the use of antifoaming agents in lauric acid oils. He had no experience in the area, but couldn't see why it could not be used. It would be advisable to avoid using lauric acid oils as frying media, particularly if the oils are mixed with other species (ex. soybean oil or coconut oil), due to the danger of foaming.

A discussion took place, with no conclusions drawn, on the theory of why two oils tend to foam when mixed. Suggestions were made that foaming is due to differences in volatility of fatty acids, smoke points or density. One speaker stated that foaming is strictly a surface phenomenon related to interface tension.

It was pointed out that the lauric acid oils may become more important in the future for the production of detergents and surfactants as petroleum oils may become less available. This could be aided by introduction of high yielding hybrids which would ensure increased availability. It is possible that with the increase in price that might occur, these oils may be used less for edible purposes. However, as an economist might point out, once the specific demand has been satisfied, the price of the lauric oils would once again approach that of other vegetable oils.

Fish Oils

The discussion on fish oil with Barlow centered around its creaming value. Fish oil is superior for its unaided creaming performance mainly due to its ease of crystallization. Many other factors are involved with this, but of major importance is the wide range of triglyceride and fatty acid types present. Fish oils also have a wide iodine value range which will have considerable effect on the product.

Rice Bran Oil

Comments were made on the quality differences in rice bran oil. Quality is relative to fatty acid compositions and to the antioxidants in the oils. Dewaxing is often difficult for rice bran oil and the amounts removed may vary, depending upon the original quality of the crude oil.

Shipping Regulations

A final comment was made by Berger of the Palm Oil Research Institute of Malaysia. There are no international regulations concerning possible contamination by previous cargoes carried by ships prior to vegetable oils. Some contracts do require declaration of the three previous cargoes, but there is no international code. It was suggested that his group will draft a code and take action on it.