Submitted to Minnesota Soybean Research & Promotion Council New Uses Action Team by AURI November 2018

Project Title:	High Oleic Soybean Oil Cooking Demonstration
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EXECUTIVE SUMMARY

Health-conscious consumers continuously expect healthier food options with clean labels, which deliver benefits such as zero grams trans-fat. Food manufacturers, restaurants, and educational institutions are transitioning to oils that can meet this demand without sacrificing performance or taste. With its extended shelf life, versatility, and superior performance, high oleic soybean oil is the perfect candidate to replace other, partially hydrogenated frying oils.

This project conducted extended trials at two sites: the Sodexo run kitchen at the University of Minnesota in Crookston (UMC) and the Chartwells run kitchen in Southwest Minnesota State University (SMSU) in Marshall, Minnesota. Both Sodexo and Chartwells are food service companies operating on the national and international level. The success of this project allowed AURI to expand the project statewide during the FY2019 with the funding support of the United Soybean Board (USB).

The high oleic oil outperformed the standard oil at both sites, having a lower percent total polar material (TPM) reading throughout each of the trials. The high oleic oil started and maintained a lower TPM value than the standard oil under normal operating conditions. It also maintained a TPM value in an acceptable range throughout a two-week stress test. Operations staff remarked on several occasions that the high oleic soybean oil looked good and left the fryers much cleaner than the standard product.

BACKGROUND

First commercialized in 2011, high oleic soybean oil is a premium oil for the food service industry. High oleic soybean oil continues to provide the clean flavor, food texture and color consumers have come to expect. For food service providers the oil provides a single oil option for use in front to back of house operations, superior fryer life, cleaner equipment, reduced maintenance time and a competitive price among high performance oils.

Starting at UMC in the fall semester of 2017, AURI worked closely with the Sodexo staff to implement two, six-week trials to test the stability of high oleic soybean oil compared to their standard product. The research team implemented a third six-week trial in the Chartwells managed kitchens at SMSU to complete the project as a management shift at Sodexo prevented completion of the final trial at UMC. The team implemented the trials to determine if high oleic oil is not only cost competitive against high performance oils but also traditional lower cost oils, including commodity soybean oil.

METHODS

Reactions that occur during frying result in the production of various degradation substances in the fat. These degradation substances are referred to under the collective term Total Polar Materials (TPM). This is a generic term for the free fatty acids, monoglycerides and diglycerides and a number of oxidation products (aldehydes or ketones). The TPM affects not only the consistency, taste and appearance of the fat, but also its deep-frying quality.

The primary analytical tool used in this study for collecting TPM data was the hand-held Testo 270 shown below in **Figure 1**. The simplicity of the instrument allows anyone to operate the unit after a short training session. AURI staff provided the training and a Data Log Binder to enable kitchen staff to quickly implement the test protocol with little disruption to normal operations. This engagement provided a tremendous opportunity for AURI to interact directly with the kitchen staff and gather additional qualitative comments.

Figure 1: TPM Meter Used to Monitor Oil Quality. The simple operation of the meter allows anyone to test oil quality. The only condition for the meter is a minimum of five minutes should elapse after fryer use before recording a reading because actively frying food will interfere with the measurement. Image from www.testo.com

The onsite teams at each test location recorded daily readings in a site-tailored Data Log Binder. Each location required a tailored approach because each facility operates a unique fryer configuration. For example, the collected SMSU data came from a single unit that has an independent reservoir for each of the three basket locations on the fryer system. A similar two-location style unit is shown in **Figure 1**. The Total Polar Material values were recorded for each reservoir in the unit.

Researchers took daily measurements in both locations at the same time to help reduce day-to-day variability. The staff were provided with identical instructions at both sites, with slight modifications to fit their standard operating procedures. The staff would then take daily readings of the oil recording the date, time temperature, and TPM reading for each fryer. AURI scientists compiled the results and reported back to the onsite teams. **Table 1** shows the correlation between oil quality and the measured TPM values as described in the instrument user guide. Since total polar materials are the various degradation products formed during frying, free fatty acids, monoglycerides, diglycerides, and other oxidative products, TPM is a simple and effective unit to precisely measure how spent the oil is and allows the onsite staff to more accurately keep track of the health of the oil in operation.

Table 1: Categories of Oil Quality by TPM.

% of Total Polar Materials (TPM)	Classification of Oil Aging
< 14 %	Fresh
14 – 18 %	Slightly Used
18 – 22 %	Used
22 – 24 %	Heavily Used, Change Oil
> 24 %	Spent, Discard Oil

RESULTS & DISCUSSION

Figure 2 reports all TPM readings recorded at both locations in the study. Shown in red triangles are the values for standard oil and high oleic oil values shown in green circles. There is a degree

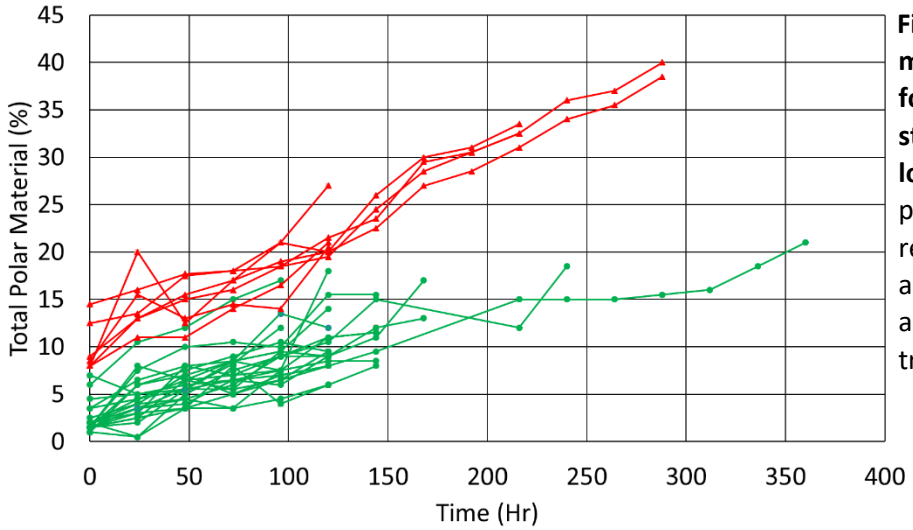

Figure 2: All total polar material readings recorded for high oleic oil and standard oil at both locations. High oleic oil total polar material readings are represented in green circles and standard oil readings are represented in red triangles.

of variation among the oil type readings; however, it is clear high oleic oil maintains a lower

%TPM reading compared to the control oil. Additionally, **Figure 2** shows the primary difference in the data is the oil type used with the variability among fryers being significantly less by comparison. The fryers in this study were multipurpose fryers with a broad range of products fried in the oil.

Both locations utilize a weekly cycle for disposal of oil and refilling of the systems with fresh oil which appears to be suited well for the standard oil used. The high oleic oil, however, could remain longer in the fryer. Averaging the data for each location by oil type along with the standard deviation as shown in **Figure 3** shows the comparison between the oil types. An extended fryer time test was not completed owing to the disruption in the test period from the data in **Figure 3** it is clear the high oleic oil would last longer. The expected fryer life is important as the high oleic oil is more expensive than the standard oil. By using the oil longer and extending the cycle before disposal of the oil, a cost recovery point could is reachable after which there would be a cost savings.

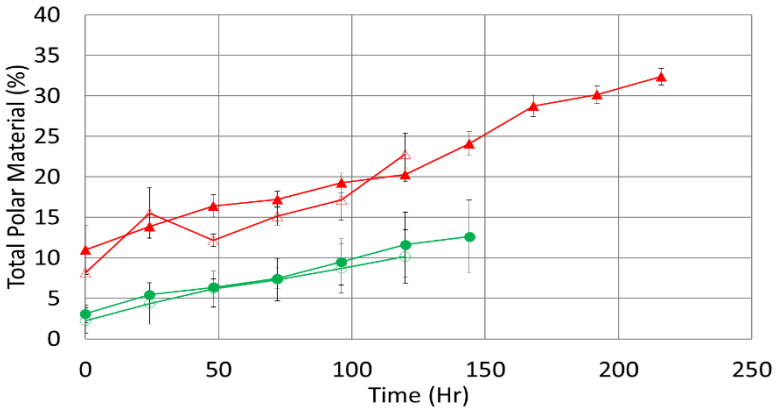

Figure 3: Average total polar material readings recorded at both locations. The performance of both oils is consistent with the high oleic oil values maintaining a higher quality, lower value, for the duration of the study. The High oleic readings are shown with circles and standard oil readings are represented as triangles. The Marshall high oleic values are open symbols and Crookston values are solid symbols.

An example from the data shown in **Figure 4** displays the standard oil TPM readings, which are averaged together and a typical disposal threshold is highlighted on the figure. From this figure it is possible to determine approximately how long the high oleic oil would have to be used in the fryer to recover the increase in purchase price. For example, if the high oleic oil were twice as expensive it would need to last twice as long or equal to the second week mark shown on the figure as the second highlighted vertical line. Similarly, if the oil is only 50% more expensive cost recovery would be half as long or relative to the data shown in **Figure 4** at approximately 250 hours.

The example analysis doesn't consider any additional savings for a facility in staff time assigned to cleaning the fryers, on disposal costs associated with the oil and in reduced number of oil changes. There are also other important nonfinancial benefits which include providing a consistently higher quality product to the customer (consider that at 22 to 24% TPM, a frying oil is considered heavily used), a healthier frying oil, and a potentially locally sourced product that supports regional growers.

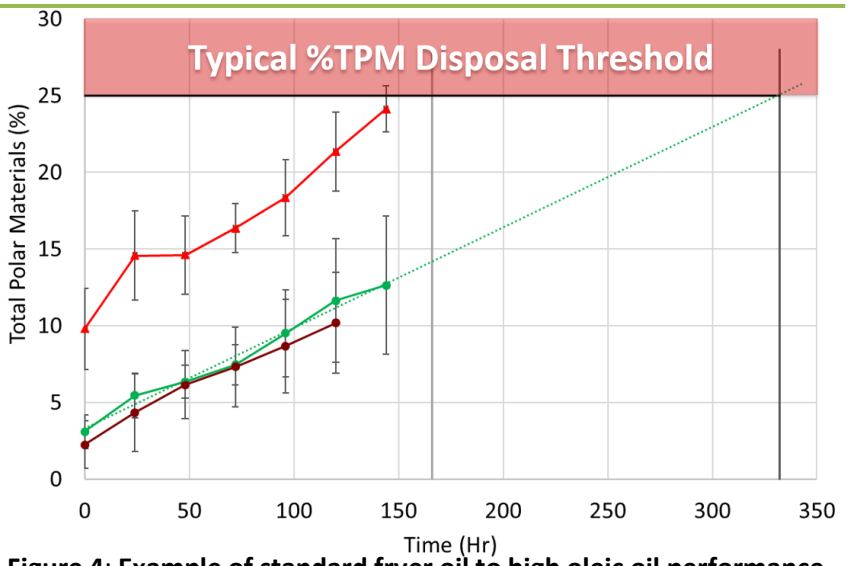

Figure 4: **Example of standard fryer oil to high oleic oil performance relative to a typical disposal threshold based on study data.** Red triangles represent average of all standard oil samples. Circles represent average of all high oleic oil data at both locations Crookston in Green and Marshall in Maroon. Error bars are standard deviation. Green dash line is trend line. First vertical line is one-week mark and second vertical in is two-week mark.

The Data Log Binder provided to each site included a section to write comments and observations for the onsite team during the trial period. A few of the comments from the onsite team recorded in the logs and through conversations during visits included the following:

- Noticeable difference when cleaning out the fryers. The high oleic oil left the fryer less dirty than the standard oil.
- High oleic oil looked fresher longer than the standard oil.
- Less smoking towards the end of the use than the standard oil.

Some informal comments collected from customers include:

- Liked how it contained more omega unsaturated fats.
- Expressed interest in seeing it used more widespread.
- Liked how it helped support Minnesota farmers.

OUTREACH & NEXT STEPS

The key differentiator for this project is the onsite food service team collected the primary data for the study. In so doing, observations of important outcomes are experienced firsthand and not simply provided as a report or presentation to the team. The benefits of a firsthand experience

allow the teams to develop a sense of ownership over the results. It also developed a higher level of interest in the high oleic oil product especially among student workers in the facilities. In early August 2018, AURI used a demonstration at Farmfest to elicit a similar firsthand experience from those in attendance. At Farmfest, visitors to AURI's tent had the opportunity to sample a food application prepared using High Oleic shortening and to read about the benefits and positive attributes of High Oleic Soybean oil from signage developed for the event.

Throughout the project, AURI actively sought opportunities for outreach and dissemination. AURI presented the results at a number of regional events that yielded positive results. In late August 2018, AURI presented to participants of the Soy Nutrition Institutes' biannual meeting on the high oleic food efforts with Chartwell's and other related activities. AURI also hosted a meeting in May 2018 at the AURI office location in Marshall, MN with Joy Blakeslee, Vice President / Culinary Studio Director, MSLGroup; Richard Galloway, USB Consultant; David Miller, Food Business Practice Lead, Clutch Performance; and AURI staff. The meeting provided AURI a unique opportunity to share the work it has been doing with MSPRC on HOSoy and the preliminary results of the High Oleic Soybean Oil Trial. The meeting created a valuable opportunity for mutual understanding of organizational expertise and was instrumental in forging a path to the current collaboration with MSLGroup on the University Foodservice Pilot and Promotion funded by USB.

Going forward, AURI will utilize the USB funding awarded to expand the high oleic oil study regionally to 4-7 university campuses. The goal of the expanded study is to specifically work with Chartwells managed campus dining facilities so that a large portion of the Midwest under the management of the district manager will have on site testing experience with the high oleic oil. From this larger data set, the experimental evidence will be much stronger but more importantly a recommendation for a change in fryer procedures from the onsite operations team could maximize the value of the performance oil. By combining the data with an operations-based recommendation for use, a change in purchasing may result. A change in the project structure that will further the likelihood of adoption is the switch to onsite purchasing of high oleic soybean oil using the teams' own procurement system.

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INNOVATE. COLLABORATE. ADVANCE.

U.S.-Grown High Oleic Soybean Oil delivers:

- An improved fat profile that includes 0 grams trans fat per serving, lower saturated fat and three times the amount of healthier monounsaturated fatty acids*
- Increased oxidative stability, which translates into enhanced functionality, less food waste, extended fry life, and cost savings

The U.S. soybean industry is committed to delivering products that meet consumer health and nutrition needs. In partnership with the Agricultural Utilization Research Institute, the Minnesota Soybean Research & Promotion Council, the United Soybean Board and QUALISOY, we have incorporated the use of U.S.- grown high oleic soybean into our operations as of March 2018.

Learn more about the benefits of high oleic soybean oil at QUALISOY.com.

*Compared to conventional soybean oil.

SMSU Campus Dining is Proud to Support U.S. Soybean Farmers...

...Now serving food cooked in locally grown High Oleic Soybean oil!

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High Oleic Soybean Oil

First commercialized in 2011, has increasingly become the oil of choice for restaurants, bakeries, food producers, consumers and clean label advocates.

High Oleic Soybean Oil extends shelf life and offers among the longest fry life of any edible oil. The oil improves product nutrition and allows foodservice operators and food manufacturers to answer consumer demand for products that help improve overall health.

Facts

- 0 grams of trans fat
- Three times the amount of beneficial monounsaturated fatty acids (MUFAs), as compared to conventional soybean oil
- High Oleic soy oil is low in saturated fats – just 2 grams per tablespoon. May help reduce coronary heart disease
- High Oleic soy oil is naturally free of trans fats
- High Oleic soy oil has a neutral flavor and is highly versatile – great for frying, baking, or use as a salad dressing

Availability

The American soybean industry dedicates itself to helping food companies deliver products meeting consumer health needs and preferences. In doing so, the soybean industry continues to develop soybean varieties with enhanced compositional traits to produce oils with a healthier profile and improved functionality.

High oleic soybeans utilize sustainable production methods and are 100 percent U.S. grown, which supports American farmers and local economies.

Currently, soybean farmers' collaboration with seed technology companies results in a ramping up of crop production and acceleration of the supply of U.S grown high oleic soybeans.

High oleic soybean acreage and oil production is expected to more than double year upon year, resulting in 9.3 billion pounds of available oil within the next decade.

*Facts and Availability Provided by Qualisoy

Health Benefits

CONSUMERS WANT TO EAT HEALTHIER AND ARE LOOKING FOR SIMPLE WAYS TO DO IT.

0g trans per tablespoon (14g)
Allergens: None

THE VAST MAJORITY OF CONSUMERS REMAIN CONCERNED ABOUT THE NUTRITIONAL CONTENT OF THE FOODS THEY EAT*

88%

HIGH OLEIC SOYBEAN OIL
High Oleic Soybean Oil's fat profile features lower saturated fat and 0 grams of trans fat, which may lower cholesterol and support heart health.

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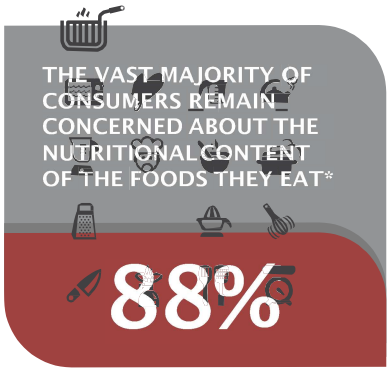

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