CDRFoodLab®

How to Optimize your Cooking Oil

Maximizing snacks Quality and Shelf Life through quality control and optimization of cooking oil during the snack frying process using the fast CDR FoodLab® analysis system and the Filsorb® oil filtration and purification system.

Oil optimization is undoubtably the key to producing a successful brand of snack food such as potato chips, extruded and pellet snacks, tortilla chips, or nuts. Optimizing your oil provides a longer lasting cooking oil, less oil absorption, and a more robust finished product.

Optimizing your cooking oil revolves around 4 critical parameters:

- **Oil type.**
- **Rate of oil degradation.**
- **Product oil absorption.**
- **Rate of oil rancidification in finished products.**

Utilizing the CDR FoodLab®, for immediate on-site oil parameter testing, in combination with FILSORB®, to achieve purification and renewal, the proper steps can be taken to produce high quality and long-lasting finished products.

Figure 1. CDR FoodLab® Top version

Oil Type

Chemically, oils are classified based on their fatty acid composition. This includes saturated fats, monounsaturated fats, and polyunsaturated fats. For example, olive oil is compromised predominantly of monounsaturated fats, while sunflower oil is high in polyunsaturated fats.

The iodine value measures the degree of unsaturation, or the number of double bonds present, in an oil's fatty acid molecules.

The iodine value is commonly used to characterize oils and fats. Oils with higher iodine values contain more unsaturated fatty acids, which tend to be liquid at room temperature and have lower melting points. Conversely, oils with lower iodine values contain more saturated fatty acids, which are typically solid at room temperature and have higher melting points.

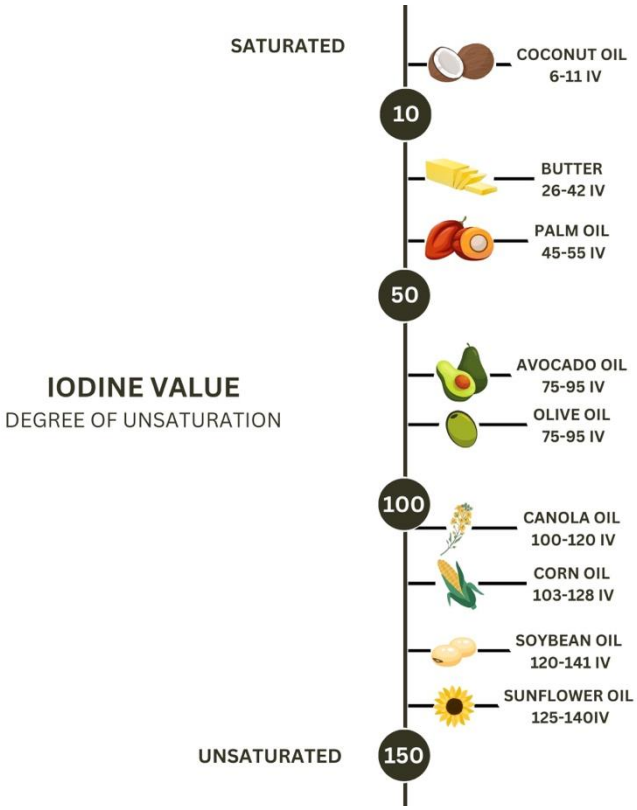

Figure 2. Iodine value of various oils.

Determining the iodine value of your frying oil can help predict how prone the oil is to oxidation and degradation. The measurement of Iodine Value on the **CDR FoodLab®** takes 3 minutes, requires no official chemistry training, and is aligned with the AOCS method 1c-85.

Rate of Oil Degradation

During the frying or roasting process hydrolysis of the oil takes place. This process involves the breakdown of triglycerides (the main component of cooking oils) into free fatty acids (FFAs) and glycerol.

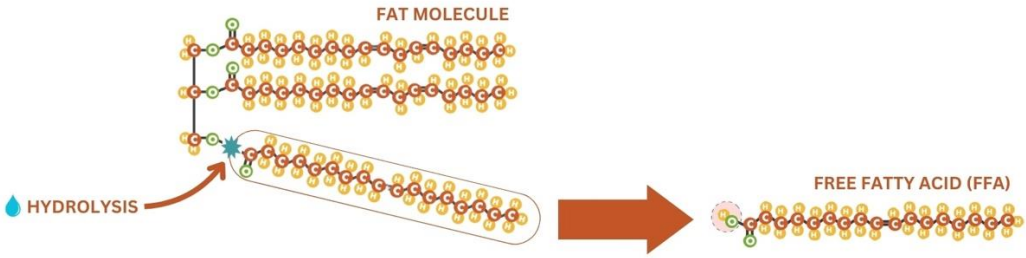

Figure 3. Illustration showing hydrolysis of the fat molecule and how free fatty acids are created.

The measurement of FFA is the key indicator of oil quality. High levels of FFAs can affect the frying performance of cooking oil, leading to reduced frying efficiency, shorter frying lifespans, and inferior finished product quality.
Oils with higher iodine values, are generally more susceptible to hydrolysis (increased FFA rise) compared to oils with lower iodine values.

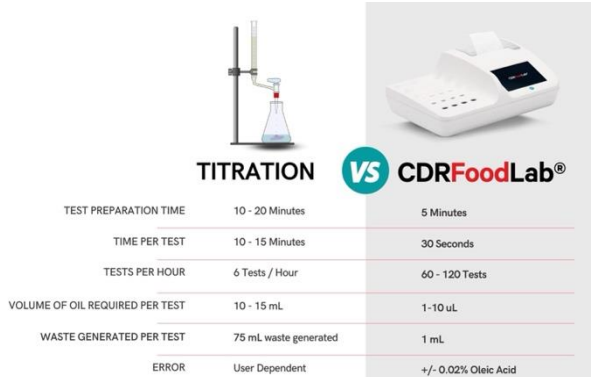

Figure 4. AOCS Official Method Ca 5a-40 titration method vs. the CDR FoodLab® free fatty acid test method.

Free fatty acids can be reduced via **FILSORB®**, an active and food safe powder that when mixed with your frying oil, will remove up to 80% of free fatty acids, as well as color bodies, impurities, and rancidity -- extending the life of your cooking oil and decreasing your virgin oil costs.

The **CDR FoodLab®** can test for FFA value in under 30 seconds versus 5-15 minutes with the traditional AOCS Ca 5a-40 but with direct correlation and very limited chemical disposal required.

Product Oil Absorption

Oils with a higher iodine value, and thus a higher number of unsaturated fatty acids, are more prone to oxidation and hydrolysis (FFA increase). This leads to a decrease in the viscosity of the oil, making it thinner and more fluid. When combining the decrease in viscosity along with higher FFA values, there is a reduction in the interfacial tension between the oil and water which in turn increases the rate of oil absorption into the food product.

An increased oil absorption leads to:

- higher level of oil carryout = increase oils costs
- More oil in finished product = more FFAs in finished product

Rate of Oil Rancidification in Finished Products

Free fatty acids will bind to hydroxyl groups to create a hydroperoxide indicated by peroxide value (PV). Peroxide value is a primary indicator of the rancidification process. This process can occur in the cooking oil itself or the oil absorbed by the finished product. Elevated peroxide values indicate that the oil has undergone oxidation and will have a reduced shelf life and deteriorated quality.

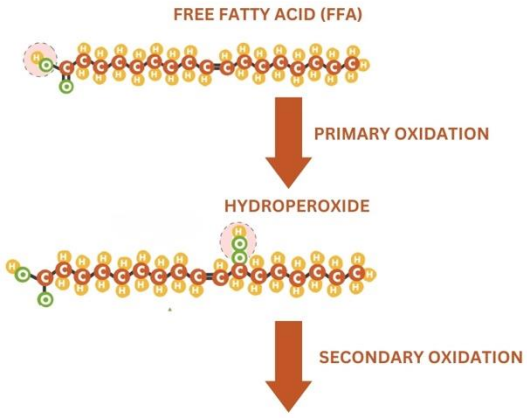

Figure 5. Illustration showing how hydroperoxides (measured by peroxide value) and aldehydes (measured by p-ansidine value) develop through primary and secondary oxidation.

One step further in the oxidation pathway is the p-anisidine value (AV) which measures the secondary oxidation that occurs in conjunction or proceeding peroxide formation in the cooking oil. A high anisidine value is directly correlated with off-flavors and odors in the oil and subsequently the finished product.

Increased oil absorption into the finished product, especially oil with elevated free fatty acids, opens the door for an exponential rate of peroxide formation and an increased level of anisidine value, reducing the shelf life of the finished product.

It is also important to note that oils with a lower iodine value are less reactive and less prone to oxidation than oils with a higher iodine value.

Unlike free fatty acids, peroxides and anisidine value cannot be treated for and reduced in the same capacity that free fatty acids can. It is important to maintain a low FFA value in ones frying oil to limit the formation of primary and secondary oxidation markers. Oil treatment with FILSORB® is the best option to accomplish this.

Mixing **FILSORB®** into your oil prior to a pressure or vacuum filtration system will remove up to 80% of your free fatty acids. **FILSORB®** works by removing the oil degrading compounds as well as particulate that forms in your oil during the frying process. Removing these compounds greatly slows the subsequent rancidification processes that takes place and causes rancid smell/taste, off odors, dark coloration, and more in your oil and finished product.

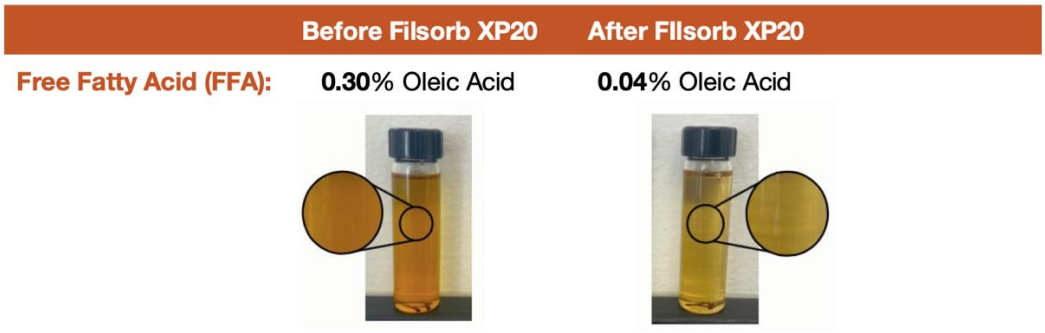

Figure 6. Oil before and after treatment with FILSORB® XP20.

The **CDR FoodLab®** has the capability to test for peroxide value in 3 minutes and Anisidine Value in 1 minute both directly correlated to the AOCS methods Cd 8b-90 (peroxide value) and Cd 18-90 (anisidine value) without the need for harsh chemicals or a specialized fume hood for testing.

Steps to Optimizing your Cooking Oil

1. **Choose your cooking oil with the knowledge of how it will act and react long term.**
    a. Test your oil's iodine value (IV) to understand the saturation level and its susceptibility to long term frying.
2. **Test each incoming lot of oil for:**
    a. Free fatty acids
        i. Ensure your oil meets the specifications of your supplier.
        ii. Ensure your oil has not been previously used.
3. **Monitor your oil and finished product consistently.**
    a. Ensure you are consistently monitoring your oil for the top degradation markers-FFA, PV, and AV. Keep a consistent log of these markers to have traceability linking the oil to the finished goods lot number.
    b. The **CDR FoodLab®** system is the ideal solution for carrying out analyses of oils and fats for quality control on production lines in real time.
        i. Free Fatty Acids- understand your oil's rate of rise and when oil treatment is required.
        ii. Peroxide Value- understand your oil's and finished product's susceptibility to rancidification
        iii. Anisidine Value- measure the current rancidification your oil and finished product has already obtained.
4. **Treat your oil to reduce Free Fatty Acid content.**
    a. When your oil has reached 0.3%-0.6% FFA value it is time to start considering treating your oil with **FILSORB®.**
    b. **FILSORB®** works by removing the oil degrading compounds as well as particulate that forms in your oil during the cooking process. Removing these compounds greatly slows the subsequent rancidification processes that takes place and causes rancid smell/taste, off odors, dark coloration, and more in your oil and finished product.

Reference

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