Care of food service frying oils

The following article was prepared by Frank T. Orthoefer, vice president of research and development for Riceland Foods Inc. It is based on highlights from Session GG (Frying Fats and Oils) from the 1988 AOCS annual meeting held in Phoenix, Arizona, in May 1988, and also on information from suppliers of frying oil filtration media.

The food service operator is familiar with frying oils that smoke excessively, foam and darken rapidly and leave fried foods tasting greasy. All of these occurrences indicate that the oil requires replacement. Steps can be taken to insure that the new oil will perform at its maximum potential to provide the consumer with an acceptable food. These steps involve the maintenance of the fryer, selection of the proper oil and daily care of the oil. Understanding the basics of frying, oil degradation and routine maintenance are essential.

Frying basics

Deep-fat frying is a simple process in which the oil serves as a heat-exchange medium. Oil is adsorbed during the frying process and solubilization of the food fats occurs. Flavor compounds are generated from heat effects on proteins, carbohydrates, lipids and minor constituents present in the food being fried. Deep frying is chosen both for rapid food preparation and for producing the desired texture and flavor of the fried foods.

The deterioration of frying fats is familiar to all users of frying oils. According to Michael Erickson of Interstate Foods Corp., this deterioration causes oils to smoke or foam and results in fried foods that are improperly browned or that have an unappealing flavor. He said primary oil deterioration includes hydrolysis, oxidation and caramelization. Edward G. Perkins of the University of Illinois noted that further degradation of the oil results in oxidation and polymerization to promote further darkening, off-flavor development and foaming.

Although frying is a simple process, several factors may influence the fry-life of the oil—that period of time before the food being fried becomes unacceptable.

Robert Regutti, a representative of Gycor International Ltd., said major factors include air exposure, stability of the oil to oxidation, steam or moisture exposure, contamination of the frying oil with oil from the food being fried, contamination from charred food particles primarily from the breading mixes used to coat fried foods, and exposure to prooxidants such as metals and strongly alkaline cleaning compounds.

Sharon Melton of the University of Tennessee noted that the deterioration of frying oils generally is followed by changes in free fatty acid level, color of the used oil or an increase in the polarity of the oil.

Oil is a significant cost to the food service operator. Matching the oil to the operator's requirements is a major way to improve the life of a shortening. Optimum care of the fryer, both in its use and cleanup, are equally important. Correct temperature setting, frying of foods with a minimum of surface moisture and proper maintenance of the fryer are part of proper care.

Fryer maintenance

Cleanliness of the fryer and proper operating conditions are necessary for maximum fry-life, according to Erickson. During frying, maintenance procedures should include periodic monitoring of frying temperatures, removal of floating debris, maintenance of fry fat level and, if possible during slack periods, reduction of fryer temperatures, Regutti said. At the beginning or end of the day, filtering the oil using a filter medium for removal of fines, and general cleanup of the fryer, baskets, hood and air filters are recommended. During startup, slow heating of the oil prevents burning near the heating elements. Adjustment

of the oil level will be needed upon reaching fry temperature.

Oil maintenance

Durkee Foods' James Jasko, surveying the types of frying oils produced for the food service market, said proper oil selection depends on the foods being fried, the rate of frying, turnover rate of the oil and stability requirements of the fried product. In addition to conventional frying oils, genetically modified products, such as SVO Inc.'s high oleic sunflowerseed oil, possess exceptional fryer stability.

Due to the high cost of oil to the food service operator, the industry has searched for methods of prolonging the life of the oil. Regenerating the oil through the use of various adsorbents has been prescribed. The suppliers of filter media have shown various benefits to frying-oil stability (Figs. 1 and 2). Adsorbents used include zeolites, bentonites, kaolin, diatomaceous earth, activated silica, activated magnesia, alumina and activated carbon. Filtration of the oil alone through a bed of diatomaceous earth removes charred food particles, a major cause of oil deterioration. Adsorbents will partially remove the free fatty acids, oxidized polar materials and colors that develop from nonenzymatic browning.

The filtration of frying oils is common practice for both the food service operator and the industrial fryer. The industrial fryer generally has a continuous filtration system. Additionally, industrial fryers are designed to isolate food particles from the heated oil, minimize air and steam exposure, and provide excellent temperature control with rapid heat recovery.

The food service operator generally filters the oil once a day before or after the business day. Multiple types of foods usually are fried in a single fryer, although fryer dedication is becoming more common. The filtration medium simply is added to the frying oil in the fryer. The suspension is allowed to pass through a coarse filter followed by a finer filter. It is recirculated to remove fines, to build up a filter bed on the filter and to rinse down the sides of the fryer. The oil then is pumped back to the fryer.

Filtration medium

According to Regutti, the guide to using the best filtering medium is to identify the medium that gives the longest fry-life and yields the highest net savings. A testing format should include a comparison of all filter aids using recommended amounts and procedures. The major parameters to be evaluated include food flavor, aroma and color at the end of each day's frying. Daily oil samples should be evaluated for color, clarity, free fatty acids and the polar compounds and polymers generated. The oil should be discarded when the flavor of the finished product is unacceptable, the oil smokes excessively or excessive foaming occurs. A correlation between analytical data and endpoints can be made. Most food service operators not having analytical facilities can use simple comparative tests.

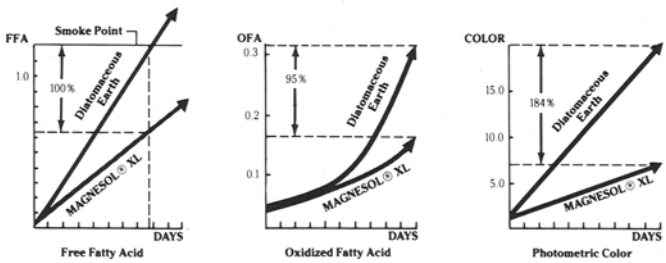
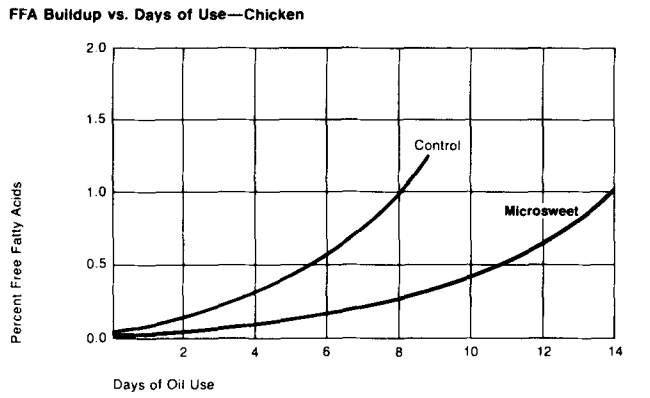
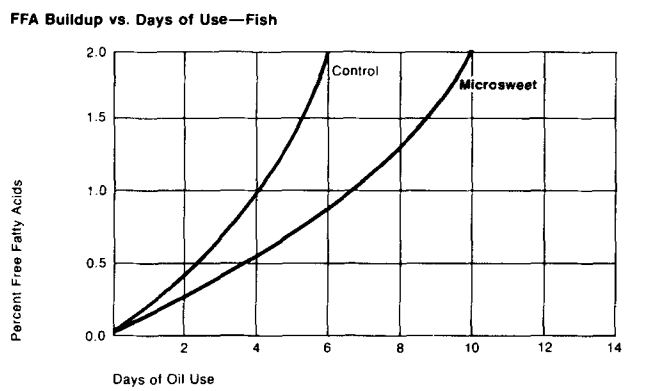


FIG. 1. Comparisons of Magnesol XL and diatomaceous earth, as provided by Reagent Chemical & Research Inc.





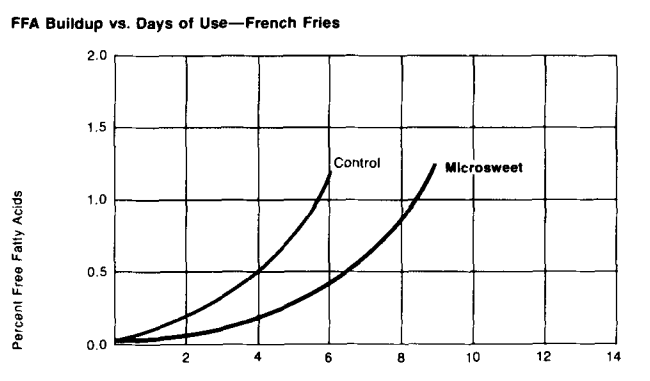


FIG. 2. Performance of Microsweet vs. a control, as provided by Manville Sales Corp.'s Filtration and Mineral Division.

Diatomaceous earth (DE) is used extensively for filtration of oils. Roger Sinram, in studies at the A. E. Staley Co., found that DE has little effect on removing the soluble breakdown components of oil degradation, but effectively acts as a filter medium removing particulate material. He noted that daily filtration to remove charred food particles that act as a catalyst of frying oil degradation is the single most important step in improving oil performance.

Suppliers of complex filtration media include Oil-Dri Inc., Manville Sales Corp.'s Filtration and Mineral Division, Engelhard Corp. (formerly Harshaw-Filtrol Partnership), Gycor International Ltd. and Reagent Chemical & Research Inc. Filtration media can be formulated to remove the free fatty acids, color bodies, peroxides and oil polymers from the frying oil. Usage levels of the filtration medium generally range from 6 to 14 fluid ounces per 50 pounds of frying fat or 0.5 to 1.5%.

According to Regutti, specialized filter media can extend the life of cooking oil up to 175%. Proprietary formulations using synthetic amorphous silicates blended with synthetic and natural amorphous silicates are prepared to a specific customer's requirements to maximize functional properties for adsorption of the decomposition compounds produced during deep-fat frying. Regutti claims Gycor filter media can adsorb both volatile and nonvolatile compounds including oxidized fatty acids, aldehydes, ketones, alcohols, organic acids, hydrocarbons, hydrolyzed fatty acids, trace metals and polymers, and physically remove carbonized food particles.

The Magnesol Food Service Division of Reagent Chemical & Research Inc. manufactures Magnesol XL "Shortening Saver." According to Jay Munson, the company's general manager, this 100% amorphous synthetic magnesium silicate is a contact adsorbent with a wide range of food, commercial, industrial and pharmaceutical purification applications.

Reagent Chemical claims Magnesol XL adsorbs metal ions, polar compounds, free and oxidized fatty acids, aldehydes, color, odor, polymers and other byproducts of oil degradation. Removal of these compounds from used frying oil helps maintain oil freshness, thereby increasing its usable life. According to Munson, customers report increases in frying-oil life two to three times normal, and savings of $5 or more in shortening for every $1 spent on Magnesol XL while consistently producing superior fried food.

Munson added that Magnesol XL has overcome filtration problems associated with most adsorbents, and tests show the product filters faster than many grades of diatomaceous earth.

Manville produces two major types of filter media for fryer use: Silasorb and Microsweet. Silasorb is a synthetic calcium silicate for adsorption of free fatty acids from cooking oils. It is used primarily for industrial fryers in which the oil is removed from the fryer to a mix tank, 1-2% Silasorb is added and mixed gently for 20-25 minutes at 170-190°F, followed by filtration from the oil. Company representative John Knudson said Silasorb is especially suitable for frying chicken, nuts, taco shells and almonds. Microsweet is a blend of diatomite filter aid, magnesium silicate and synthetically produced calcium silicate. The diatomite filter aid is used to remove the charred food particles from the oil, the magnesium silicate removes color bodies and the calcium silicate removes free fatty acids. Typical dosages are about 1% of the oil. Fry-life extension of 50% has been reported, he said.

Donald Hoffmann of Engelhard Corp. claims the company's FryLight can cut frying oil expenses up to 50%. FryLight is an active adsorbent used to remove liquid impurities such as free fatty acids, soaps and color bodies from used cooking oil.

The maximum fry-life of a food service oil requires both the selection of the proper oil having the desired stability and physical characteristics, and a program of fryer maintenance and oil treatment. This includes the correct operation of the fryer and routine cleanup, including filtration of the oil. Filter media are available that have the potential of extending the oil's fry-life. However, filter media may require adjustment to a particular user's needs.