Quality-assured oil

In order to best maintain the quality of frying oil it is necessary to remove not only the particulate, but also the soluble degradation products, according to Bryan Bertram and Brian Cooke of the USA-based Dallas Group.

Frying oil is susceptible to many unfavourable conditions. In response, oil manufacturers have continuously pursued techniques to enhance its stability. Traditionally, this has been accomplished by the use of hydrogenation. It is now known that this leads to the formation of unhealthy trans-fatty acids.

Processors of fried potatoes, therefore, are presented with the challenge of balancing the health demands of consumers, frying process efficiency and finished product stability.

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Basic oil chemistry

Fats and oils are triacylglyceride molecules composed of a glycerin molecule with three attached fatty acids. The type of fatty acid is determined by the origin of the oil or fat. Fatty acids vary in size (determined by the number of carbon atoms they contain) and in shape (determined by the manner in which the carbon atoms are put together).

The manner in which the carbon atoms are put together results in fatty acids that are either saturated or unsaturated. The saturated fatty acid molecules are more stable during frying than the unsaturated ones. Unsaturated fatty acids are more prone to degradation. Hydrogenation of oils converts unsaturated fatty acids to saturated fatty acids.

Unfortunately, this process also results in the formation of trans-fatty acids or "trans-fats". Due to consumer pressures, producers of fried products are striving to remove the trans-fatty acids from their labels. This results in reduced stability of the oils during the frying operation as well as during the storage of the finished fried product.

Regardless of the origin, virgin frying oils are chemically non-polar. However, as these oils degrade, polar compounds are produced. The main degradation reactions that occur during frying are hydrolysis (creates free fatty acids), oxidation (creates peroxides, aldehydes, ketones) and polymerisation (caused by heat stress).

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The concentration of the polar materials increases as the frying process continues until the oil is considered unfit for use. The quality of food fried in the oil will continue to decrease as well until it is unacceptable for human consumption. A relationship between the taste and quality of fried food and the concentration of total polar materials has been established (2). As a result, legal limits have been set by various countries limiting the amount of degradation products present in frying oils, the most common of these being free fatty acids (FFAs), total polars and polymers. (3).

Maintaining frying oil quality

Filtration has long been used in the frying industry for removal of particulates from the used oil. Excess build-up of particles in the oil result in accelerated degradation. Filter paper, steel screen or cartridges can typically remove particles down to approximately five micrometers. The use of a filter aid such as

diatomaceous earth or perlite can remove particles down to about one micrometer or less by forming a "filter cake" resulting in what is commonly called "depth filtration" (see diagram).

In order to best maintain the quality of frying oil it is necessary to remove not only the particulate, but also the soluble degradation products. This may be accomplished by the use of an adsorbent that will act as a depth filter to remove particulate and will also remove soluble degradation compounds. The surfaces of adsorbents attract and hold onto the degradation compounds.

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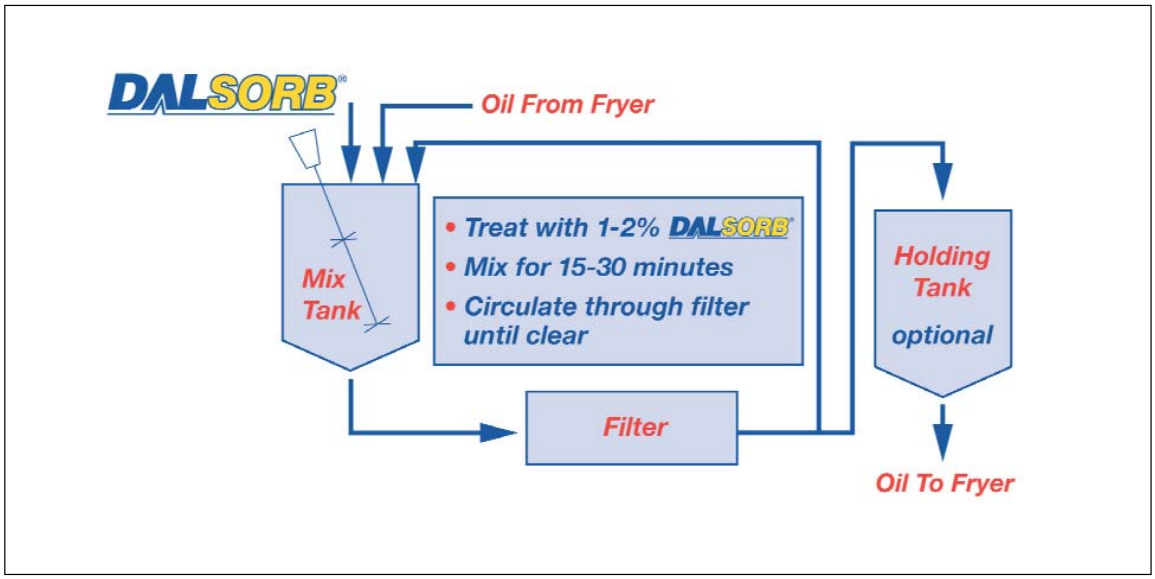
When evaluating adsorbent materials for their potential use in the frying operation, there are several key aspects to consider.

Evaluation of an adsorbent should include: ease of use, safety considerations, governing body approvals (FDA, Kosher, Halal), effectiveness and cost. Effectiveness of the adsorbents may be judged by measuring the levels of degradation products in the oil including: free fatty acid (FFAs), soap, colour, anisidine and polymeric material.

One adsorbent product, Dalsorb from the Dallas Group, forms a filter cake that removes particulate and adsorbs the degradation



products that are formed during the frying process.

Dalsorb was evaluated in a field study of a commercial frying operation in which daily oil samples were collected. The samples were analysed for FFA content, soap content, colour analysis, anisidine value, total polar materials, and polymeric content. The oil quality after filtration each day was near that of new oil. Daily averages are summarised below:

FFA	**0.05 %**
soap	**10 ppm**
anisidine value	**30**
polar material	**2 per cent**
Polymeric material	**0.8 per cent**

One measure of the quality of oil always used is the colour of the oil. An example of oil before and after filtration with Dalsorb is shown on page 12 (before treatment on left, after Dalsorb treatment on the right):

Daily use of the adsorbent, Dalsorb, yielded the following benefits:

- No oil discard
- Reduction in oil usage
- Reduction in downtime
- Reduction in energy usage
- Reduction in clean-up costs
- Improved finished product quality resulting in increased shelf life
- Consistent oil quality

Fortunately, an efficient adsorbent filtration solution is readily available to producers of

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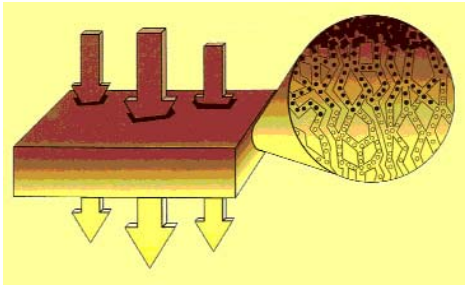

fried products, even when low-trans oil is used. Daily use of adsorbent filtration has been demonstrated to maintain frying oil and finished product quality. ■