

De-oxygenation of edible oils

History

The negative effects of the presence of oxygen in nearly all beverage and food products are common knowledge.

In the beer and beverage industry minimization of the oxygen content in the final product has been of primary concern for years. Oxygen will enter the processes via the process water if it is not de-oxygenated or removed otherwise. Today it is not only the water used in the processes as such which is de-oxygenated, but even the water used for cleaning of the process systems (tanks, piping etc.) is often de-oxygenated to ensure that oxygen does not enter the systems during CIP.

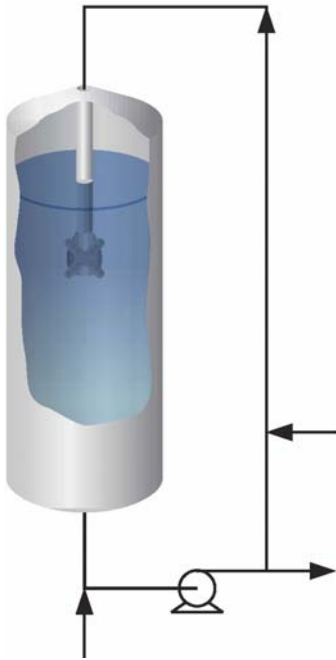
Present applied technologies.

Typically, de-oxygenation of water used in the beer and beverage industries has been performed using either a combination of heating and vacuum treatment or counter-current absorption. The process equipment for these de-oxygenation processes is not simple, is rather expensive, and is not always designed in a way which fulfils the very strict sanitary requirements the industry is demanding.

New simple de-oxygenation method.

During the last couple of years, the Danish company ISO–MIX A/S has developed the ISO-MIX fluid/fluid mixing technology into an extremely efficient gas dispersion system as well.

The ISO–MIX system consists of a pump, a recirculation loop and an ISO-MIX Rotary Jet Head (RJH) mixer installed under the liquid surface in the tank containing the product which ought to be de-oxygenated. (see fig.1)



The de-oxygenation process is performed by recirculating the liquid from the bottom of the tank over the pump and back into the tank through the ISO-MIX RJH. Stripping gas in the form of e.g. nitrogen or carbon dioxide (if a carbonized liquid is wanted) is blown into the loop on the pressure side of the pump. The ISO-MIX RJH is equipped with 4 nozzles which are rotating around two axes – driven by the inlet pressure of the fluid - in such a way that the entire tank volume is continuously swept by hydraulically balanced jets. This ensures that the entire tank volume is being exposed to the agitating effects of the jets.

Fig. 1



The efficiency of the RJH system for fast mixing of tanks has been documented (see www.iso-mix.com) and the mixing system is now widely used in the beverage, food and chemical industries. In the beer and beverage industries the technology has been applied for de-oxygenation of water and beer, and the resulting simple and cost effective system has already shown its value in several breweries. In the beer and beverage industries it is not only water which may be de-oxygenated by means of nitrogen or carbon dioxide, but also juice and beer.

The nitrogen is dispersed into the liquid in extremely fine bubbles.

De-oxygenation of edible oils



ISO-MIX A/S was recently asked by an oil manufacturer if they could de-oxygenate linseed oil and other cold pressed oils like rapeseed oil and olive oil. The oil manufacturer had been requested by a large retailer to guarantee an oxygen content of less than 0.2 ppm in the produced linseed oil. This proved to be a difficult task if traditional technologies had to be used.

Using an ISO-MIX system, however, proved that it was very easy to reach the desired oxygen content. At the same time the operating cost and the investment costs were much lower than the costs for the traditional systems.

In continuation of this project it was tested whether it was possible also to de-oxygenate fish oil in the same simple fashion by stripping the oil with nitrogen in an ISO-MIX de-oxygenation system.

The results were rather convincing. First of all it proved to be very easy to reach the desired oxygen content. However, what proved to be just as interesting was that the level of oxidation in the de-oxygenated oil, was less or equal to the oxidation level of the oil which was solely treated with a commercial antioxidant.

In fig. 2 TotOx values are shown for oils being treated to various levels of oxygen content from 2ppm to 0.01 ppm.

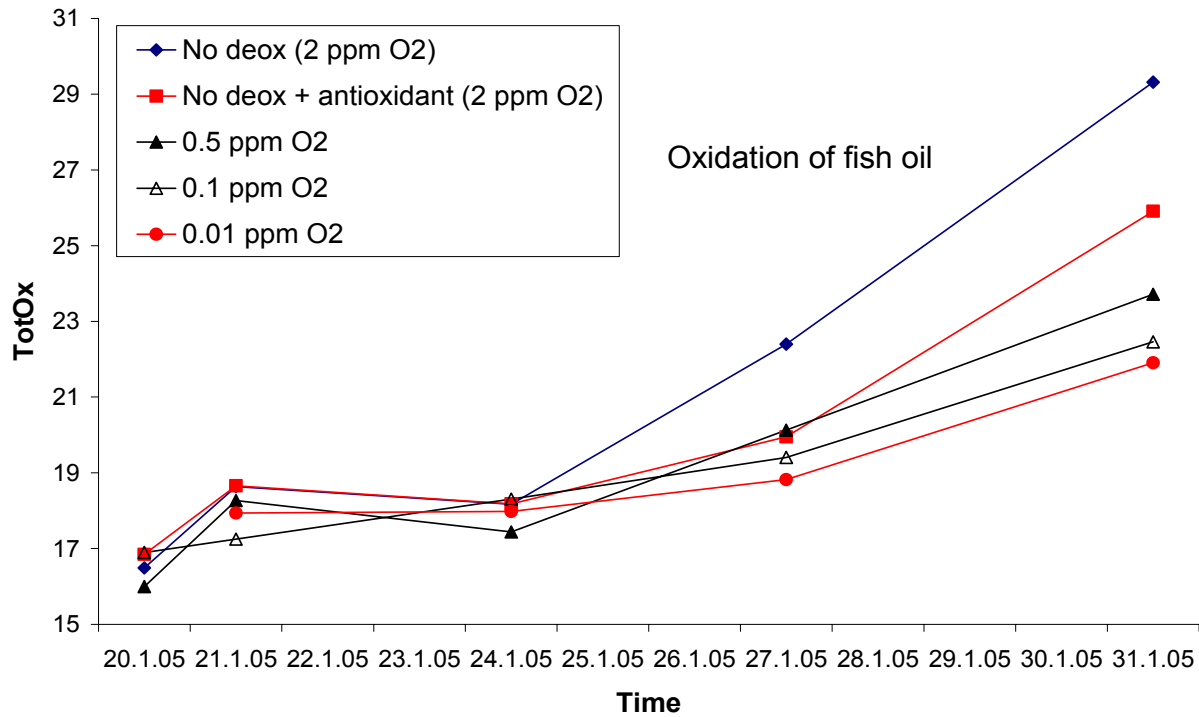


Fig. 2

An accelerated test where the oil was left in open beakers in sunlight showed that the de-oxygenated oil was less oxidized after 11 days than the untreated oil. This was not surprising. However, the de-oxygenated oil was also less oxidized than the oil treated with a commercial antioxidant normally used by the fish oil manufacturer. In another test where the oil was left in the dark for 60 days, the level of oxidation of the de-oxygenated was as low as in the oil treated with an antioxidant in traditional manner. (BHT used in a 200 ppm concentration)

Discussion

Surprisingly, it proved to be difficult to find good data for the ability of edible oils to dissolve oxygen. Data obtained in the literature indicate that the oil may contain more oxygen than water (8-9 ppm at 20 degrees C) . Figures of 30-40 ppm are mentioned. At the same time the literature indicate that the oils can contain more oxygen at higher temperatures, whereas for water this is the opposite.

Conclusions

It has been proven that it is very easy to remove oxygen from edible oils in a simple, fast, and inexpensive way by using nitrogen in an ISO-MIX de-oxygenation system. The operating cost will be in the order of 0.25-1.25 Euro per ton of oil, depending a.o on start level of the oxygen content and to which level the oxygen concentration must be lowered. Nitrogen costs will be the major operating cost. The power consumption is negligible.