Slick Answers

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Hindsight is a wonderful thing. It is interesting to look back at the developments that have been made over the past couple of decades in bakery release agents. During this time, release agents have moved from being based on mineral oils to being based on hydrogenated and, now, non-hydrogenated vegetable oils.

Essentially there are four main applications:

- Trough greases.
- Divider oils.
- Pan oil or tin grease.
- Belt release agents.

In all of these cases there is direct contact between the release agent and the baked product and, inevitably, there will be some carry-over of the release agent to the final product, however minimal this may be considered to be. This has meant that the nature of the release agent and, especially, any health and nutrition concerns relating to the release agent have been scrutinised more closely in recent years.

If we look at what can happen to a release agent during its use, then two main forms of degradation can occur - polymerisation and oxidation. It goes without saying that the release agent is used in a very thin film with a large surface area. This makes it much more susceptible to oxidative attack. It also makes it much more susceptible to polymerisation when used as a tin or pan oil or as a belt release agent where the oil is going to get to a high temperature. Mineral oils - which were widely used up to about 15 years ago, and are still used in some countries - are very stable to both oxidation and polymerisation. From a health and nutrition point of view, though, a number of question marks have been placed on their use. And so manufacturers, in general, moved to using vegetable oil based release agents.

Depending on their origin, vegetable oils contain different fatty acids and have differing degrees of unsaturation. Some, such as soyabean oil and rapeseed oil, are highly unsaturated. Others, such as coconut oil and palm kernel have a low level of unsaturation. Palm oil has a good balance of saturates and unsaturates. The relative levels of saturates and unsaturates in common vegetable oils is shown in Table 1.

Table 1
Levels of saturates and unsaturates in common vegetable oils

Oil	Saturates	Monounsaturates	Polyunsaturates
Palm kernel oil	82%	16%	2%
Coconut oil	92%	6%	2%
Palm oil	51%	40%	9%
Rapeseed oil	8%	62%	30%
Sunflower oil	12%	24%	64%
Soyabean oil	16%	23%	61%

The more unsaturated an oil, and especially the more polyunsaturated it is, the greater the risk of oxidation and polymerisation. However, if the oil is partially hydrogenated then a large part of the polyunsaturated fatty acids are converted into either less unsaturated

fatty acids or into trans fatty acids. Both of these will improve the oxidative stability of the fat. Using base oils such as soyabean oil or palm oil that contain high levels of natural antioxidants will improve things even more. Fractionating the partially hydrogenated fat will then give a liquid fraction that still retains its high oxidative stability. So, when question marks appeared over mineral oils, this is where users of release agents turned to. Now, we are seeing question marks placed over partially hydrogenated fats and about trans fatty acids in particular and so there is now a move towards non-hydrogenated trans free systems.

Such a move will have an effect on the oxidative stability of the oil. Whether or not this is critical depends on the application and the type of release agent being used.

Table 2 compares the fatty acid profiles and oxidative stability of two Loders Croklaan products - partially hydrogenated Durkex 500NG, and non-hydrogenated Durkex LC-200 - with rapeseed oil.

Table 2
Properties of vegetable oil release agents

	Durkex 500NG	Durkex LC200	Rapeseed oil
Stability (typical Rancimat time at 120°C)	50 hours	15 hours	<2 hours
Saturates	13%	38%	8%
Cis-monounsaturates	27%	47%	62%
Cis-polyunsaturates	4%	15%	30%
Trans	56%	<1%	<1%

The baker therefore has a choice. Either a high stability release agent with a high level of trans fatty acids or a trans-free product with a good, but lower degree of oxidative stability.

While there are certainly nutritional benefits in moving to trans-free systems, we do need to put such changes into perspective. Typical application levels of release agents are about 0.5% of the product weight on to the tin, divider blade or belt. Only a proportion of this will end up on or in the finished product.