



## Release Agents

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# Introduction

**T**he use of release agents in today's food production is indispensable. Release agents are used with food products having a moist surface and a tendency towards stickiness. The use of release agents prevents the food product from adhering to moulds, machines and equipment as well as to packaging materials. Release problems not only occur in the food production process but also with the final product.

With the increasing trend towards industrial food production, new release challenges have to be mastered. The eating habits of consumers have also changed which is reflected in the high number of bakery shops.

Thus, the field of release agents has developed into its own scientific subject. With the advances in food technology, the requirements for the performance of release agents have grown at the same pace. Correctly working release agents must be specifically designed for the individual release problems. All-purpose release agents can no longer solve the different release problems of today.

Release agents for moulds, pans and trays include substances that facilitate the removal of a food product from moulds or other carriers. This type of release agent prevents baked goods and confectionery products from caking because it is used to coat moulds, pans, trays or other working surfaces. Example: the removal of baked goods from baking pans or sugar mass from chilled pans.

## Definition and function of release agents

**T**he use of release agents is technologically indispensable in bakeries and pastry shops. The contact of traditionally baked bread loaves with each other or the contact of the dough pieces to be baked with moulds, pans, trays and belts may result in severe problems with stickiness if no specific release agent is used. The result may be material loss and delays in production. Moulds and pans in the bakery must be ready for use right after the baked goods have been removed. If bread or cake residues remain in the moulds or pan due to poor release, the quality deteriorates. Consumers will not accept baked goods with “holes” in the crust.

Baked goods to be coated with chocolate need a smooth surface without larger pores otherwise the coating will seep away. All these problems are avoided with the use of the proper release agent.

The factors determining the type of release agent include surface structure, uniform browning and storage stability of the baked goods.



Release agents must be able to form a homogeneous film between the mould, pan or baking sheet and the dough. Due to the complete coating of the baking sheet with the release agent, pores and roughness of the sheet are closed and a smooth surface obtained. This film formation is achieved by applying the release agent onto the surface. It is desirable that the release agent adheres well to the wall of the mould or pan. However, the transfer of the release agent onto the baked good must be prevented because the product would develop an oily surface which is not appealing to the consumer and will also stain the packaging material.

As release agents are not added to the food as anti-caking agents, but are applied to the surfaces, they will adhere to the food only in technologically inevitable amounts. Therefore, release agents are not food additives or ingredients but rather processing aids.

In the broadest sense, oils used in the bakery for cutting are also classified as release agents. Such oils are applied onto the blades of the bread cutters to prevent crumb residues adhering to the blades and therefore impeding a clean cut. The oils should not migrate onto the cut slices of bread.

### Requirements for release agents

- Release agents must be able to make the surface of the mould or pan hydrophobic (water-repelling). They should form an uninterrupted film between the surface of the mould, pan or tray and the baked good. They must also be able to form a good adhering film on steep walls. The film formed must withstand high temperatures.
- Release agents must not react with the food they come into contact with. They must not carbonize or resinify, and they must not react with the surface of the mould, pan or tray. On the contrary, the surfaces should be protected against corrosion by the release agents.
- Of course, release agents must not have a detrimental effect on the taste or the odor of a food product. Fats and oils have a natural tendency to oxidize or resinify at elevated temperatures. This is not desirable as it might cause off-flavor or off-odor of the baked good.
- Added to that, release agents must be easy to apply by spraying. A clogging of the nozzles during application of the release agents must be prevented. They should develop only low amounts of fog.
- Release agents must have a good physical stability, i.e. the individual components should not segregate.
- The user expects an optimum dosage and economical consumption of the release agent.
- Organic bakeries need organic release agents made from materials complying with Regulation 2092/91/EEC on organic agricultural food production.



## Composition of release agents

The main components of advanced release agents are vegetable oils and fats, waxes and emulsifiers.

### Raw materials for release agents

#### ■ Vegetable oils

Soy oil  
Rapeseed oil  
Sunflower oil  
Palm kernel oil  
Coconut fat

#### ■ Waxes and wax esters

Bee's wax  
Carnauba wax  
Candelilla wax  
Wax esters

#### ■ Emulsifiers

Lecithins  
Mono- and diglycerides of fatty acids  
Thermo-oxidized soy oil

#### ■ Antioxidants

Tocopherols  
Ascorbyl palmitate  
Citric acid



The vegetable oils and fats used are refined vegetable oils and fats in food-grade quality. Often, the fats and oils are subjected to further processing steps such as fractionation or transesterification in order to yield the desired properties such as good film formation and stability against oxidation.

The fatty acid composition in vegetable oils is also important in terms of oxidation stability and tendency to polymerization. Hydrogenated fats are hardly ever used in release agents. Today, animal fats are no longer used.

Waxes will improve the release action. The viscosity of a release agent is controlled by the use of waxes. An increased viscosity allows a more uniform distribution and an uninterrupted film on the surfaces of moulds, pans, trays and equipment. Furthermore, waxes reduce the risk of resinification thus providing for multiple use of baking sheets and pans between the cleaning cycles and subsequent re-application of release agents. This is, in particular, true for fine bakery wares rich in sugar.

Wax esters are used in release agents with low viscosity. They do not increase the viscosity and they do not cause a turbidity of the oil. These release agents are very suitable for tin plate and perforated baking sheets because the holes are not clogged with the release agent. Compared to unsaturated triglycerides, they have a lesser tendency to polymerization and display an improved release action.

Emulsifiers such as lecithins have a good release action which is due to an improved wettability and consequently improved distribution of the release agents on the surface. Release emulsions cannot be produced without the use of emulsifiers. Release emulsions are water-in-oil emulsions with a water content of 5–60%. Emulsions are whitish, viscous release agents adhering well to upright surfaces. Due to their whitish color, they are highly visible after spraying onto the surfaces.

Often antioxidants are employed for improvement of the oxidation stability.

## Quality parameter

Important quality parameters include:

### ■ Viscosity

Depending on the respective application, the viscosity is considered to be a measure for the rheological properties of a release agent.

### ■ Oxidation stability

This is a measure for the susceptibility of a fat to become rancid. In particular for dry baked goods, residual amounts of release agents adhering to the product must not become rancid.

### ■ Iodine number

This is a measure for the portion of unsaturated fatty acids. During baking, the release agent is exposed to high temperatures for a prolonged time. Unsaturated fatty acids tend to polymerize under these conditions resulting in a viscosity increase of the release agents.

### ■ Smoke point

Starting temperatures of 210–230 °C are common in the bakery and therefore heat-resistant release agents are necessary.

### ■ Easy spraying

The application units are equipped with fine spraying nozzles for optimum dosage of the release agents. The nozzles must not become clogged by solid particles.

# Release agents in the context of food legislation

**R**elease agents are used in the production and/or processing of raw materials, food or food ingredients for technological reasons. As already mentioned, they are applied to moulds, pans and sheets and not added to the food products as an ingredient or additive. However, it is technologically inevitable that minor traces will adhere to the surface of the food product. These residues are technologically inevitable, harmless to one's health and have no technological effect on the final product. The raw materials used in release agents are either food or food additives.

Therefore, release agents are to be classified as processing aids according to Regulation (EC) No. 1333/2008. They do not need to be approved as long as they are harmless to one's health, do not affect the flavor or odor of the product and adhere in unintentional, technologically inevitable amounts to the baked good. As processing aids, release agents need not be labeled on the packaging of the baked goods.

Oils used for cutting are also classified as release agents in terms of composition, function and food law assessment.

However, the requirement to label allergenic substances also includes processing aids. For the protection of the consumer, possibly allergenic raw materials contained in release agents must be labeled.

## Production of release agents

**N**on-aqueous release agents are commonly mixed in heated stainless steel tanks. Vegetable oils, fats and waxes are gently heated while stirring. The temperature is maintained until the waxes are completely melted. The next step is cooling under defined time and temperature conditions. Some processes also include further steps for quality improvements. Additional filtration and sieving units prevent possible contaminations.

For the production of release emulsions, the oil/wax phase is heated in suitable containers with stirrers to a pre-set temperature. The added water is finely distributed in the oil. Release emulsions have a higher viscosity and also adhere well to upright surfaces.

Oils used for cutting are characterized by low viscosities because, in general, they contain no or hardly any waxes. These products are made using a mixing process at a precisely defined temperature.

## Use of release agents

**T**he selection of the correct release agent is dependent on the recipe of the product, the baking temperature and the material of the mould or pan. The packaging material and the shelf life of the product (dry baked goods) must also be taken into consideration.

For the release of bread and rolls – which have a lower tendency to stick – simple release oils or emulsions are sufficient. However, the trend towards dark special breads and whole meal breads requires high performance, viscous release agents. Release agents with too low viscosity will result in fat accumulation inside the moulds and ugly residues of release agents at the bottom of the bread.

High sugar baked goods require a release agent with a high amount of wax for proper release. For pound and Madeira cakes, the release agents must be viscous and adhere well to the sides of the pans and mould. They would otherwise impede the volume development.

Dry baked goods (wafers, gingerbread) with long shelf lives need release waxes with high oxidation stability to prevent the rancidity development of possibly adhering release agent residues.

For baking sheets and perforated sheets, liquid release agents with good flow behaviors are preferred.

Even though Teflon has its own release properties, the use of release agents is also recommended for moulds coated with this substance. This will increase the service life of the coating. Emulsions are not suitable for use with Teflon.

Silicone coated moulds should not be used with release agents as the coating might be damaged by the release agents.

The oiling of sheets and moulds is done manually or automatically, depending on the specific situation.

In general, for manual application, hand-held spray devices are used. They operate according to the airless or airmix system.



With the airless system, the release agent is applied without air fogging. This system is only suitable for release agents with low viscosity. The application is not very precise.

In the airmix system, the release agent is pressed through nozzles together with an air stream. The distribution of the release agent onto moulds, pans and sheets is very fine. With this system, the viscosity and the application quantity can be excellently adjusted thus yielding a very precise dosing. This system is also suitable for the application of high viscous release agents.



In general, oiling in the baking industry is performed automatically. The moulds are sprayed with the release agents in a passage. This allows a highly targeted application. A constant amount is dosed which is applied to the spot. This type of oiling goes along with low consumption and less staining of the moulds.

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