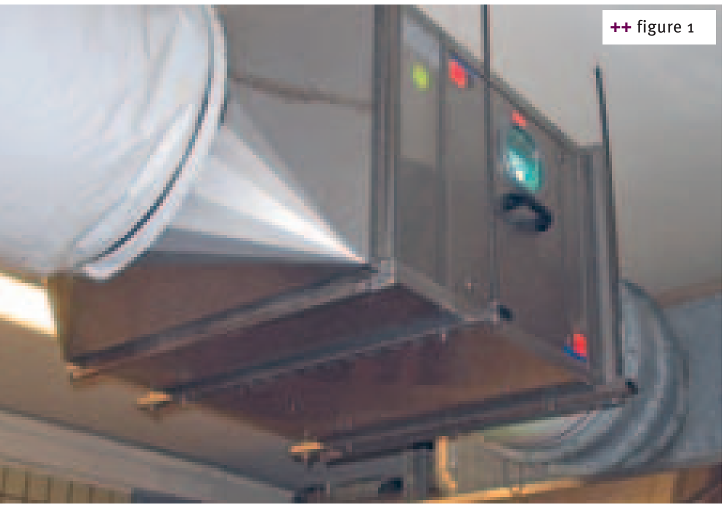
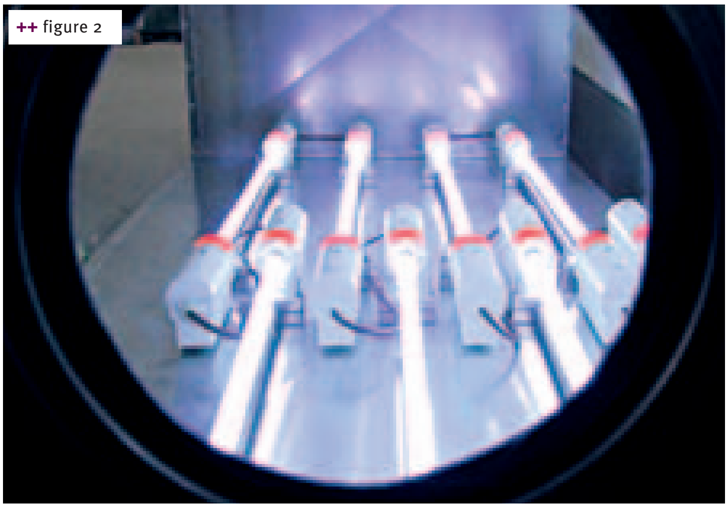
Kill ’em

MICROORGANISMS CAN BE BAKERS’ BEST FRIENDS AND WORST ENEMIES. THEY CAN ONLY BE MASTERED IF THEIR CHARACTERISTICS ARE KNOWN





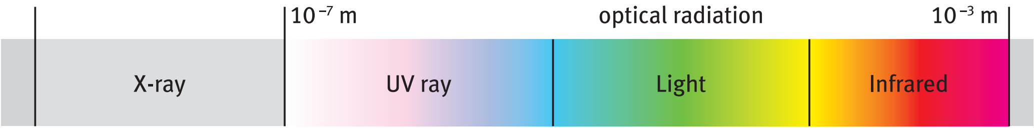
++ figure 1
Degermination module

++ figure 2
Degermination module (inside)

A bakery free from microorganisms would not be able to manufacture any bread. However, not all species are the bakers’ friends. In particular mould in clean bakeries is not well accepted. These microorganisms are named Aspergillus niger, Penicillium, Sporothrix cyanescens, Cladosporium herbarum Rhizopus nigricans, Thrychothecium roseum and although they are unwelcome they are often still present in bakeries. Moulds live on dough and bakery raw materials and leave visible traces, often in places where they are not wanted. No matter whether they leave their visible or invisible marks on proofing baskets, peel boards, dough belts or other equipment – they are undesired microflora. Some of these species produce enzymes that impair the baking result. Others may trigger allergic reactions. For food inspectors and consumers mould is a sign of poor hygiene – yet another reason for eradicating them. For their survival and multiplication, moulds need nutrients, moisture, warm temperatures and a friendly acidic milieu. It is here that traditional control methods begin. Scientific investigations carried out by a German professional trade association for the food sector have shown that in order to meet hygienic requirements it is sufficient to store cloth liners in a way so that they can dry quickly after use and that they must be washed at least once a month at 60 °C or higher. However, typical mildew marks can not be avoided. Therefore, the trend in bread making is to use liners in proofing equipment that can be quickly exchanged. The lining is made of a thin, fine plastic mesh (gauze) which will not contaminate as quickly as cotton. In the case of hangers for bread roll plants, plastic gauze is available as a topcoat. Up until now there have been only a few alternatives for the degermination of felt belts and lines that are not equipped with replaceable cloth liners. One possibility would be the cold-fogging of an active agent in aroma suspensions. However, the areas to be treated in this way must be clearly defined and secluded. The relative high expense in terms of investment and operating costs only pays off if the products can also be stored in a low count environment. The most common method for degermination is the use of UV rays. Ultraviolet rays are rays which occupy the wavelength range between X-rays and the visible light. Due to their physical properties, UV rays are optical rays even if they are invisible. UV rays are subdivided into three different types:

+ UV-A (long wave) 400-315 nm
+ UV-B (medium wave) 315-280 nm
+ UV-C (short wave) 280-100 nm and below

[1 nm = 1 nano meter = 0.000 000 001 m]



UV-rays are short and high energy waves which are absorbed by the DNA. Here they cause a photo-chemical change in certain areas of the so-called helix. In this case two adjoining information carriers (bases) interlink or adhere to each other. This makes them useless for the copying process of the helix. Necessary information of the DNA can not be passed on. If the number of information disturbances exceeds a certain level (specific for each species), the cell can no longer multiply or duplicate itself. This does not actually kill the microorganisms. Instead they are inactivated and their ability to accumulate to a critical number by proliferation is stopped.

Technically, UV-C rays which are harmful to microorganisms are produced by mercury lamps. The lamp also emits light (above 400 nm) and heat. The bluish glow of a UV-lamp does not allow any conclusion as to its performance. As all gas discharge lamps, the output of UV-lamps is also reduced if the temperature of the lamp's surface deviates from a defined optimum. According to scientific findings, the disinfection performance of UV-C lamps is clearly reduced in areas with high humidity. This has to be taken into consideration when calculating the performance.

New for the bakery trade is radiation with carbon infra-red radiators which are capable of not only acting on the surface but also of reaching deeper layers. These rays are generated by quartz glass lamps with a peak wavelength of 2 µm at a power density of 40 W/cm and a maximum power of 60 kW/m2. The light is reflected by gold reflectors behind the tubes. Trials at the European Institute for Bakery Technology in Bremerhaven, Germany, have shown that depending on the power density, temperatures of above 160 °C can be achieved for a short time on textile materials. The radiation period must be less than 30 seconds, but up to this limit the following is valid:

+ The longer the radiation period, the higher the effect.
+ The moister the textile liner is at the beginning of the radiation, the quicker the mould count can be reduced.
+ The higher the capacity of the IR radiation, the quicker the temperature will rise. But higher intensity also means less exposure time.
+ The higher the temperature the quicker the mould count is reduced.
+ A large heat conductivity of the textile materials impedes the heating of the surface.
+ Dust particles do not shield the microorganisms against the IR radiation.

The degermination of bakery equipment with IR is still at the initial stage. The life span of the lamps and the required protection against performance-reducing dust is another challenge for the industry. But the fact that IR radiation also develops a degerminating effect underneath the surface in deeper layers is a powerful criterion. +++