Title High-temperature Treatment for Efficient Drying of Bread Rye and Reduction of Fungal Contaminants
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Abstract

Mycotoxin-producing fungi are natural contaminants of cereals and their toxins are harmful to humans and animals. Ochratoxin A (OTA) is among the most important. Heat treatment by drum drying does not eliminate already formed mycotoxins but the technique can reduce the number of viable fungi on the grain. The aim of this study was to establish a drying regime that kills fungal propagules on rye without reducing its quality for baking. Special attention was paid to some important mycotoxin-producing species. As drying temperatures and retention time in the drum are essential, the drum drier must be equipped with an effective control unit. Two different control systems were tested. The results showed that fungi colonising the grain can be much more efficiently and precisely reduced by controlling the maximum grain temperature (MGT) than the fixed constant drying air temperature (FAT). Drum drying very efficiently reduced the fungal propagules colonising the grain, including the mycotoxin-producing *Penicillium verrucosum*, *Fusarium avenaceum, F. culmorum, F. poae, F. sporotrichioides* and *F. tricinctum.* Both temperature and retention time in the drum affected survival rate of the fungi. Using MGT, a retention time of 10·5 min and a temperature of 64 °C killed 99% of the yeast propagules and 98% of the filamentous fungi. Moisture contents were reduced to about 12%. A similar drying regime in a supplementary trial reduced the number of *P. verrucosum* contaminated kernels from more than 70% to 12% but confirmed that drum drying did not destroy already formed OTA. The combination of a high drying capacity and a short but efficient heat treatment was obtained by drum drying as opposed to on-floor, batch and ordinary continuous flow drying, and it reduced the risk of mould deterioration to almost zero when the grain was properly stored afterwards. At the same time a high quality for baking was maintained. The highest baking quality in rye was obtained at grain temperatures of about 62 °C and only at grain temperatures above 70 °C visual quality changes were detected.