

Taking cereals seriously

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Cereals

Cereals such as wheat and barley have always been a valuable source of food, for humans and animals. Wheat is mostly used as a raw material for the baking industry, although malting and brewing industries take up a significant portion of cereals production. These cereals are very sensible towards *Fusarium* infections of cereals intended for malting. Wheat and barley intended for malting have to fulfil strict limits and recommendations on the quality of raw material used for malting and brewing. Some of the main quality parameters for malt are: protein content, β -glucan content, Kolbach index, malt extract, extract difference, saccharification time, wort colour, viscosity, FAN (free amino nitrogen) etc. [1]. Protein content is one of the most important parameters and the ideal range is between 11 - 12% [2]. Protein content higher than 12% results in heighten soluble proteins content in wort, releasing undesirable flavours in final beer. On the other hand, lower protein content is correlated with low carbohydrate levels, lower extract values [3], and may adversely affect the fermentation due to the poor amino acid content available for yeast nutrition.

Fusarium infections seriously degrade and lower the quality of malting and brewing cereals, such as wheat and barley [4]. This causes economic losses for malting and brewing companies and significantly lowers the quality of malt and beer. *Fusarium* fungi produce mycotoxins, compounds that are toxic for humans and animals, causing nephropathy, infertility, cancer or death [5]. Some of the mycotoxins, mainly belonging to group of trichotecenes (deoxynivalenol, nivalenol, etc.), are considered important in barley-to-beer-chain (due to their water-soluble properties) and are regularly monitored prior cereals entrance to malting industry. The special attention is given to the masked mycotoxins that occur in beer in much higher concentrations and ratios than in other food [6]. There are other important mycotoxins in malt-beer chain that receive special attention: aflatoxins, fumonisins, ochratoxin A and zearalenone [7-9]. However, every day new and new analytical methods are being developed that detect and quantify very low concentrations of new mycotoxins in different foodstuffs [10]. The data base of mycotoxins is getting bigger and health safety regulations are very slow in updating new compounds. This arises the problem of emerging mycotoxins whose concentration limits are not being regulated accordingly to the new findings. Malt and beer are continuously monitored for mycotoxins and numerous scientific and professional papers have been written on this subject but there is still no regulation on mycotoxins in these foodstuffs.

Malting and brewing by-products (germ/rootlets, spent grains, spent yeast) can also be contaminated with mycotoxins and represent a serious threat to animal and human health [11,12]. They represent low-cost and nutritious, high-in-fibre animal food [13] and can also be utilized in food industries, primarily baking industry, as to improve sensorial and nutritional properties [14,15].

Clear limits, regular and mandatory controls of mycotoxins in malt and beer should be set, especially since beer is a popular recreational

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drink and new craft and home-breweries are gaining on popularity. Also due to high possible levels of deoxynivalenol in beer the PMTDI levels can be exceeded by drinking only 1 L of beer [16,17] and this should be taken in to consideration when preparing new limits for mycotoxins in raw materials, final products and by-products.

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