Changes in the mycotoxin contaminations from grain to wheat bread or cornflakes

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Background

In cereal plants, Fusarium spp. are widespread pathogens that can cause mycotoxin contaminations in cereal-based foods. Major Fusarium mycotoxins are fumonisins, which are suggested to act as tumour promoters, and trichothecenes. The most prevalent trichothecene is deoxynivalenol (DON) that act as inhibitor of protein synthesis and can lead to acute gastrointestinal symptoms including nausea, vomiting, and diarrhoea. To avoid acute and chronic affections of consumers’ health, maximum levels (MLs) are set in the European Union (EU) by Commission Regulation 1881/2006 and amending regulations[1]. The limits depend on the mycotoxin, the cereal, and its grade of processing. For fumonisins, MLs for the sum of fumonisin B1 and B2 (FB1 and FB2) are laid down.

Here, the potential effects of wheat and maize processing in the production of bread and cornflakes (as described in literature) are depicted and compared with the changes in the EU legal limits. It should be noted that MLs are defined on an “as is” basis, whereas studies analysing the survival of mycotoxins during food processing usually provide data that are corrected for changes in moisture and composition. Thus, also dilution or concentration effects are displayed below.

DON in wheat bread production – Processing factors* and dilution/concentration effects** –

- Milling to white flour: ~0.4–0.9; often ~0.6–0.7[9-13]
- Wholemeal flour: no reduction

Flour content: ~0.9
- Dilution by change in moisture: ~0.7

EU ML for unprocessed wheat, except durum wheat (uncleaned or cleaned): 1,250 µg/kg[1]

EU ML for for unprocessed maize (uncleaned or cleaned): 4,000 µg/kg[1]

FB1/FB2 in cornflakes production

- Milling to grits: ~0.05–0.15[28-33]

EU ML for maize milling products ≤500 µm (not used for direct human consumption): 2,000 µg/kg[1]

Factor to grains: 0.5

EU ML for unprocessed maize:
- Cleaning: ~0.3–0.5; often ~0.7[29-34]
- Milling to flour: ~0.3–1; often ~0.75–4[29-32]

Processing factors:

- Changes in the mycotoxin concentations during the indicated processing step(s) given as ratio of final to initial; if not mentioned otherwise, data are corrected for changes in moisture and composition
- * Change in the mycotoxin concentration during the indicated processing step(s) given as ratio of final to initial. If not mentioned otherwise, data are corrected for changes in moisture and composition
- ** Estimated dilution (d) or concentration (e) by changes in moisture or composition given as factor

EU ML for maize-based breakfast cereals: 800 µg/kg[1]

0.45–1 for bread and cornflakes (as described in literature) are depicted and compared with the changes in the EU legal limits. It should be noted that MLs are defined on an “as is” basis, whereas studies analysing the survival of mycotoxins during food processing usually provide data that are corrected for changes in moisture and composition. Thus, also dilution or concentration effects are displayed below.

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