不同环境条件下粮食及其制品真菌毒素变化趋势

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摘要：目的 为了解在不同环境条件下粮食及其制品真菌毒素含量的变化趋势，为食品安全风险评估、标准制定、修订及跟踪评价提供真菌毒素含量数据。方法 采用同位素稀释超高效液相色谱-串联质谱法（UPLC-MS/MS）测定小麦、玉米不同环境条件下 16 种真菌毒素含量。结果 小麦低温密闭的储存条件仅对伏马菌素（FB，包括 FB_1、FB_2 和 FB_3）含量有影响，在 30 天 FB 含量变化不显著，在 90 天后显著提高 2.1-34.0 倍，对脱氧雪腐镰刀菌烯醇（DON）含量稳定；小麦干燥通风条件下，16 种真菌毒素含量 30 天无显著性差异，DON 在 90 天时显著下降 1.4 倍，在其它时间含量变化不显著，180 天 DON 小幅升高至 0 天水平，FB_2 在 90 天和 180 天分别显著上升 6.4 倍和 11.5 倍，FB_3 在 180 天显著上升 2.1 倍；高温高湿条件下 3-乙酰脱氧雪腐镰刀菌烯醇(3-ADON)、雪腐镰刀菌烯醇(NIV)和 FB_1 在 30 天，DON、ZEN 在 90 天时均显著降低，分别降低 1.2-4.6 倍，AFB_1 在 30 天、FB_2 在 90 天、FB_3 在 180 天分别显著升高 3.8、11.0 和 3.9 倍；不同粮食状态贮存 365 天后低温麦粒和低温小麦粉除 FB_2 有显著性差异，DON、ZEN、FB_1 以及 FB_3 均无显著性差异；不同包装材料真菌毒素密闭低温和干燥贮存时纸袋与塑料袋 DON、玉米赤霉烯酮（ZEN）以及 FB 均无显著差异。玉米及其制品在不同贮存条件对 DON 和 ZEN 含量的影响无显著差异性，15-AC 在 3 个贮存条件下都显著升高，在 180 天和 365 天黄曲霉毒素 B_1(AFB_1)含量降低，黄曲霉毒素 B_2(AFB_2)含量升高（除在 365 天低温密闭和干燥通风降低外），FB_1、FB_2 和 FB_3 在 3 个贮存条件储存 180 天后含量均下降，至 365 天又有小幅回升。结论 粮食及其制品中 DON 含量相对较稳定，小麦 FB 含量在三个储存条件下均有不同程度的升高，对于已经存在的真菌毒素，三种储存方式下其含量变化趋势不同，应根据不同的粮食种类选择合适的储存条件和储存时间，总体来看真菌毒素稳定存在，因此从源头控制是最好的措施，粮食储存环节也是至关重要的环节。

关键词：粮食；小麦；玉米；储存 ；真菌毒素

Trends of mycotoxins in grain and its products under different

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environmental conditions

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Abstract: **Objective** In order to understand the changing trend of mycotoxins content in grain and its products under different environmental conditions, and to provide mycotoxins content data for grain safety risk assessment, standard formulation, revision and follow-up evaluation. **Methods** The contents of 16 mycotoxins in wheat and maize under different environmental conditions were determined by UPLC-MS /MS. **Results** The contents of Fumonisin (FB, including FB_1, FB_2 and FB_3) in wheat were only affected by the storage conditions under low temperature and airtight storage conditions. FB content was not significantly changed at 30 days, but increased by 2.1-34.0 times at 90 days, especially for the content of deoxynivalenol (DON) was stable. Under dry and ventilated conditions, there was no significant difference in the contents of 16 mycotoxins at 30 days, DON decreased 1.4 times at 90 days, and FB_2 increased 6.4 times and 11.5 times at 90 and 180 days, respectively. FB_3 increased 2.1 times in 180 days. At high temperature and high humidity, 3-acetyl deoxynivalenol (3-ADon), NIvalenol (NIV) and FB_1 significantly decreased at 30 days, DON and ZEN significantly decreased by 1.2-4.6 times at 90 days, respectively. AFB_1 at 30 days, FB_2 at 90 days and FB_3 at 180 days were significantly increased by 3.8, 11.0 and 3.9 times, respectively. There were significant differences between low temperature wheat grains and low temperature wheat flour except FB_2, but no significant differences between DON, ZEN, FB_1 and FB_3. There was no significant difference between paper bag and plastic bag DON, zelalenone (ZEN) and FB when the mycotoxins of different packaging materials were stored in sealed low temperature and dry. There was no significant difference in the effects of maize and its products on DON and ZEN contents under different storage conditions, 15-AC increased significantly under three storage conditions, aflatoxin B_1(AFB_1) content decreased on 180 days and 365 days, aflatoxin B_2(AFB_2) content increased (except low temperature airtight and dry ventilation decreased on 365 days). The contents of FB_1, FB_2 and FB_3 decreased after 180 days of storage, and then increased slightly after 365 days. **Conclusion** DON content in grain and its products is relatively stable, FB content of wheat under the condition of the three storage has the varying degree to rise, to the already existing mycotoxins, three storage