

李 银,李 侠,张春晖,孙红梅,董宪兵.羟自由基导致肉类肌原纤维蛋白氧化和凝胶性降低[J].农业工程学报,2013,29(12):286-292

羟自由基导致肉类肌原纤维蛋白氧化和凝胶性降低

Oxidation and decrease of gelling properties for meat myofibrillar protein induced by hydroxyl radical

投稿时间: 2013-02-03 最后修改时间: 2013-05-15

中文关键词: [蛋白质](#),[核磁共振](#),[肉](#),[羟自由基氧化体系](#),[肌原纤维蛋白](#),[微观结构](#)

英文关键词: [proteins](#) [nuclear magnetic resonance \(NMR\)](#) [meats](#) [hydroxyl radical \(·OH\) oxidizing system](#) [myofibrillar protein \(MP\)](#) [microstructure](#)

基金项目:国家自然科学基金(31271902);农业(行业)科技资助项目(200903012, 201303083, 201303082)

作者	单位
李 银	中国农业科学院农产品加工研究所/农业部农产品加工综合性重点实验室, 北京100193
李 侠	中国农业科学院农产品加工研究所/农业部农产品加工综合性重点实验室, 北京100193
张春晖	中国农业科学院农产品加工研究所/农业部农产品加工综合性重点实验室, 北京100193
孙红梅	中国农业科学院农产品加工研究所/农业部农产品加工综合性重点实验室, 北京100193
董宪兵	中国农业科学院农产品加工研究所/农业部农产品加工综合性重点实验室, 北京100193

摘要点击次数: 56

全文下载次数: 31

中文摘要:

为研究羟自由基(·OH)氧化体系中肌原纤维蛋白(myofibrillar protein, MP)氧化及其凝胶特性的变化, 试验分析了羟自由基氧化体系中不同H₂O₂浓度对蛋白氧化程度及MP凝胶白度、持水力、质构特性(texture profiles analysis, TPA)与弹性模量等特征指标的影响。结果表明: 随H₂O₂浓度的增加, MP中羰基值上升, 蛋白氧化程度加剧, 凝胶白度、保水性、硬度、咀嚼性及弹性模量则与H₂O₂浓度呈显著负相关。与对照组相比, 当H₂O₂浓度增加至20 mmol/L时, 羰基含量增加至2.82 nmol/mg蛋白(p<0.05), 凝胶白度、持水性及硬度则分别下降了2.83%、14.65%及52.77%(p<0.05)。扫描电镜(scanning electron micrograph, SEM)观察表明, MP氧化导致凝胶微观结构破坏, 形成空隙较大且分布不均的网络; 低场核磁共振分析(nuclear magnetic resonance, NMR)结果显示, 随H₂O₂浓度的增加, MP凝胶中的一部分不易流动水"态变"为自由水, 凝胶持水力降低。综上所述, ·OH氧化体系中肌原纤维蛋白氧化会影响其凝胶形成, 破坏蛋白凝胶结构, 降低凝胶功能, 这为肉类生产加工过程中蛋白氧化控制提供理论参考。

英文摘要:

Abstract: Oxidation and changes of gelling properties of myofibrillar protein (MP) induced by the hydroxyl radical (·OH) were studied in this paper. Pork myofibrillar protein was suspended in 15 mmol/L piperazine-N, N-bis(2-ethane sulfonic acid) (PIPES) buffer (pH 6.0), and 0.6 mol/L NaCl, and incubated at 4°C for 24 h with ferric ion (Fe³⁺) and ascorbic acid (Vc) at six concentrations of hydrogen peroxide (0, 0.5, 1.0, 5.0, 10.0, 20.0 mmol/L H₂O₂). The indexes including protein carbonyl content and whiteness, water-holding capacity (WHC), and texture profile analysis (TPA) of MP gel were measured. The ability of MP to form a fine gel network was described in terms of shear storage modulus (G'), and it was analyzed by small strain oscillatory rheological testing. The microstructure of MP gel was observed by scanning electric microscopy (SEM). The transverse relaxation time (T₂) and water distribution of MP gel were analyzed by low-field nuclear magnetic resonance (low-field NMR). Correlation analysis between indexes of MP gel was also performed to establish possible linkages between concentration of H₂O₂ and different parameters of MP gel in this study. The results showed that carbonyl content steadily increased with H₂O₂ concentration, increased from 1.17 nmol/mg protein (non-oxidized MP) to 2.82 nmol/mg protein (20.0 mmol/L H₂O₂). With increasing H₂O₂ concentration, the whiteness and WHC of MP gel decreased significantly (p<0.05) (89.89, 64.17% respectively for non-oxidized MP gel, 87.35, 54.77% respectively for 20.0 mmol/L H₂O₂). The texture (hardness, springiness, cohesiveness and chewiness) and shear storage modulus (G') also attenuated with increasing H₂O₂ concentration. The SEM results demonstrated that oxidation of protein could significantly affect the microstructure of MP gel. The non-oxidized MP gel exhibited a compact and homogeneous fine network microstructure, whereas the oxidation process produced empty spaces and changed the compact and fine gel structure to a coarser network, and the effect increased with higher H₂O₂ concentration. The low-field NMR relaxation measurement results indicated that the oxidation degree of protein had no effect on the bound water (T₂₁) of MP gel but had significant effects on immobile water (T₂₂) and free water (T₂₃) of MP gel. T₂₂ water content (P₂₂) decreased with increasing H₂O₂ concentration (94.03% for non-oxidized MP gel, 91.16% for 5 mmol/L H₂O₂, 88.14% for 20 mmol/L H₂O₂). T₂₃ water content (P₂₃) increased with H₂O₂ concentration (1.37% for non-oxidized MP gel, 4.25% for 5 mmol/L H₂O₂, 7.56% for 20 mmol/L H₂O₂). Taken together, these results demonstrate that with increasing H₂O₂ concentration, some part of the immobile water of MP gel shifts to free water, and the free water would become the potential centrifuge drip loss. Correlation analysis results showed that concentration of H₂O₂ was highly negatively correlated with whiteness, WHC, hardness and chewiness (p<0.05). Based on the synthetic evaluation on the testing results of the MP gel, it can be concluded that the ·OH will result in oxidation of MP, and have detrimental effects on the gelling property of porcine MP. Therefore, it is imperative to inhibit the oxidation of MP during storage and processing of meat to avoid losing the functional properties of porcine MP.

[查看全文](#) [下载PDF阅读器](#)

关闭

主办单位：中国农业工程学会 单位地址：北京朝阳区麦子店街41号

服务热线：010—65929451 传真：010—65929451 邮编：100125 Email: tcsae@tcsae.org
本系统由北京勤云科技发展有限公司设计