Disinfection of Rough Rice Using Combined Pulsed Light and Holding Treatment

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Abstract

Pulsed light (PL) treatment as a rapid surface decontamination method has the potential to conduct an effective disinfection of rough rice. The objective of this study was to investigate the effectiveness of disinfection of rough rice against Aspergillus flavus using integrated pulsed light and holding treatment. The rice samples were treated using PL under different intensities and times. After PL treatment, a holding process was performed. The results revealed that 0.9-log cfu/g reduction was obtained when the rice sample was treated for 20 s under distance of 5 cm. PL followed by holding treatment for 4 h led to 5-log reduction for rough rice samples. The inactivation was achieved by damaging the cell wall structure of Aspergillus flavus.

Materials and Methods

Sample inoculation
Added 5 mL of spore suspension onto 450 g rough rice and mixed. Kept it in an incubator set at 30 ℃ for 7 days.

PL irradiation
Rice samples were treated by PL under different distances (5, 9, 13 and 17 cm) for different durations ranging from 5 to 30 s.

Holding treatment
After the PL treatment, holding treatment was conducted by keeping the samples in an incubator set at 60 ℃ for 4 h.

Results and Discussion

The obtained results revealed that effective fungal disinfection of rough rice could be achieved using PL and holding treatment. PL treatment resulted in 0.9-log cfu/g reduction of A. flavus on rough rice samples treated for 20 s under the distance of 5 cm (Fig. 1A). Holding treatment after PL significantly improved the disinfection effect. PL followed by holding treatment for 4 h led to 5.2-log reduction of A. flavus spores (Fig. 1B). The inactivation was achieved by damaging the cell wall structure. There was no adverse effect of PL and holding treatment on milling quality of rough rice.

Background

Fungal contamination of rough rice during pre/post harvest and storage is a major cause of kernel damage and health hazard. The fungi Aspergillus flavus (A. flavus) as its ability of producing high toxicity aflatoxin has been reported as a serious pathogen in rough rice. Pulsed light (PL) treatment, a novel technique, has been considered as possible approach to reduce the level of microbial contamination on food product. PL kills pathogens and spoilage microorganisms using intense pulses with broad spectrum (100-1100 nm). The photochemical and photothermal reactions are the main effects for microorganisms inactivation.

Objective

To study the effect of pulsed UV light and holding treatment on effectiveness of rough rice disinfection.

Conclusions

This study revealed that PL followed by holding treatment was effective in reducing Aspergillus flavus spores that were inoculated onto rough rice. Consequently, effective disinfection of rough rice without affecting the milling quality can be achieved using PL for 20 s followed by holding treatment for 4 h.

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