



Title: Bactericidal Action of UV-A Light-Irradiated Ferulic Acid

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This study examined photobactericidal mechanism of ferulic acid (FA) irradiated with an ultraviolet-A (UV-A) LED having a peak wavelength of 365 nm (wavelength range: 350-385 nm). FA is one of the most abundant phenolic acids in plants. Previously, we found that the bactericidal activity of FA against various food spoilers and pathogens was remarkably enhanced by UV-A irradiation. Irradiation with UV-A at 0.73 J/cm² in the presence of 50 mg/l FA against *Escherichia coli* NBRC12713 resulted in a significant 1.3-log reduction in viable cell count. Conversely, combination treatment with irradiation at 0.52 J/cm² followed by UV-A light-out showed little reduction of viable cells. Therefore, the bactericidal activity of FA was enhanced after UV-A irradiation. A thiobarbituric acid reactive substances assay was used to investigate bacterial lipid membrane peroxidation by the action of reactive oxygen species (ROS). The level of lipid peroxidation increased significantly despite low fluence (1.0 J/cm²) in the presence of FA. Respiratory activity of bacterial cells untreated/treated with FA without UV-A light was investigated using the CTC rapid staining kit by flow cytometry (FC). The CTC fluorescence level for FA-treated cells showed a 16% reduction at a 1.94-min incubation time, as compared with that for untreated cells. When the combined treatment provided a 4.8-log reduction in viable cells, the propidium iodide fluorescence level for the cells increased significantly on FC. These results suggest that the bactericidal action of the UV-A-irradiated FA is due to adsorption of FA onto the bacterial membrane, followed by oxidative disruption by ROS.

Biography

Akihiro Shirai completed his PhD at Tokushima University, Japan. He is an assistant professor at Tokushima University, Japan where he mainly focuses on antimicrobial activity of disinfectants and food additives. He synthesized the disinfectant “Hygenia” and reported the existence of synergistic bactericidal effect between the disinfectant and ultraviolet-A irradiation. He is currently focusing on photobactericidal activity of phenolic acids, such as ferulic acid, which are activated by UV-A, and is synthesizing novel photo-induced compounds that prevent pathogenic microorganisms by modifying ferulic acid and coumaric acid, which are natural compounds.

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