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Glow discharge plasma efficiently degrades T-2 toxin and patulin

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Glow discharge plasma (GDP) is a novel kind of electrochemical process in which plasma is sustained by dc glow discharges between a pointed electrode and the surface of the liquid electrolyte. The feature of GDP is that various active species such as hydrogen peroxide and hydroxyl radicals are formed when discharges take place and degrade most organic molecules. T-2 is one of the most toxic trichothecenes mycotoxins produced by different *Fusarium* species. Patulin is a mycotoxin produced by species in the fungal genera Aspergillus and Penicillium. P. expansum, caused blue mold of pome fruits and grape berries is a major fungal produced patulin. Although much attentions have been focused on the degradation of T-2 toxin and patulin; however, the information of how GDP degrade them is unavailable. In this study, the effects of GDP on the degradation of T-2 toxin and patulin in aqueous solution were investigated at different conditions. The degradation kinetic curves, kinetic models and the optimum process conditions were evaluated. In order to investigate the efficiency and to get the highest degradation rate of patulin in apple juice by GDP, the work voltage, degradation time and initial concentration of patulin in apple juice were taken as single factors and the orthogonal design experiments were carried out. Meanwhile, the quality of apple juice was evaluated during the treatment. The results showed that GDP treatment rapidly and effectively degraded T-2 toxin and patulin in aqueous solution. The higher toxin initial concentration, the higher treatment efficiency would be. The faster toxin removal rate was achieved at a relatively higher acidity and basify. The Fe2+ and H2O2 exhibited strongly catalysis ability to the degradation reactions, but nano ZnO inhibited the catalysis. The dynamics equation curve fitted well and belonged to the first order kinetics reaction. The values of pH in the degraded solution were rapidly decreased due to the carboxylic acids formed, then the values increased because carboxylic acids was decomposed into CO2 and H2O. Moreover, GDP treatment completely degraded patulin in apple juice, the degradation rate was considerably affected ($p<0.05$) and reached 96.63% for 5 min of the treatment. Based on single factor and orthogonal array design experiments, the influence degree of various factors followed the descending orders of voltage>treatment time>initial concentration. The optimal conditions were voltage at 550 V, treatment time for 3 minutes, initial concentration of toxin at 7 mg·L-1. Quality evaluation of apple juice indicated that GDP treatment within 10 minutes did not affect the content of total soluble solid and the total acid, pH, viscosity, conductivity, turbidity and browning degree of the juice. The content of flavonoids and flavonols increased with the increasing of treatment time, the total phenol content had noticeably enhanced. It is suggested that GDP could rapidly and effectively degrade T-2 toxin and patulin in aqueous solution. GDP treatment has almost no remarkable effects on quality of apple juice.

Biography

Lumei Pu has completed her PhD in Chemistry department at Northwest Normal University of China. She works at College of Science of Gansu Agricultural University, China. She teaches Chemistry and is engaged in the research of Natural Product Chemistry. She has published more than 20 papers in reputed journals.

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