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Micro Corona Ionizer as an Ozone Source for Bacterial Cell Lysis

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DNA extraction is a critical process of DNA assays including polymerase chain reaction (PCR), microarrays, molecular cloning, and DNA hybridization which has been well established and can be implemented by commercial kits. DNA extraction involves cell lysis, precipitation, and purification through the combination of physical and chemical processes. Cell lysis is essential to high DNA recovery yield which can be achieved via a variety of physical, chemical, and enzymatic methods. However, these methods were originally developed for bioassays that were labor intensive, time consuming, and vulnerable to contamination and inhibition. Here, we proposed to employ a micro corona ionizer as an ozone source to lyse bacterial cells. Ozone has been well known and used as a disinfectant which allows cell lysis and DNA extraction. Previously, we have shown that a micro corona ionizer is capable of generating a significant amount of ozone. In this study, we employed the micro corona ionizer for the bacterial cell lysis which consists of a 50 μm diameter cantilever wire as the discharge cathode and a 50 μm thick copper foil as anode. Applied voltages varied from 1900 to 2200 V with corresponding corona currents from 16 to 28 μA. The resultant ozone (concentration > 0.14 ppm) generated from the micro corona ionizer was bubbled into the sample via a miniature pump. We demonstrated the cell lysis of *Pseudomonas putida* as the target bacterium using the micro corona ionizer. At a flow rate of 38 ml/min and applied corona voltage of 2000 V, 98.5 $\pm$ 0.2% lysis (normalized to sonication result) was achieved after 10 min. In comparison, untreated and air-treated samples showed normalized % lysis of 11.9 $\pm$ 2.4 and 36.1 $\pm$ 1.7%, respectively. We also showed that the cell lysis efficiency could be significantly increased by increasing the flow rate and the applied corona voltage. By comparing the experimental results for continuous and pulsed treatment, we verified that the percentage of lysis is primarily determined by the total ozone treatment time.