
Influence of reactive oxygen and nitrogen species on the plasmid DNA and transformation of Escherichia coli with plasmid

GeonJoon Lee ¹, Eun Ha Choi ¹, Heesu Kim ¹, Jae Ho Shin ¹, Jieun Kim ², Jun Young Kim ², and Seong Hwan Kim

¹Kwangwoon University, Korea, Republic of

²Dankook University, Korea, Republic of

The influence of reactive oxygen and nitrogen species (RONS) on the conformation of plasmid DNA (pDNA) and the transformation efficiency of Escherichia coli cells were studied. An atmospheric-pressure plasma jet and nitric oxide water (NOW) were used to generate RONS in an aqueous solution. When E. coli cells were transformed, the transformation efficiency of E. coli with plasma (NOW)-treated plasmid was lower than with control plasmid. Transformation efficiency was reduced due to structural modification and degradation of the pDNA by plasma (NOW). Plasma (NOW) treatment caused structural modification of the plasmid from the supercoiled form to the linear form, and also decreased the amount of plasmid by degrading the deoxyribonucleic acid (DNA) structure accompanied by disruption of nucleobases and DNA strand breakage. The formation of linear plasmid from supercoiled plasmid by plasma (NOW) treatment was verified through electrophoretic analysis of the NdeI restriction enzyme-cut supercoiled plasmid. The structural modification and/or decrease in the amount of pDNA are attributed to the reactive species from the plasma itself and to those derived from the interaction of plasma radicals with the aqueous solution. The NOW treatment also exhibited the structural modification of pDNA. Overall, these results revealed that plasma-generated RONS can modify the structural and optical properties of bacterial pDNA, thus affecting its biological function.

Key words: Plasmid, Plasma jet, Nitric oxide water, Transformation of Escherichia coli, Electrophoresis, Circular dichroism

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