Impact of Reactive Oxygen Species (ROS) in the Cell Using the Plasma Irradiation

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Abstract

Reactive Oxygen Species (ROS) are fundamental to each of the signaling roles of the endothelium on the cell. In this study, we used The EL-4 T-cell that is activated with the T-activator CD3/CD28 and was irradiated with the atmospheric oxygen plasma to investigate growth characteristics of the cell. The results obtained that the irradiation supplementation for ROS increased significantly with increasing the period of irradiation.

Keywords: oxygen plasma, EL-4 T-cell, activator CD3/CD28, irradiation.

1. Introduction

The study has confirmed that Reactive Oxygen Species (ROS) is fundamental to each of the sensing/signaling roles of the endothelium and also was reported that plasma irradiation potentially damaging DNA in the cell if gas flow is heavy during the irradiation process.

In this study, we proposed to investigate the ROS in the cell using different irradiation periods to find the behavior of the cell after irradiated using atmospheric oxygen.

2. Experimental procedure

The Schematic of the experimental apparatus, as shown in Figure 1. The T-cells used in this experiment were sensitized by applying a mixture of microbeads conjugated with antibodies against cell surface glycoproteins CD3/CD28 and were cultured in RPMI-1640 medium with 10% FBS under a constant CO_2 concentration of 5% in the 37°C incubator. The cell population was adjusted to approximately 5x104 cells, and 100 µl was placed in each well of the 96-well plate. The irradiation period was varied between 10 s to 120 s with increases 30 s intervals. After the irradiation, the cells were cultured in an incubator at 37°C for 24 h, and the cell number was quantified using a cell counting WST-8.

3. Results and Discussion

Figure 2 shows the number of T-cells after irradiated by oxygen plasma with a discharge voltage of 4.2 kV. The plasma irradiation for period 10 s, 60 s, and 120 s was found increases the T-cell number by approximately 70% compared with that in the control population.

While the plasma irradiation for period 30 s and 120 s was found to decrease, but if compared to the control population, the cell number still increases. This may cause an excess of active oxygen when the irradiation duration was 30 s and 120 s. Due to the T-cells emitted by the Reactive Oxygen Species (ROS) production such as H_2O_2 and NOx, which are inactivated microorganisms and abnormal cells, and provide the oxygen supply that T-cells require as they increase. In general, the number of T-cells increased with the plasma irradiation period, indicating that the irradiation supplementation for ROS increased significantly and that T-cell growth depends strongly on the plasma irradiation period. Furthermore, there is an optimum irradiation condition at which the level of active oxygen is ideal.

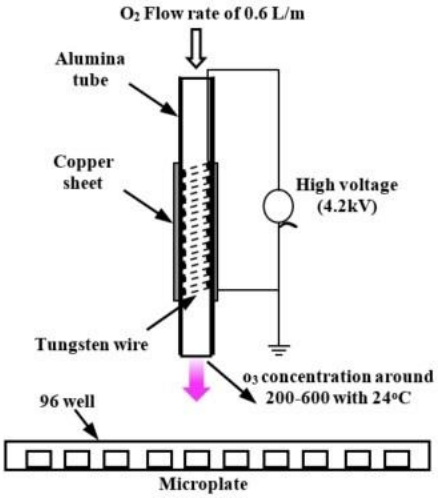

Fig. 1 Schematic of atmospheric discharge apparatus

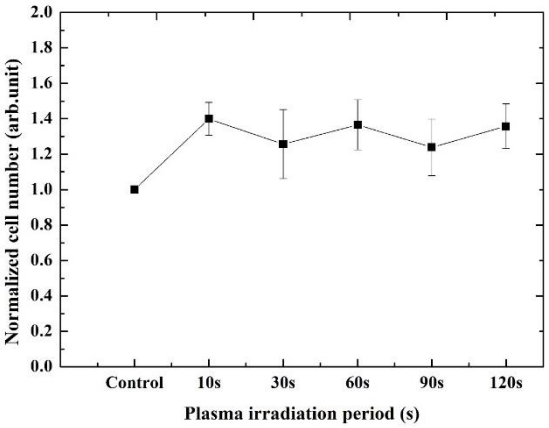

Fig. 2 Cultured cell numbers of T-cells changing periods of the plasma irradiation.