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The fibroblast growth factor modified nitrogen-containing graphene for regeneration of photo-damaged retinal pigment epithelial cells

Abstract:

Age-related macular degeneration (AMD) is one of the most common ocular diseases which may cause irreversible blindness, particularly among people who are aged more than 65 years. AMD is mainly caused by the apoptosis of retinal pigment epithelial (RPE) cells. RPE cells contain lipofuscin and rich long-chain unsaturated fatty acids which are sensitive to reactive oxygen species (ROS). Presence of excessive ROS inside cells always results in the damage or apoptosis of cells. Thus, it is a big challenge for both scientists and clinicians on how to decrease the level of ROS inside damaged RPE cells and realize the regeneration of RPE cells, for the treatment of AMD related diseases.

In this work, we synthesized nanocomposites from the basic fibroblast growth factor (bFGF) and graphene which could efficiently facilitate the reduction of ROS. Our recent study discovered that nitrogen-doped graphene (NG) exhibited superb catalytic activity for reduction of oxygen [1]. It is thus interesting to investigate the capability of NG on the reduction of ROS inside cells. This work presents a facile way to prepare nitrogen containing molecules (such as bFGF) modified graphene (bFGF-NG) via a self-discovered edge-functionalized ball milling method [2, 3]. The capability of the resulting bFGF-NG to eliminate the ROS inside photo-damaged RPE cells will be discussed. Presence of bFGF can further inhibit the oxidative stress of cells by enhancing the activity of signal pathways such as PI3K/AKT and Nrf_2. Incorporation of graphene with bFGF is also beneficial for improving the poor stability and half-life period of bFGF inside cells. Our preliminary results support that the ROS level of photo-damaged RPE cells could be significantly reduced by the utilization of the as-synthesized bFGF-NG nanocomposites, suggesting possibility for the regeneration of ROS induced apoptotic cells.

References

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[3] M. Lin, S. Shan, P. Liu, et al. J. Biomed. Nanotechnol. (2018) 14, 1-10.

Figures

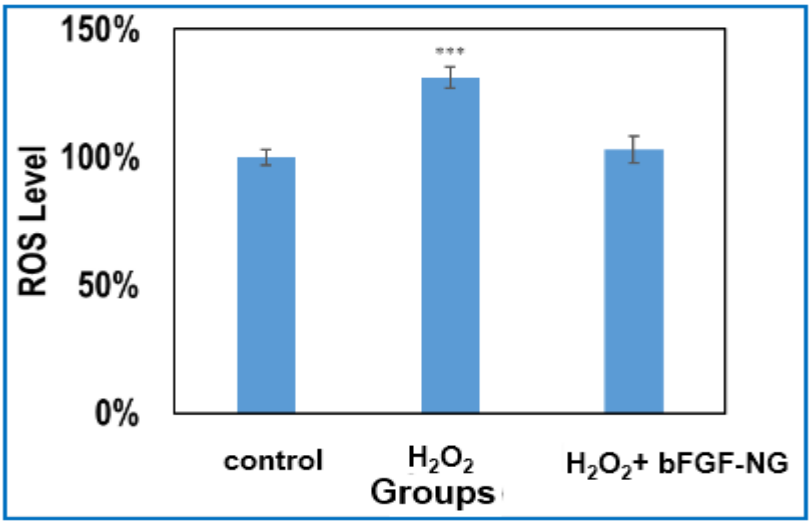

Figure 1: The ROS level of ARPE-19 after cultured with H_2O_2 and H_2O_2+ bFGF-NG. The ROS level is reduced near to 40% by bFGF-NG.