

Hydroxyl radical (OH) is a crucial trigger for the photoautotrophic astaxanthin production in the unicellular green alga, *Haematococcus pluvialis*

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Autotrophic culture offers a promising strategy for high yield of astaxanthin production without supplying organic carbon source in *H. pluvialis*. However, the lower astaxanthin productivity than the heterotrophic culture needs to be improved. SC (second carotenoid) synthesis could be associated with the generation of ROS. Notably, overproduction and accumulation of intracellular  $O_2^-$  delayed the carotenogenesis and decreased the astaxanthin productivity, whereas the rapid conversion of overproduced  $O_2^-$  to  $OH\cdot$  by Haber-Weiss Fenton reaction improved the productivity. Above all, the combination of high temperature condition (30~40°C), and Fenton reaction showed the remarkable astaxanthin production under photoautotrophic condition. These results indicate the explosive supply of superoxide under stress-induced condition followed by the rapid conversion of  $O_2^-$  to  $OH\cdot$  can be an effective solution for the acceleration and improvement of photoautotrophic astaxanthin production.