*NIES-C medium preparation*

*Haematococcus pluvialis* was cultured using NIES-C medium, comprised of the following (per liter): 0.64 mM $Ca(NO_3)_2$, 0.99 mM $KNO_3$, 0.23 mM β-glycerophosphoric acid disodium salt pentahydrate, 0.16 mM $MgSO_4 \cdot 7H_2O$, 4.13 mM Tris-aminomethane, 0.03 μM thiamine, $4.09 \times 10^{-4}$ μM biotin, and $7.38 \times 10^{-5}$ μM vitamin $B_{12}$, along with 3 mL PIV solution. The PIV metal solution consisted of 8.06 mM ethylenediaminetetraacetic acid disodium salt dihydrate, 2.18 mM $FeCl_3 \cdot 6H_2O$, 0.55 mM $MnCl_2 \cdot 4H_2O$, 0.23 mM $ZnSO_4 \cdot 7H_2O$, 0.05 mM $CoCl_2 \cdot 6H_2O$, and 0.03 mM $Na_2MoO_4 \cdot 2H_2O$. After adjusting the pH to 7.5, the NIES-C medium was sterilized using a 0.2 μm filter.