Supplementary Material

Denitrification by Purple Phototrophic Bacteria: A Carbon-Neutral and Resource-Efficient Route for Nitrogen Removal

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The following are included as supporting information for this paper:

number of pages: 9

number of tables: 3

number of figures: 4

S1. Bacterial strain enrichment

The enrichment and growth medium are shown in Table S1. The ratio of SLA solution is as follows: H_3BO_3 (0.5 g L^{-1}), $ZnCl_2$ (0.1 g L^{-1}), $FeCl_2 \cdot 4H_2O$ (1.8 g L^{-1}), $Na_2MoO_4 \cdot 2H_2O$ (0.03 g L^{-1}), $CoCl_2 \cdot 6H_2O$ (0.25 g L^{-1}), $NiCl_2 \cdot 6H_2O$ (0.01 g L^{-1}), $CuCl_2 \cdot 2H_2O$ (0.01 g L^{-1}), $MnCl_2 \cdot 4H_2O$ (0.07 g L^{-1}).

Table S1

Composition of culture medium

Title	Composition
Enrichment medium	CH_3COONa 1.0 g, KH_2PO_4 4.4 g, K_2HPO_4 3.4 g, $NaHCO_3$ 1 g, $CaCl_2 \cdot 2H_2O$ 0.0146 g, $MgCl_2 \cdot 6H_2O$ 0.2 g, NH_4Cl 1.3 g, NaCl 0.5 g, KCl 0.78 g, SLA solution 1 mL. Replenish distilled water to 1.0 L and control it with sodium hydroxide to 7.
Growth medium	CH_3COONa 3.8437 g, KH_2PO_4 0.6 g, K_2HPO_4 0.9 g, $CaCl_2 \cdot 2H_2O$ 0.075 g, $MgSO_4 \cdot 7H_2O$ 0.2 g, NH_4Cl 0.5 g, EDTA 0.02 g, $FeSO_4 \cdot 7H_2O$ 0.0118 g, D-Biotin 15 ug, SLA solution 1 mL. Replenish distilled water to 1.0 L and control it with sodium hydroxide to 7.

S2. Growth of PPB under light sources

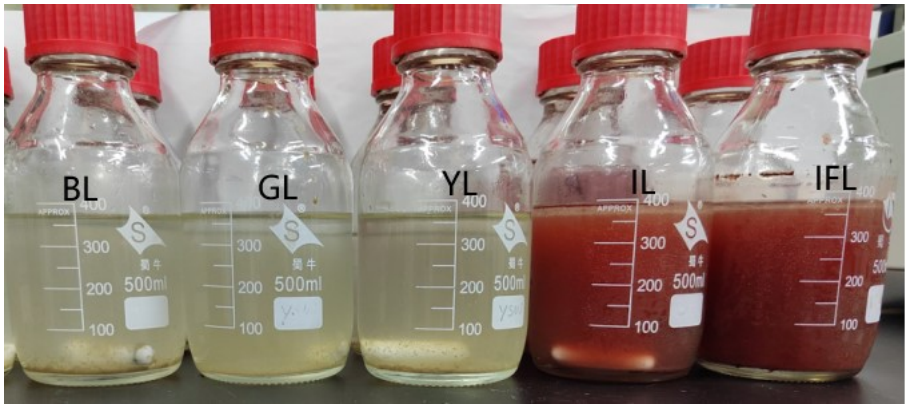

Figure S1. The colour changes of the medium after five days under different light sources. The light sources from left to right are blue LED (BL), green LED (GL), yellow LED (YL), incandescent lamp (IL) and infrared light (IFL).

S2. Growth of PPB under light sources

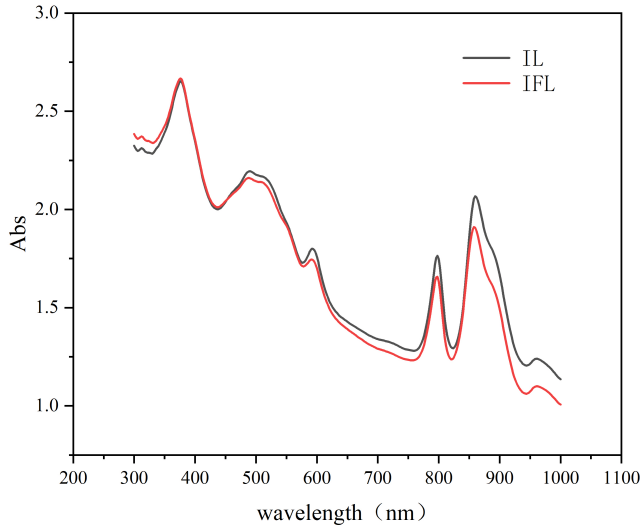

Figure S2. Absorption spectra of cultures under incandescent lamp (IL) and infrared light (IFL) at 300-1000 nm of the enrichment after 5 days.

S3. Denitrification experiments set-up

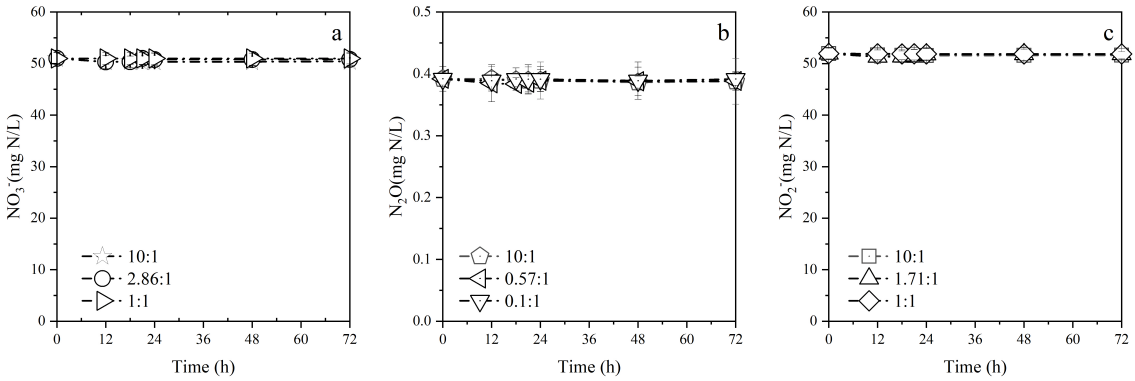

Figure S3. Denitrification effect of PPB under dark condition. The nitrogen sources are NO_3^- (a), N_2O (b), and NO_2^- (c).

S3. Denitrification experiments set-up

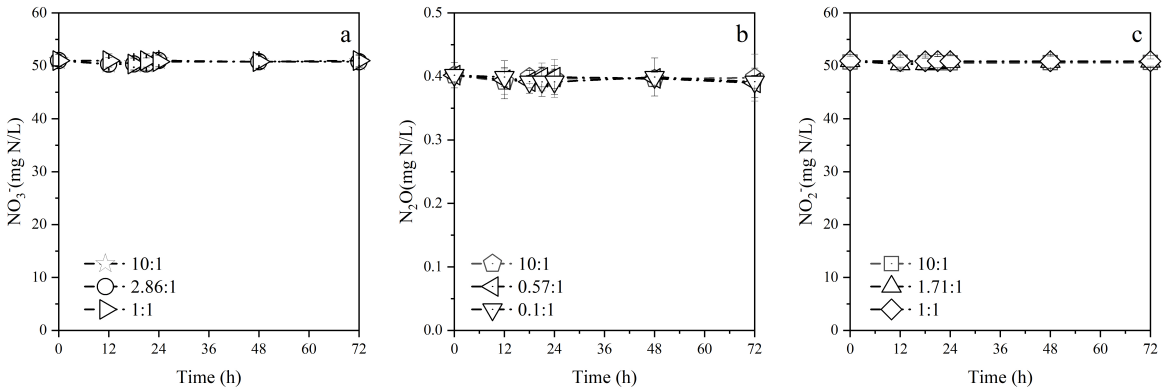

Figure S4. Denitrification effect of *Rb.sphaeroides* under light anaerobic condition. The nitrogen sources are NO_3^- (a), N_2O (b), and NO_2^- (c).

S4. Yield of high-value substances

Protein, carotenoid and bacteriochlorophyll of PPB initially and after three days are shown in Table S2 under different nitrogen sources and C/N ratios.

Table S2
Changes in the content of high-value products

Title / Product (mg/gBiomass)	NO_3^-				NO_2^-				N_2O			
	initial	3 days later			initial	3 days later			initial	3 days later		
		10:1	2.86:1	1:1		10:1	1.71:1	1:1		10:1	0.57:1	0.1:1
Protein	85.10	111.58	105.04	90.52	82.40	95.58	83.31	80.52	78.86	131.58	80.04	70.52
Carotenoid	21.18	23.70	25.88	26.31	18.89	27.94	17.11	14.01	20.80	21.99	18.80	17.58
Bacteriochlorophyll	58.80	71.35	70.93	80.58	50.89	90.18	51.21	49.12	53.18	61.18	57.18	50.93

S5. High-value product earnings estimation

It is assumed that PPB denitrification technology will be applied to the treatment of wastewater containing NO_3^- (C/N: 10:1; protein price: 20 \$ kg^{-1} [1]; pigments price: 162 \$ kg^{-1} [2])

Table S3
Calculation of pigment and protein gains

Light source	Protein (mg/gBiomass)	Pigments (mg/gBiomass)	Protein price (\$ kg^{-1})	Protein price (\$ kg^{-1})	Product benefits(\$ kg^{-1} Biomass)
Incandescent lamp	111.58	95.05	20	162	17.63

References

1. Zhi, R.; Cao, K.; Zhang, G.; Zhu, J.; Xian, G., Zero excess sludge wastewater treatment with value-added substances recovery using photosynthetic bacteria. *Journal of Cleaner Production* **2020,** 250.
2. Popescu, M.; Iancu, P.; Plesu, V.; Todasca, M. C.; Isopencu, G. O.; Bildea, C. S., Valuable Natural Antioxidant Products Recovered from Tomatoes by Green Extraction. *Molecules* **2022,** 27, (13).