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Improvement in modular scalability of polymeric thin-film photobioreactor for autotrophic culturing of *Haematococcus pluvialis* using industrial flue gas

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1 **Improvement in modular scalability of polymeric thin-film photobioreactor for**
2 **autotrophic culturing of *Haematococcus pluvialis* using industrial flue gas**

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21 **Abbreviations**

22 A_r : cross-sectional area of riser (m^2); A_d : cross-sectional area of downcomer (m^2); D :
23 column diameter; d_B : bubble diameter (μm); DO: dissolved oxygen (mg/L); ϵ_g : gas
24 holdup (dimensionless); H : column liquid height; k_L : mass transfer coefficient; $k_L a$:
25 volumetric mass transfer coefficient (s^{-1}); PBR: photobioreactor; PS: porous stone

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