

Supplementary information

Aquatic macrophytes in morphological and physiological responses to the nanobubble technology application for water restoration

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The SI contains 5 pages, which has 3 Figures and 2 Tables.

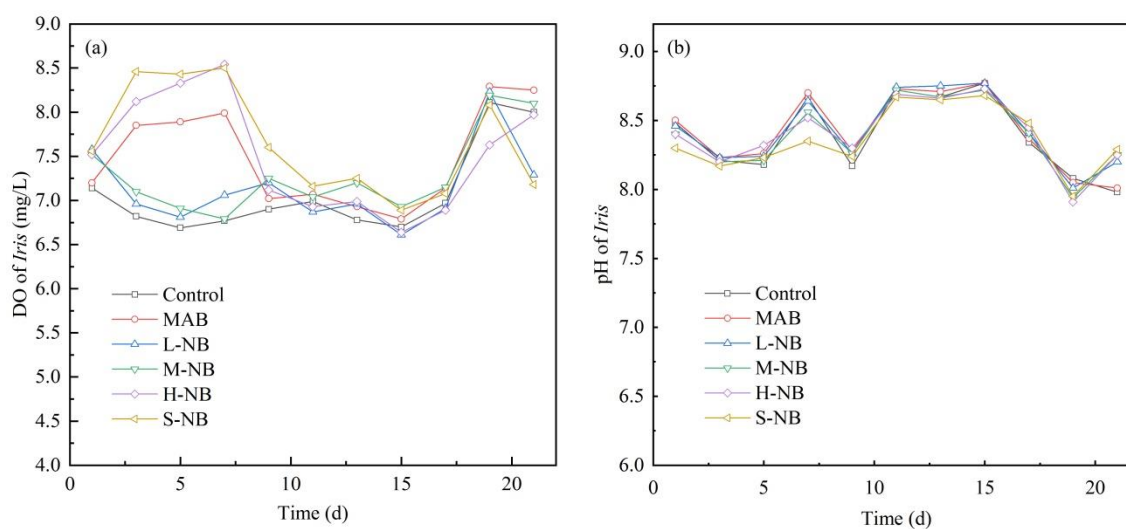


Figure S1. Changes in (a) DO level and (b) pH in water over the 21 days of cultivation of *Iris*. MAB, L-NB, M-NB, H-MB, S-NB represent macrobubble aeration, low, medium, high and super-high nanobubble aeration groups, respectively.

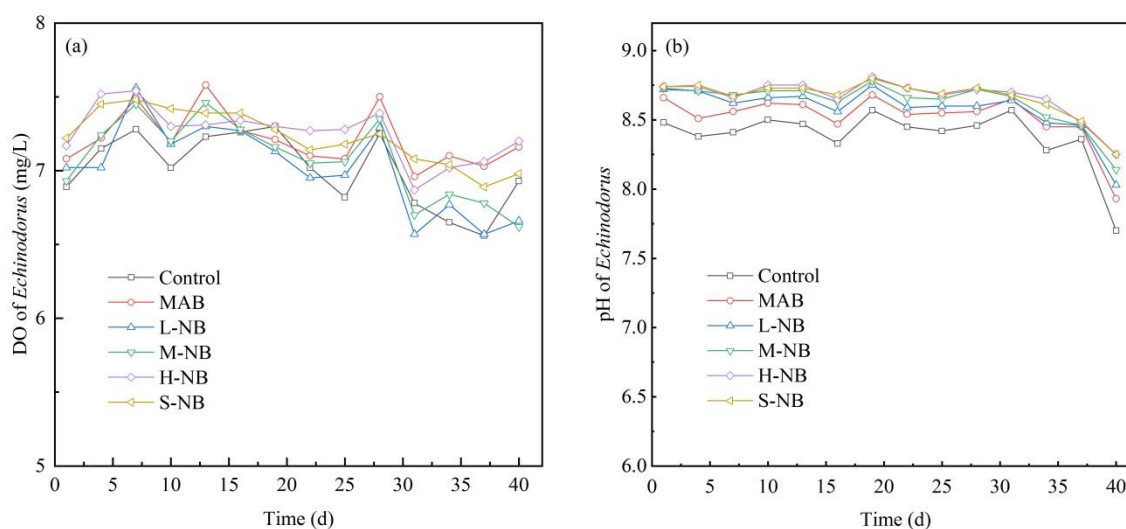


Figure S2. Changes in (a) DO level and (b) pH in the nutrient solution during the 40 days of cultivation of *Echinodorus*. MAB, L-NB, M-NB, H-MB, S-NB represent macrobubble aeration, low, medium, high and super-high nanobubble aeration groups, respectively.

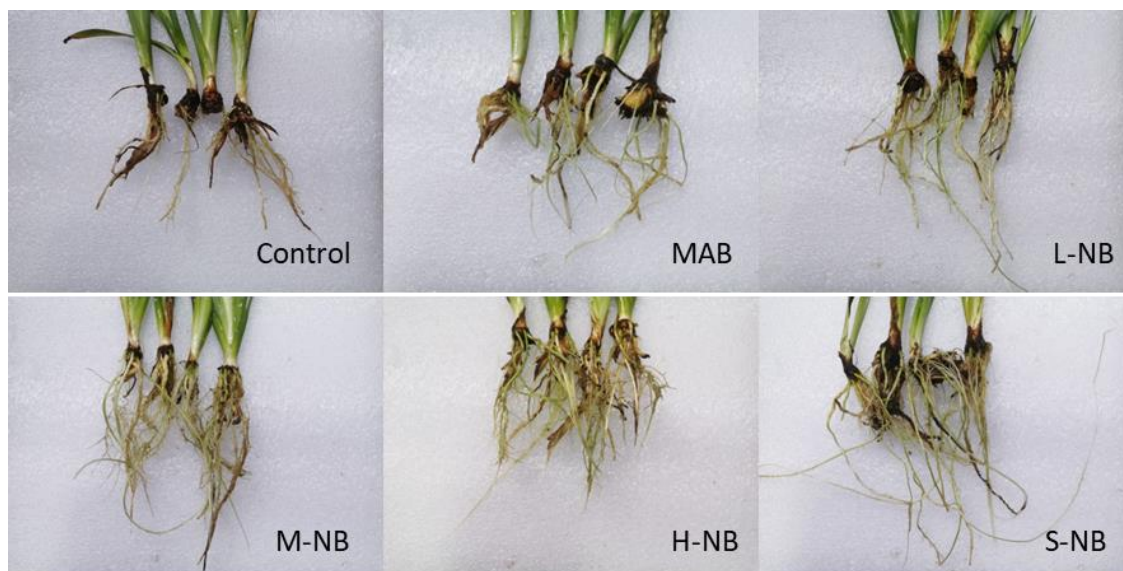


Figure S3. The appearance of *Iris* root at the end of the experiment. MAB, L-NB, M-NB, H-MB, S-NB represent macrobubble aeration, low, medium, high and super-high nanobubble aeration groups, respectively.

Table S1

Significantly enriched Gene Ontology (GO) classification of DEGs in *Iris* for MAB group vs. H-NB group (P-value < 0.05).

Description	Up	Down	Term_type
heme binding	33	12	molecular_function
tetrapyrrole binding	33	12	molecular_function
iron ion binding	28	14	molecular_function
oxidoreductase activity, acting on paired donors, with incorporation or reduction of molecular oxygen	28	11	molecular_function
chitinase activity	6	0	molecular_function
nutrient reservoir activity	5	4	molecular_function
intramolecular lyase activity	6	1	molecular_function
endopeptidase inhibitor activity	5	8	molecular_function
endopeptidase regulator activity	5	8	molecular_function
peptidase inhibitor activity	5	8	molecular_function
peptidase regulator activity	5	8	molecular_function
enzyme inhibitor activity	12	10	molecular_function
methionine adenosyltransferase activity	5	0	molecular_function
O-methyltransferase activity	12	2	molecular_function
oxidoreductase activity, acting on single donors with incorporation of molecular oxygen, incorporation of two atoms of oxygen	4	6	molecular_function
serine-type endopeptidase inhibitor activity	4	4	molecular_function
oxidoreductase activity	103	46	molecular_function
release of cytochrome c from mitochondria	2	1	biological_process
chitin catabolic process	7	0	biological_process
amino sugar catabolic process	7	0	biological_process
glucosamine-containing compound catabolic process	7	0	biological_process
S-adenosylmethionine biosynthetic process	5	0	biological_process
cellular transition metal ion homeostasis	2	3	biological_process
chitin metabolic process	7	0	biological_process
glucosamine-containing compound metabolic process	7	0	biological_process
transition metal ion homeostasis	2	3	biological_process
cell wall macromolecule catabolic process	6	0	biological_process
response to stress	46	29	biological_process
defense response	18	5	biological_process
oxidation-reduction process	103	38	biological_process

Table S2

Significantly enriched Gene Ontology (GO) classification of DEGs in *Echinodorus* for MAB group vs. S-NB group (P-value < 0.05).

Description	Up	Down	Term_type
structural constituent of ribosome	159	127	molecular_function
structural molecule activity	178	197	molecular_function
oxidoreductase activity	133	378	molecular_function
peptidase inhibitor activity	11	35	molecular_function
peptidase regulator activity	11	35	molecular_function
ribosome biogenesis	173	142	biological_process
ribonucleoprotein complex biogenesis	173	142	biological_process
cellular component biogenesis	216	216	biological_process
peptide biosynthetic process	169	164	biological_process
translation	169	158	biological_process
amide biosynthetic process	179	184	biological_process
peptide metabolic process	172	168	biological_process
oxidation-reduction process	131	359	biological_process
organonitrogen compound biosynthetic process	228	282	biological_process
cellular amide metabolic process	183	195	biological_process
cellular component organization or biogenesis	263	336	biological_process
organonitrogen compound metabolic process	314	467	biological_process
metabolic process	794	1580	biological_process
photosynthesis	12	93	biological_process
ribonucleoprotein complex	173	169	cellular_component
ribosome	168	141	cellular_component
macromolecular complex	352	672	cellular_component
thylakoid	14	97	cellular_component
thylakoid part	14	97	cellular_component
photosynthetic membrane	12	92	cellular_component
photosystem	11	86	cellular_component
thylakoid membrane	5	47	cellular_component
photosystem II oxygen evolving complex	3	40	cellular_component
photosystem II	7	63	cellular_component
intracellular non-membrane-bounded organelle	229	249	cellular_component