Figure Captions

Fig. 1. **The bibliometric analysis of studies on the interaction of MNPs and pesticides in the environment.** (a) Network Overlay visualization map that depicting literature trends over the last five years, (b) Network Visualization map showing clusters of co-occurring terms, (c) Sankey diagram on number of core studies on the adsorption of pesticides on MNPs in the environment, (d) Sankey diagram on number of core studies on ecotoxicology of pesticides and MNPs in the aquatic and terrestrial organisms. Created with (https://www.vosviewer.com).

Fig. 2. Interactions between MNPs and pesticides in the environment. The adsorption capacity of (a) carbofuran and (b) carbendazim pesticides on PE and PP polymers; the adsorption capacity of (c) flusilazole and (d) epoxiconazole on PE and PS polymers; sorption kinetics atrazine on pristine and aged PS, PE, and PP polymers: (e) pseudo-first-order and pseudo-second-order kinetic models and (f) intraparticle diffusion model. Where Qe (mg/g) is the amounts of adsorbed pesticides at equilibrium. Copyright (2021-2022) Elsevier. (a, b) Adapted with permission from (Mo et al. 2021). (c, d) Adapted with permission from (Liu et al. 2022). (e, f) Adapted with permission from (Wang et al. 2022).

Fig. 3. Factors affecting the adsorption of pesticides on MNPs in the aquatic and terrestrial environment. Created with www.biorender.com

Fig. 4. Combined toxicological impacts of MNPs and pesticides in the freshwater, marine water and terrestrial ecosystem. Created with www.biorender.com

Fig. 5. Accumulation and toxic implications of MNPs and pesticides in aquatic and terrestrial organisms: (a) NPs uptake in zebrafish larvae exposed to fluorescent PS-NPs for 96 h to control, NPs, DDE and NPs + DDE mixture, the representative images obtained at 96 hpf were captured using a green fluorescence filter, **(b)** ROS production determined by the relative fluorescence of daphnids after 48 h exposure of *D. magna* to glyphosate (Gly) and polystyrene nanoplastics (PSNPs) as individual compounds and in a mixture, **(c)** H&E stained tissue sections showing microplastic accumulation in control group (A, A′), 2,4-dichlorophenoxyacetic acid (B, B′), MP (C, C′) and mixture (D, D′) in earthworms tissues after 14 days of exposure. Microplastic particles (red arrows) appear glowing in polarized light (A′, B′, C′, D′). TC: Connective tissue, N: nucleus, MT: muscle tissue. Copyright (2022) Elsevier. (a) Adapted with permission from (Varshney et al. 2023). (b) Adapted with permission from (Nogueira et al. 2022). (c) Adapted with permission from (Boughattas et al. 2021).

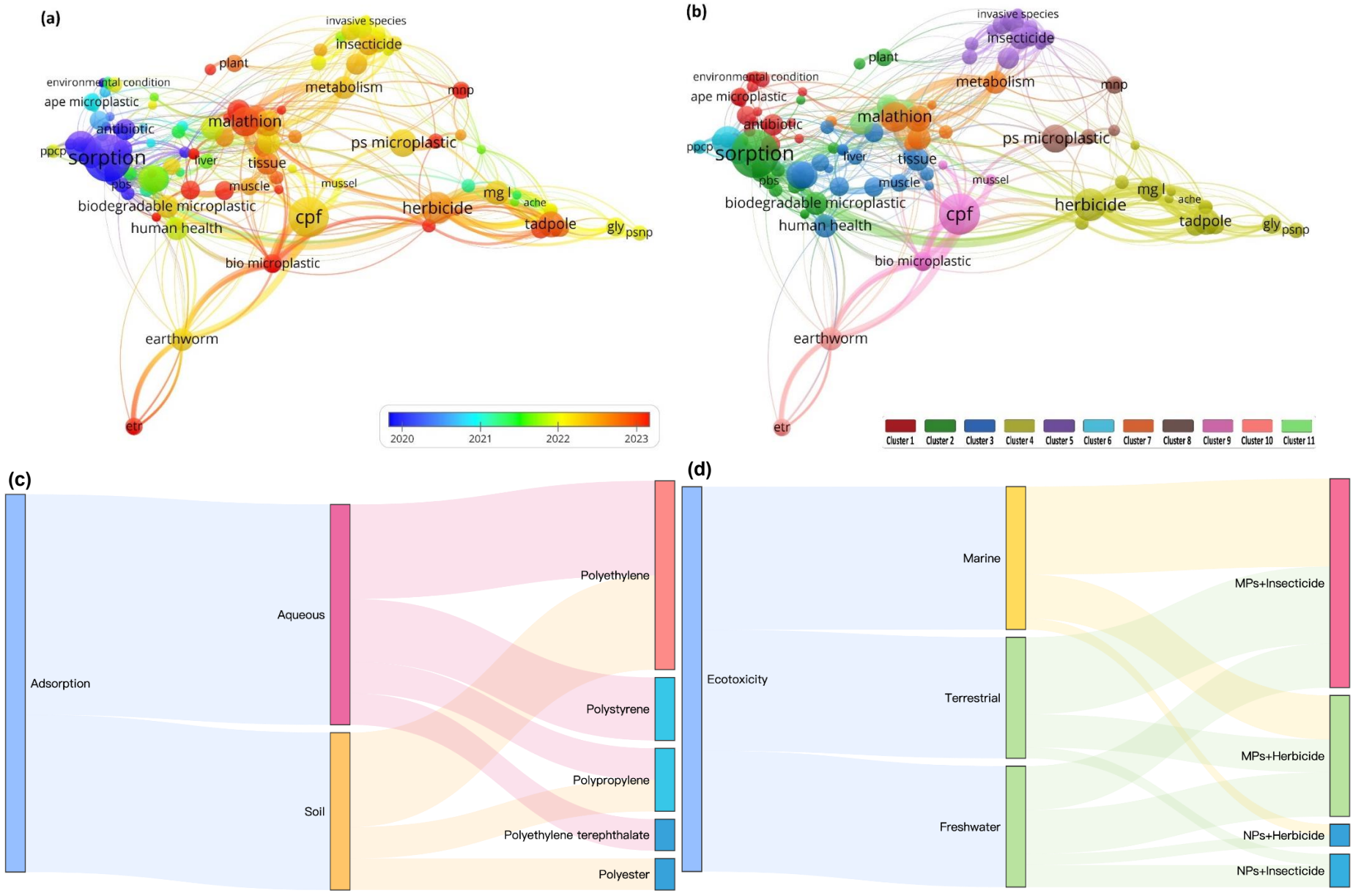
(a)
invasive species
insecticide
plant
environmental condition
metabolism
mnp
ape microplastic
malathion
antibiotic
ps microplastic
ppcp
sorption
liver
tissue
pbs
muscle
mussel
mg l
ache
biodegradable microplastic
cpf
herbicide
tadpole
gly
psnp
human health
bio microplastic
earthworm
etr
2020
2021
2022
2023
(b)
invasive species
insecticide
plant
environmental condition
metabolism
mnp
ape microplastic
malathion
antibiotic
ps microplastic
ppcp
sorption
liver
tissue
pbs
muscle
mussel
mg l
ache
biodegradable microplastic
cpf
herbicide
tadpole
gly
psnp
human health
bio microplastic
earthworm
etr
Cluster 1
Cluster 2
Cluster 3
Cluster 4
Cluster 5
Cluster 6
Cluster 7
Cluster 8
Cluster 9
Cluster 10
Cluster 11
(c)
Adsorption
Aqueous
Soil
Polyethylene
Polystyrene
Polypropylene
Polyethylene terephthalate
Polyester
(d)
Ecotoxicity
Marine
Terrestrial
Freshwater
MPs+Insecticide
MPs+Herbicide
NPs+Herbicide
NPs+Insecticide

Fig. 1

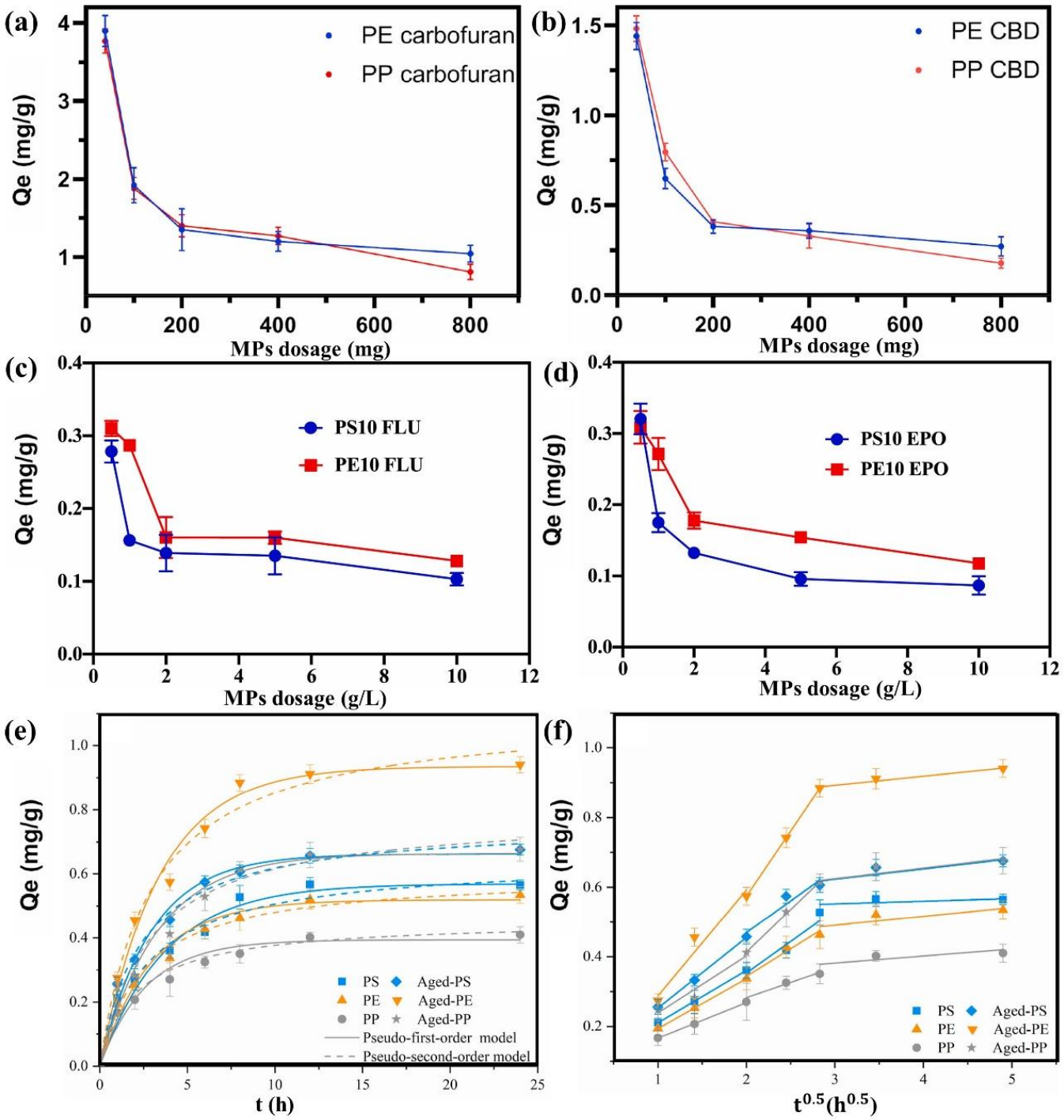
(a)
PE carbofuran
PP carbofuran
Qe (mg/g)
MPs dosage (mg)
(b)
PE CBD
PP CBD
Qe (mg/g)
MPs dosage (mg)
(c)
PS10 FLU
PE10 FLU
Qe (mg/g)
MPs dosage (g/L)
(d)
PS10 EPO
PE10 EPO
Qe (mg/g)
MPs dosage (g/L)
(e)
PS
Aged-PS
PE
Aged-PE
PP
Aged-PP
Pseudo-first-order model
Pseudo-second-order model
Qe (mg/g)
t (h)
(f)
PS
Aged-PS
PE
Aged-PE
PP
Aged-PP
Qe (mg/g)
t^0.5 (h^0.5)

Fig. 2.

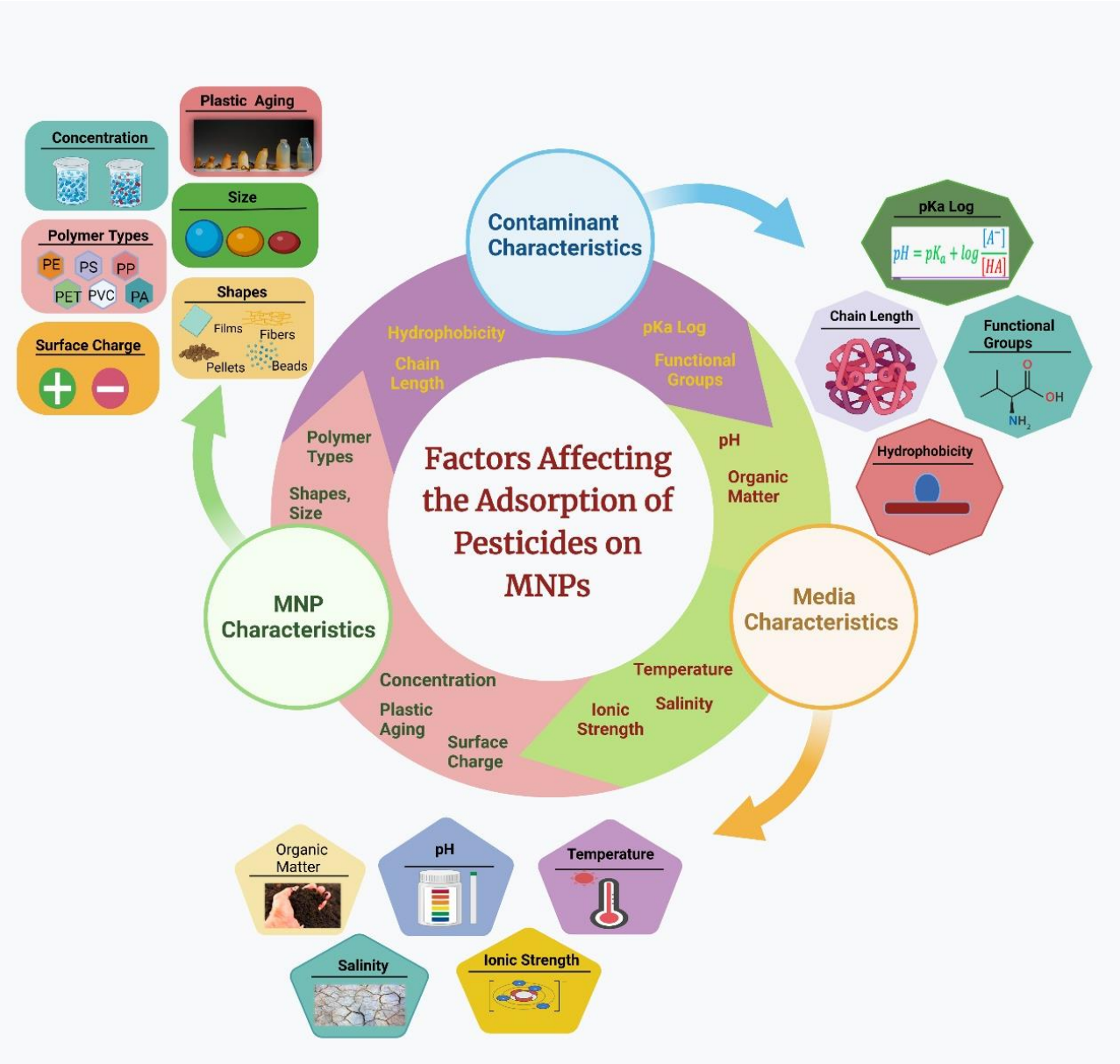
Concentration
Plastic Aging
Size
Polymer Types
PE
PS
PP
PET
PVC
PA
Shapes
Films
Fibers
Pellets
Beads
Surface Charge
Contaminant Characteristics
pKa Log
$pH = pK_a + \log \frac{[A^-]}{[HA]}$
Chain Length
Functional Groups
Hydrophobicity
Factors Affecting the Adsorption of Pesticides on MNPs
Hydrophobicity
Chain Length
pKa Log
Functional Groups
pH
Organic Matter
Media Characteristics
Temperature
Salinity
Ionic Strength
Surface Charge
Plastic Aging
Concentration
MNP Characteristics
Polymer Types
Shapes, Size
Organic Matter
pH
Temperature
Salinity
Ionic Strength

Fig. 3.

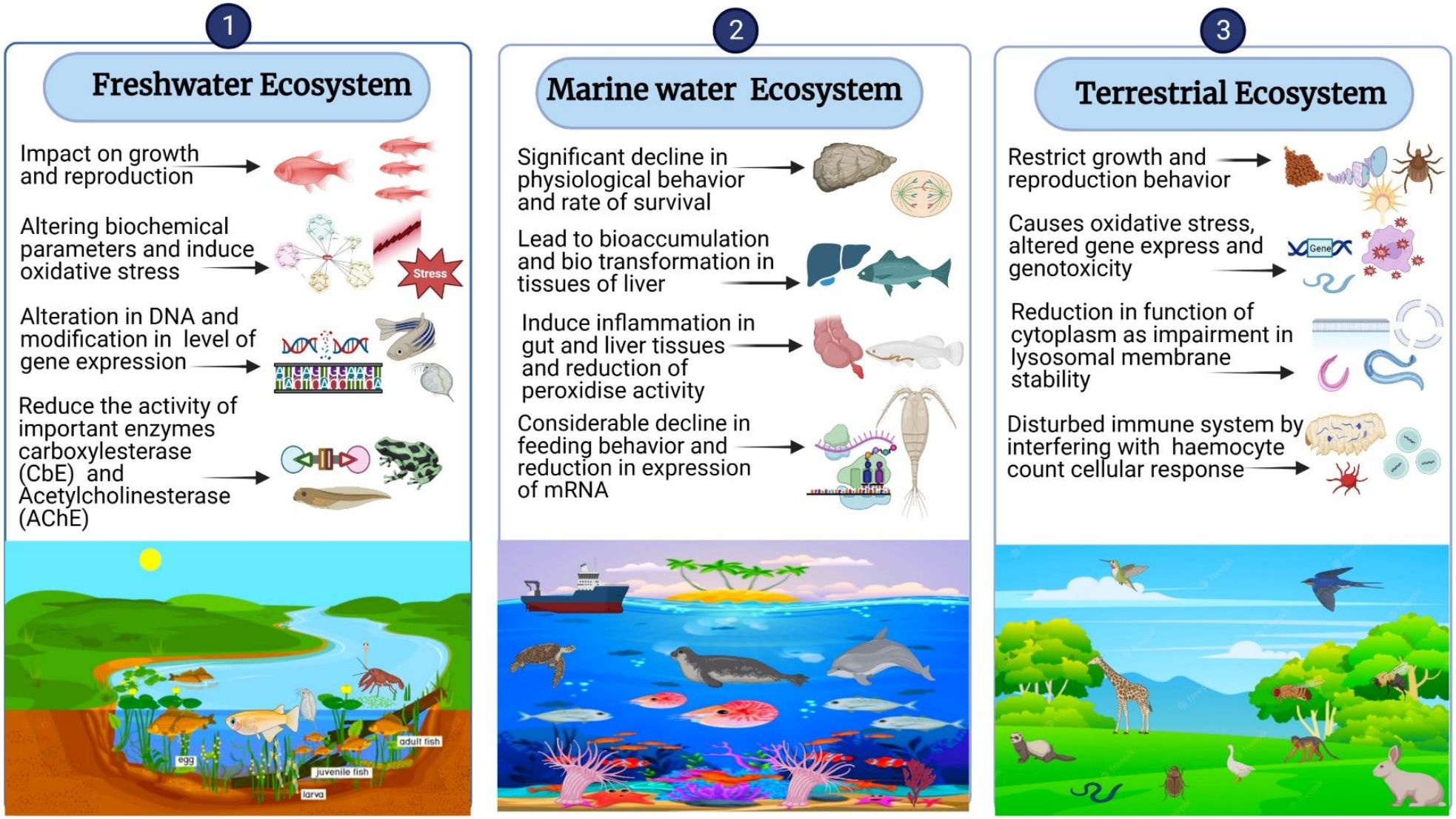
Combine toxicity of MNPs with Pesticides
1
Freshwater Ecosystem
Impact on growth and reproduction
Altering biochemical parameters and induce oxidative stress
Stress
Alteration in DNA and modification in level of gene expression
Reduce the activity of important enzymes carboxylesterase (CbE) and Acetylcholinesterase (AChE)
egg
adult fish
juvenile fish
larva
2
Marine water Ecosystem
Significant decline in physiological behavior and rate of survival
Lead to bioaccumulation and bio transformation in tissues of liver
Induce inflammation in gut and liver tissues and reduction of peroxidise activity
Considerable decline in feeding behavior and reduction in expression of mRNA
3
Terrestrial Ecosystem
Restrict growth and reproduction behavior
Causes oxidative stress, altered gene express and genotoxicity
Gene
Reduction in function of cytoplasm as impairment in lysosomal membrane stability
Disturbed immune system by interfering with haemocyte count cellular response

Fig. 4.

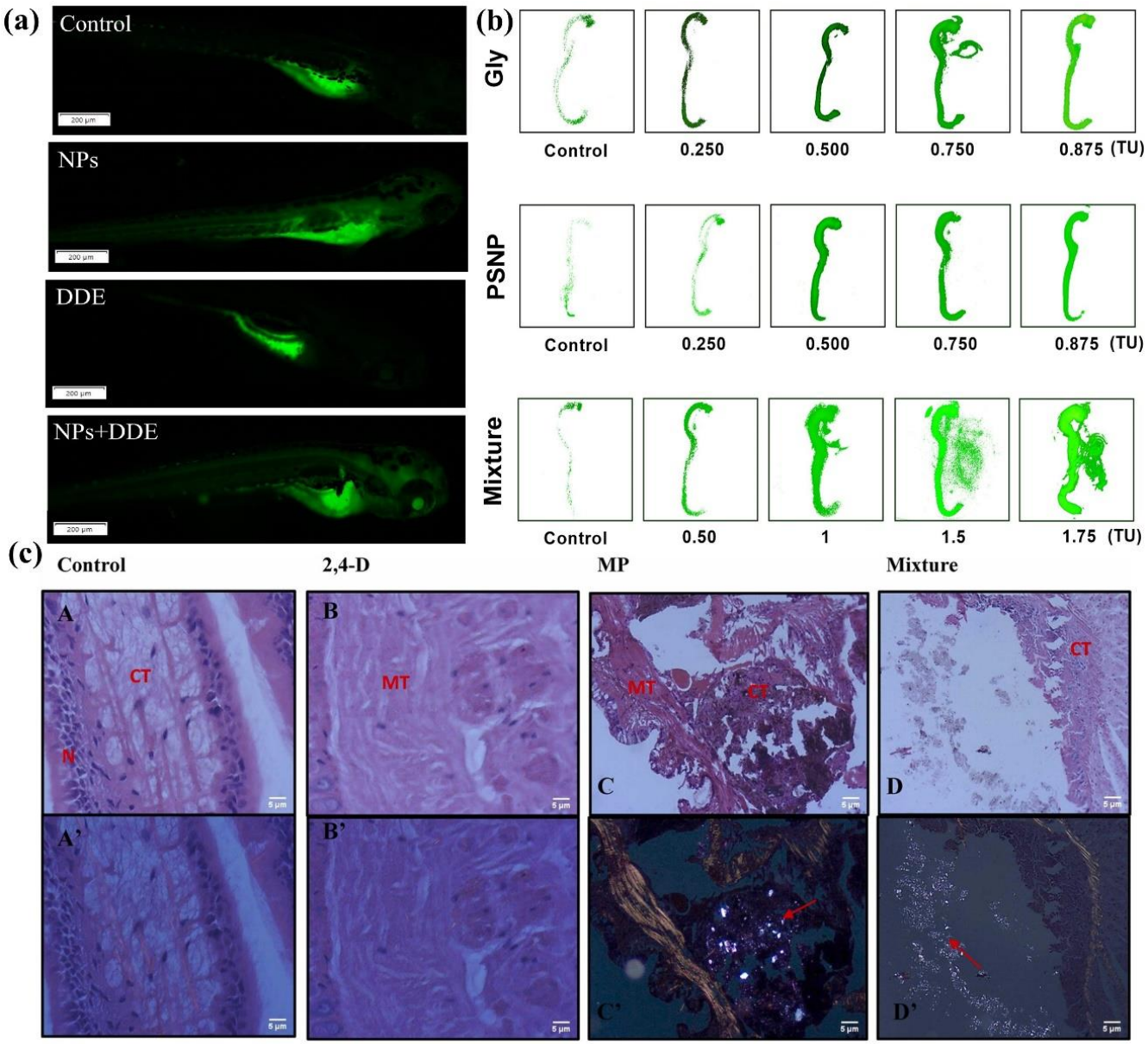
(a)
Control
NPs
DDE
NPs+DDE
(b)
Gly
Control
0.250
0.500
0.750
0.875 (TU)
PSNP
Control
0.250
0.500
0.750
0.875 (TU)
Mixture
Control
0.50
1
1.5
1.75 (TU)
(c)
Control
2,4-D
MP
Mixture
A
CT
N
B
MT
C
MT
CT
D
CT
A'
B'
C'
D'

Fig. 5.