Hydro Nation Scholars Programme

Toxic plastic particles:
Microplastic as vector for cyanobacterial toxins microcystin-LR and -LF

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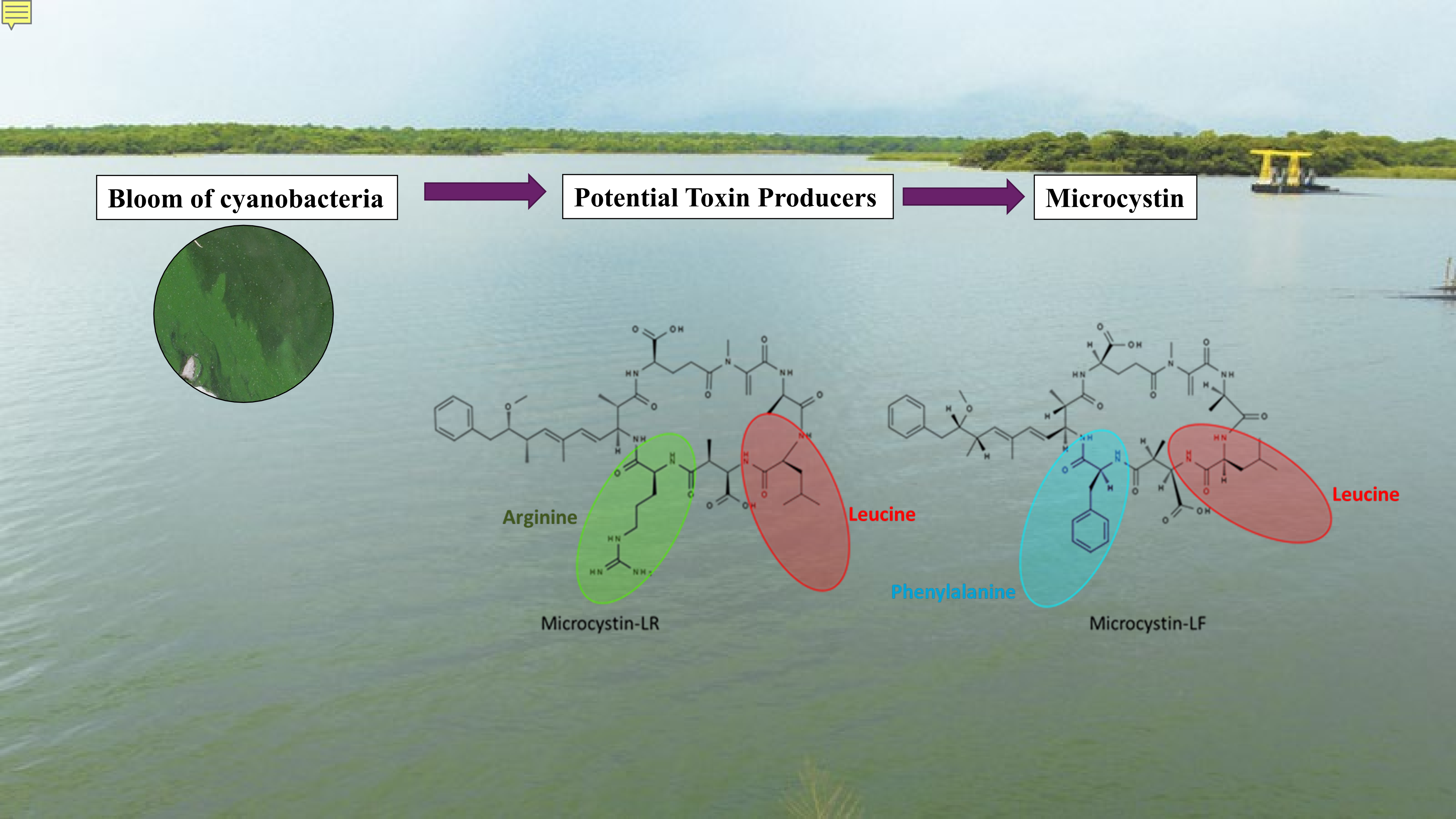
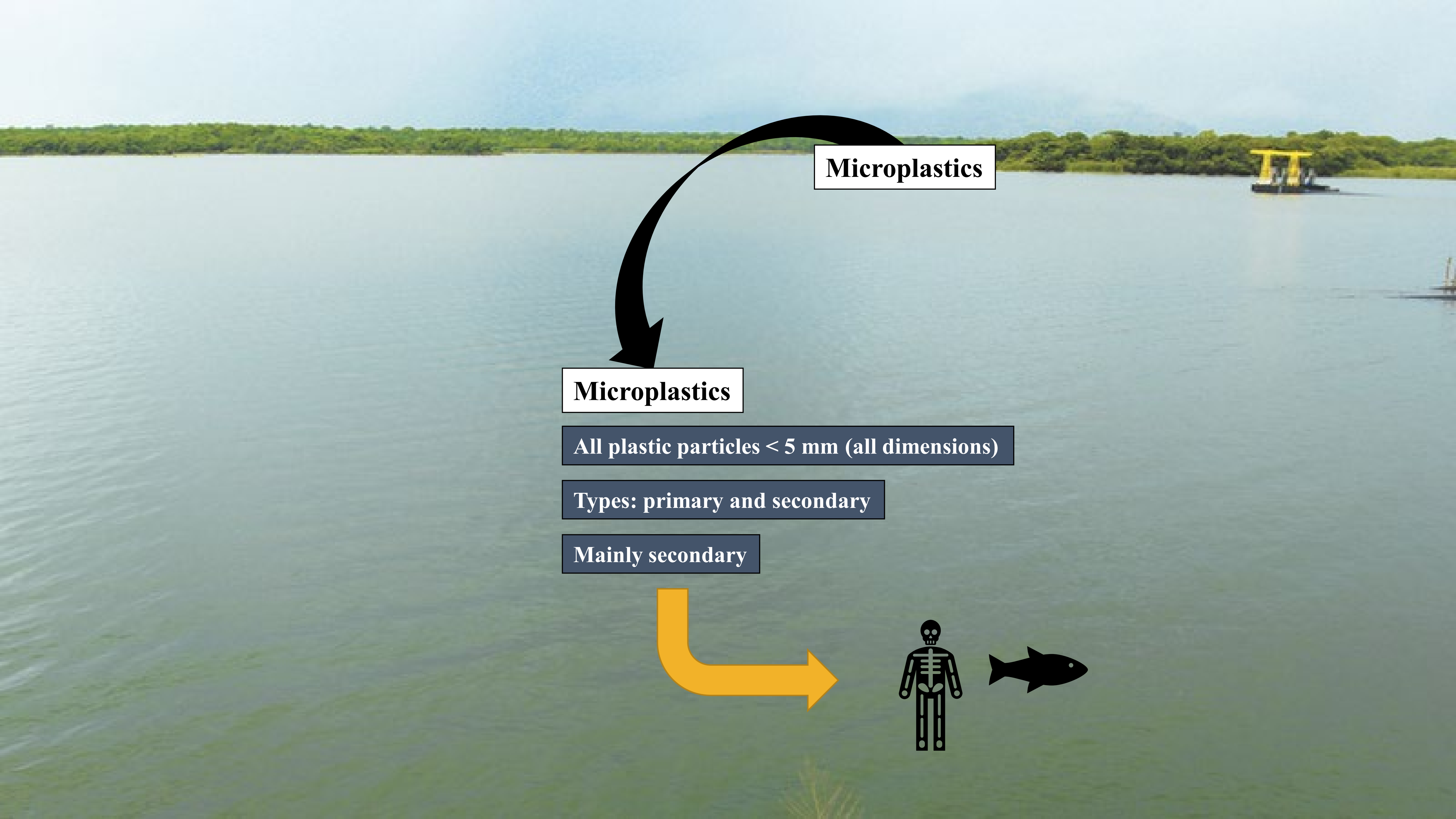
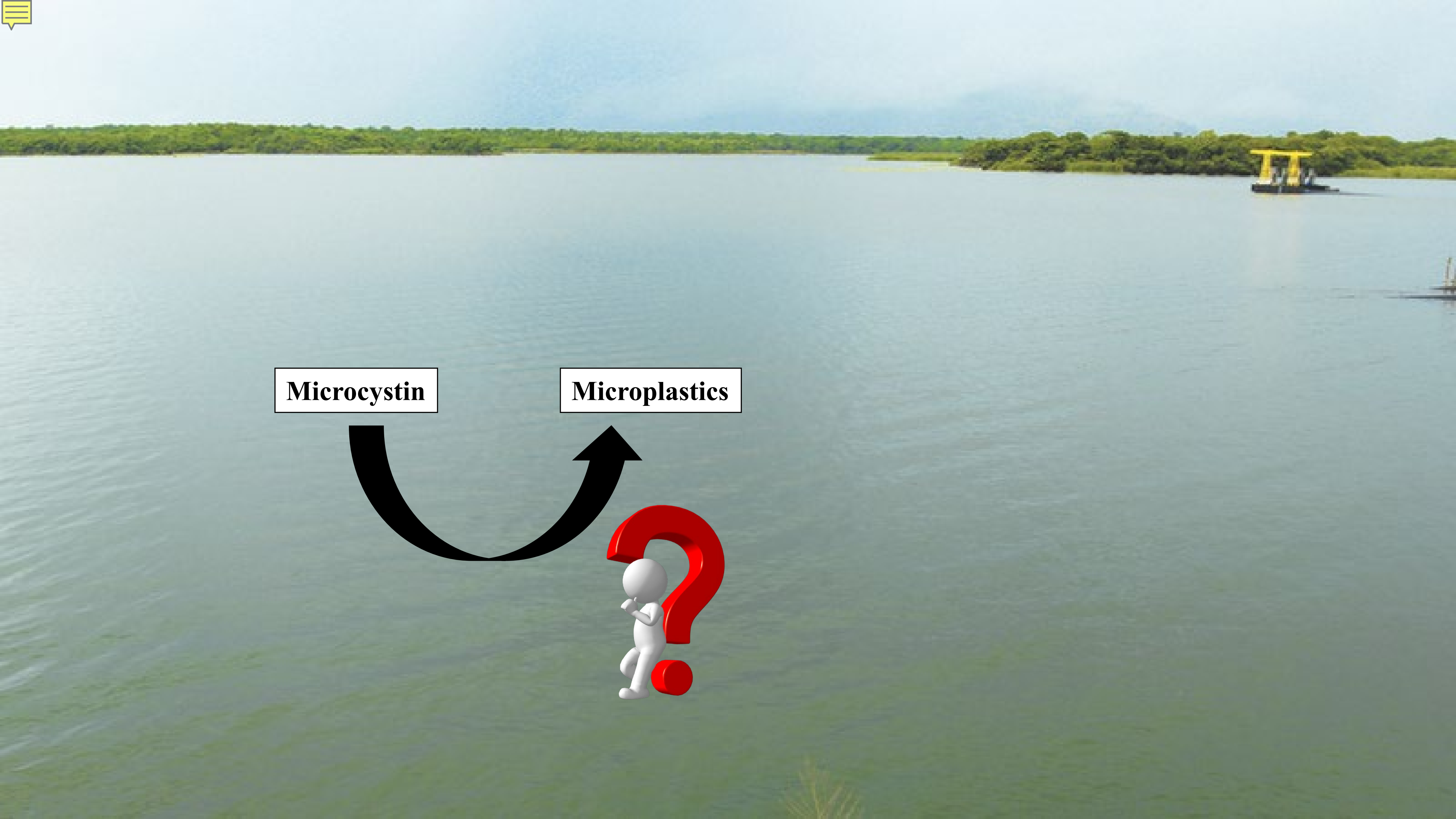

Bloom of cyanobacteria
Potential Toxin Producers
Microcystin
Arginine
Leucine
Microcystin-LR
Phenylalanine
Leucine
Microcystin-LF

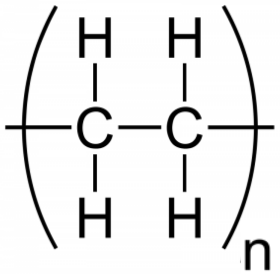

Microplastics
Microplastics
All plastic particles < 5 mm (all dimensions)
Types: primary and secondary
Mainly secondary


Microcystin
Microplastics

Polymers commonly use

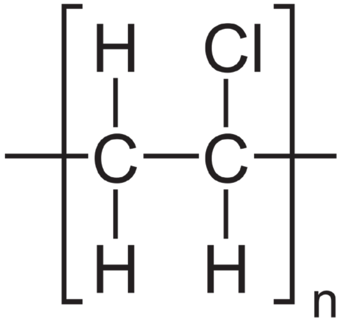
PE-LD

Reusable bags, trays and containers, agricultural film, food packaging film, etc.



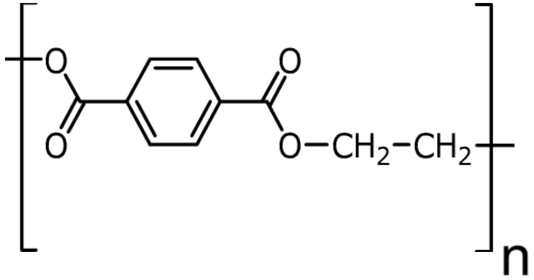
PVC

Window frames, profiles, floor and wall covering, pipes, cable insulation, garden hoses, inflatable pools, etc.



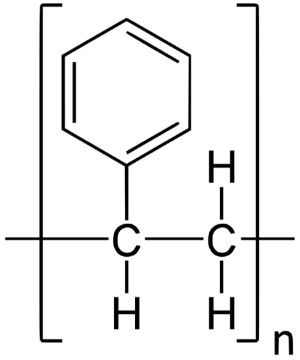
PET

Bottles for water, soft drinks, juices, cleaners, etc.



PS

Food packaging (dairy, fishery), building insulation, electrical & electronic equipment, inner liner for fridges, eyeglasses frames, etc.



Overview of the experiment

MC – LR
MC – LF

➔

pH 5
pH 7
pH 9
pH 11

➔

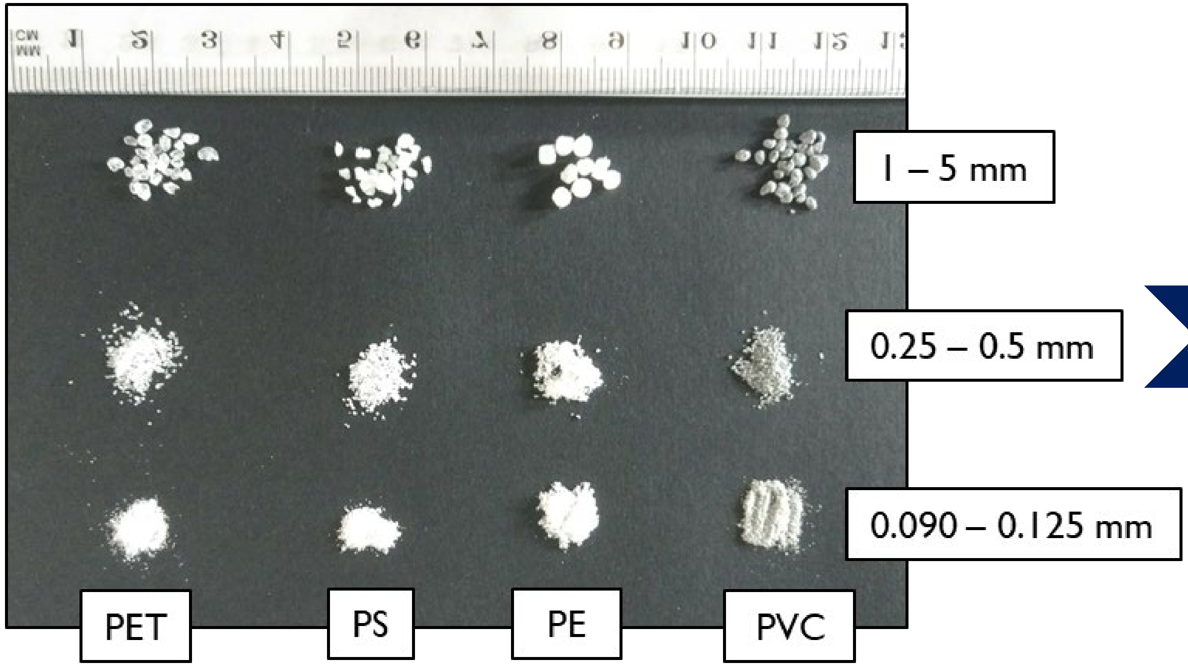
PET
Polystyrene
PVC
Polyethylene

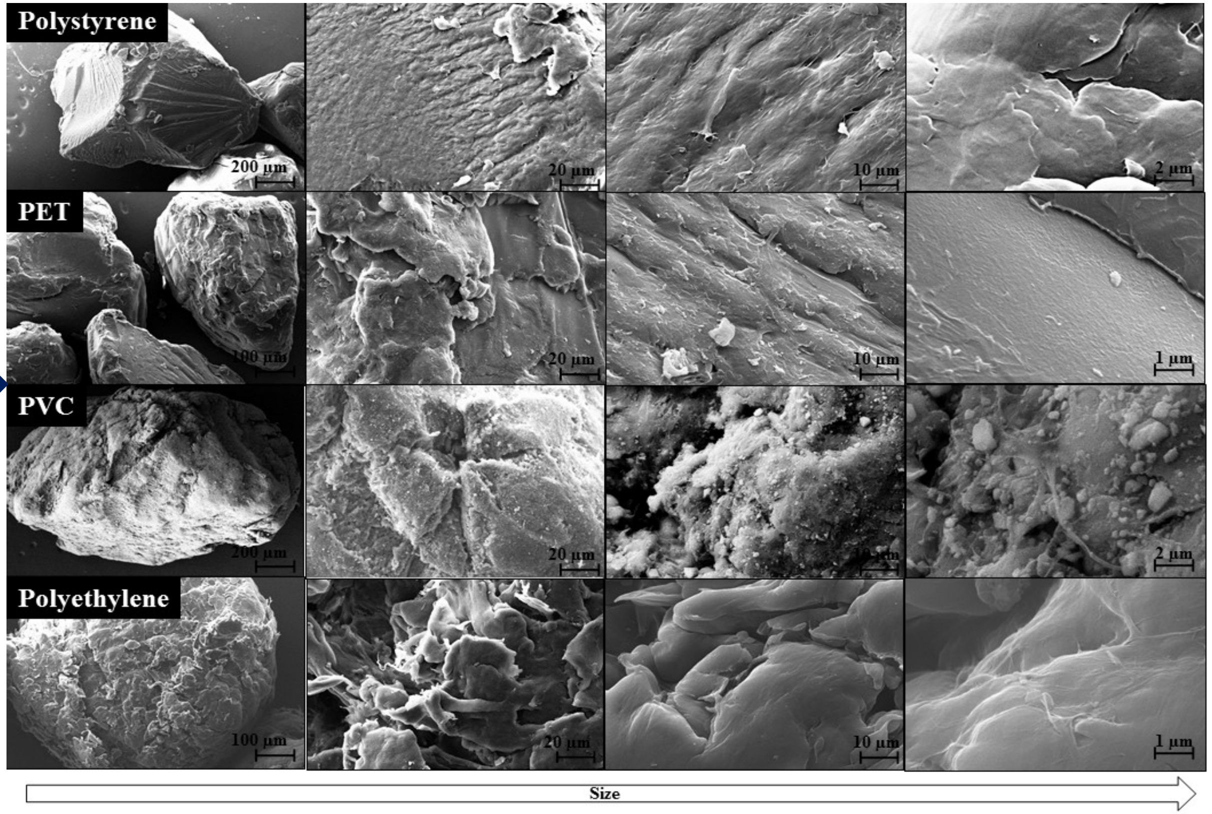
➔

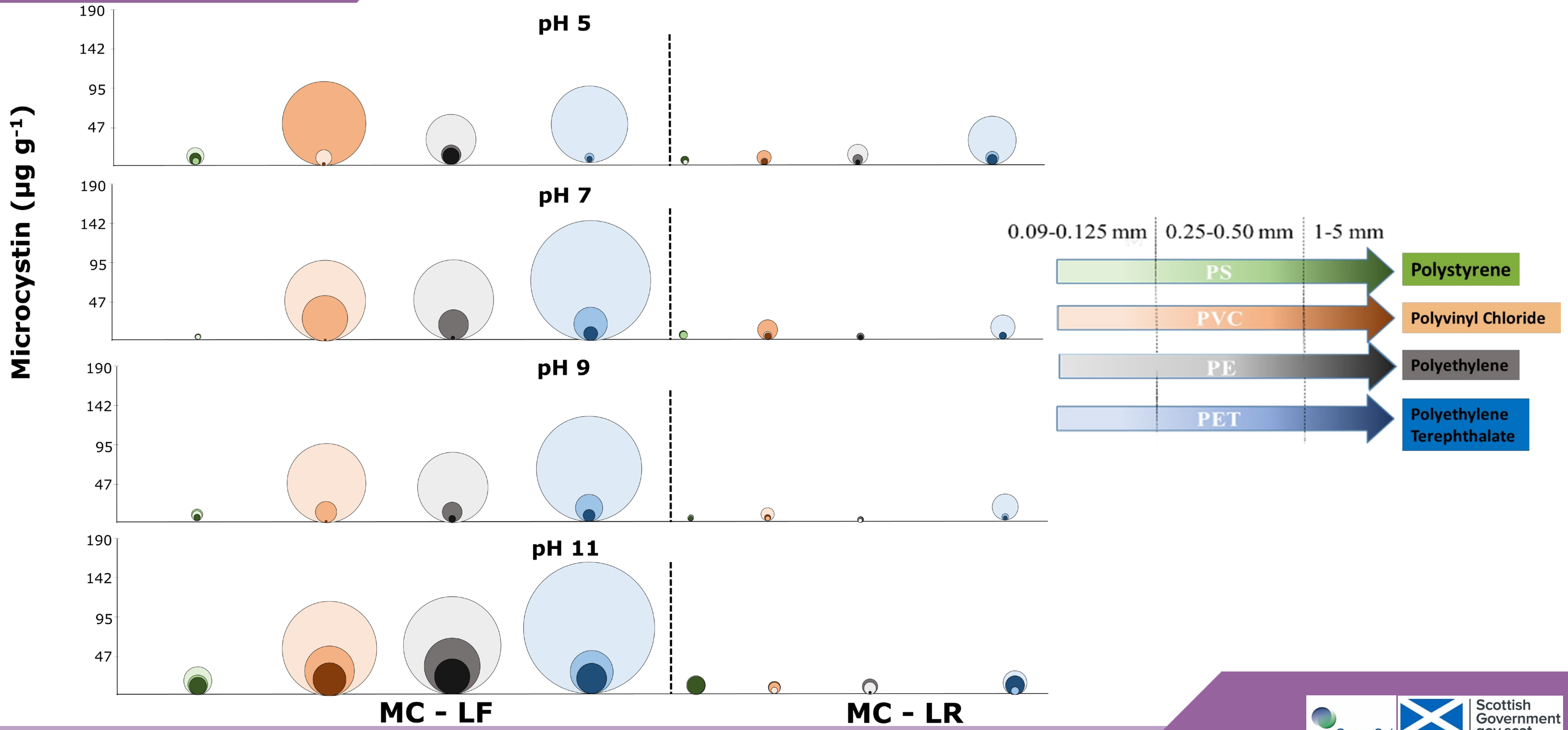
0.09-0.125 mm
0.25-0.5 mm
1 mm-5 mm
Control

*Experiment performed in artificial fresh water (AFW) – Adjusted with nitric acid and sodium hydroxide

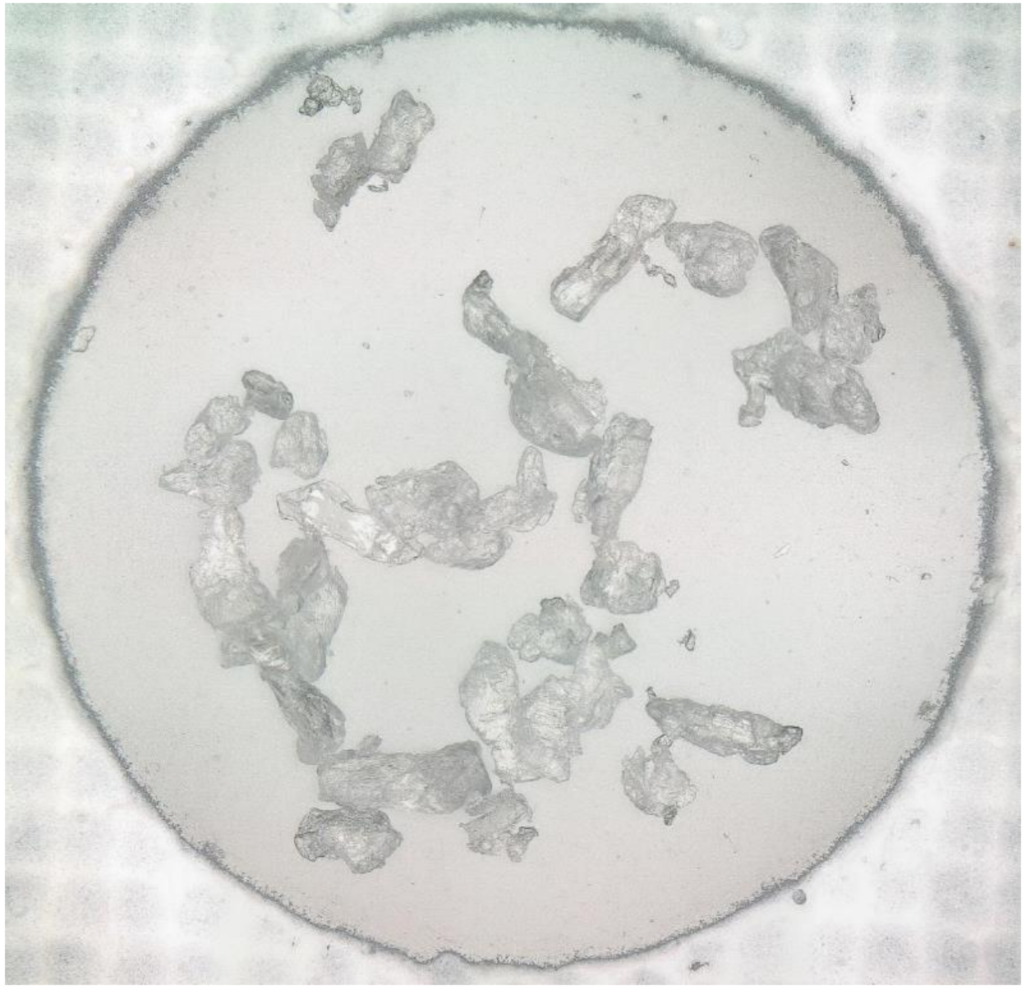
Polymers particles



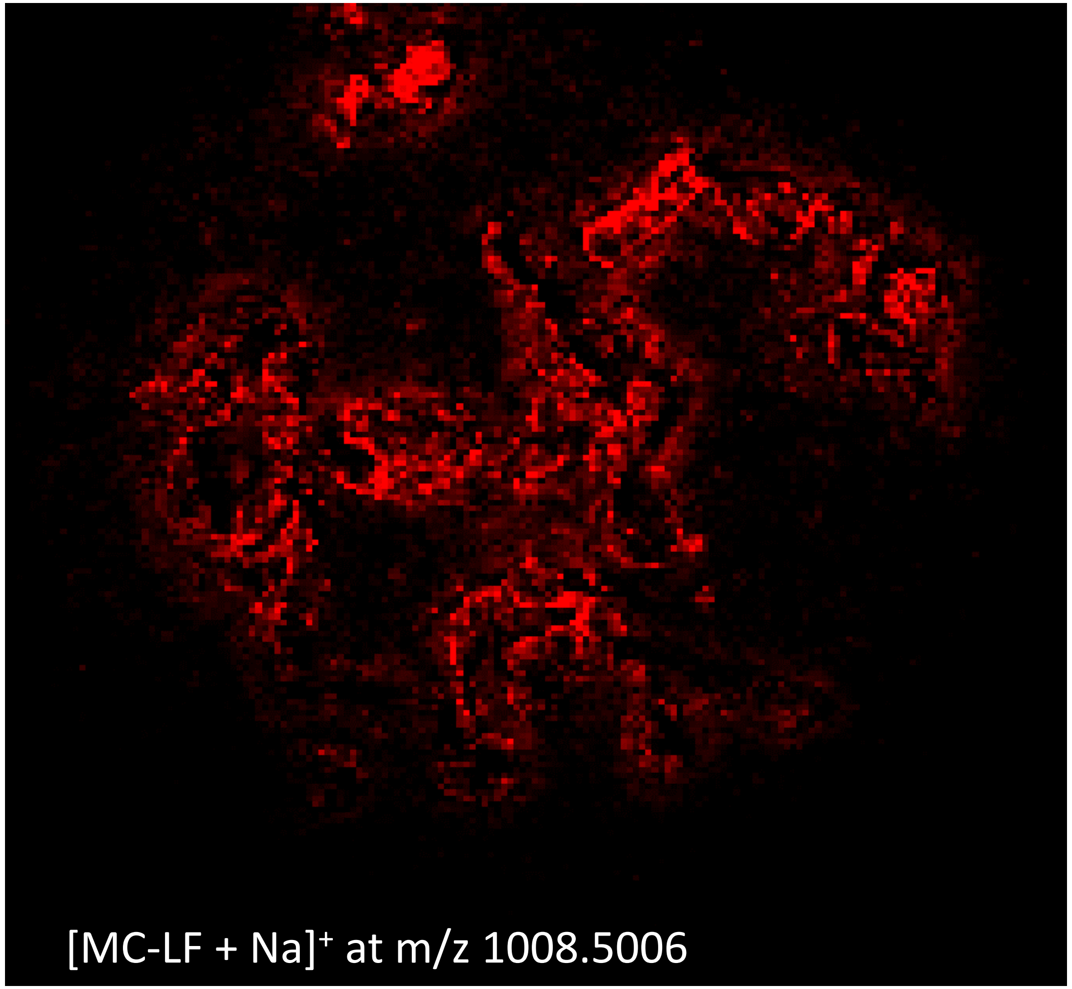



Microcystin (µg g⁻¹)
pH 5
pH 7
pH 9
pH 11
190
142
95
47
MC - LF
MC - LR
0.09-0.125 mm
0.25-0.50 mm
1-5 mm
PS
PVC
PE
PET
Polystyrene
Polyvinyl Chloride
Polyethylene
Polyethylene Terephthalate

Matrix-assisted laser desorption/ionization mass spectrometric imaging (MALDI MSI)



Optical image of PET before matrix application



All three adducts of (H,Na,K) of MC-LF were detected

Conclusions

- Microplastics can be a vector of hydrophobic toxic compounds;
- Size of microplastic affects adsorption of microcystins onto plastics;
- The pH of the matrix appears to affect adsorption of microcystins onto plastics;
- It is not possible to predict the behaviour of microcystin analogues by just analysing one variant (MC – LR).

Next steps

- Evaluate the adsorption of other microcystin variants onto microplastics, singular and mixtures;
- Investigate the desorption capacity of the microcystin from microplastics;

Acknowledgement

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gov.scot
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Thank you for your attention!