THE USE OF DAPHNIA CARINATA FOR ECOTOXICOLOGICAL ASSESSMENT OF ACID MINE DRAINAGE-AFFECTED STREAMS IN SUBTROPICAL CHINA

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Surface mining in the Guangdong Dabaoshan Mine, South China has induced soil acidification due to oxidation of metal sulfides contained in the mine spoils. Acid mine drainage (AMD) from this mine site has caused the degradation of the downstream aquatic ecosystems. Investigations show that macroinvertebrates were absent to a distance at least 25 km downstream of mine water discharge point even when pH rose to above 6 (Lin *et al.*, 2003). In order to develop management strategy and also establish an evaluation method for assessing the remediation efforts in the future, ecotoxicolgical approach has been developing to supplement the chemical analyses.

Daphnia magna is a standard toxicity test organism recommended by International Standard Organization (ISO, 1989) and has been universally used for biotoxicological testing purposes. However, this *Daphnia* species does not tolerate high temperature and thus does not occur naturally in South China. Research effort has therefore been made to select more appropriate *Daphnia* species for being used in the study area.

In a comparison between *Daphnia carinata* that commonly occurs in South China and *Daphnia magna*, we found that *D. carinata* was superior to *D. magna* as a test organism for ecotoxicological assessment of toxicants. The major advantages of *D. carinata* (Clone DC_{42}) over *D. magna* include: (a) a wider range of temperature tolerance (–4°C - 38 °C, compared to 5°C - 28 °C for *D. magna*); (2) rapid growth rate and shorter cycle of reproduction (5 days, compared to 15 days for *D. magna*); (c) more sensitive to toxicants; (d) stronger phototaxis; and (e) a wider food range. These advantages make the *D. carinata* (Clone DC_{42}) an ideal biotoxicity test organism for being used in South China Region.

An integrated biomarker method for ecotoxicological assessment of AMD-affected stream using *Daphnia carinata* is currently under development in our laboratory, covering physical, biochemical, molecularly biological, physiological and behavioural aspects of test endpoints, as well as acute toxicity test (LC_{50} and EC_{50}). In this presentation, a rapid ecotoxicity assay using the phototactic behaviour of *Daphnia carinata* is reported.

The preliminary results show that good relationship exists between the *D carinata*'s phototaxis index (Ip) and the concentration of a range of typical contaminants associated with acidic mine water (see Fig. 1 for an example). It was also found that the phototactic behaviour of *D. carinata* (Clone DC_{42}) is genetically very stable and this makes Ip an excellent biomarker for development of rapid and undestructive analytical methods for ecotoxicity testing of AMD-affected aquatic environments.

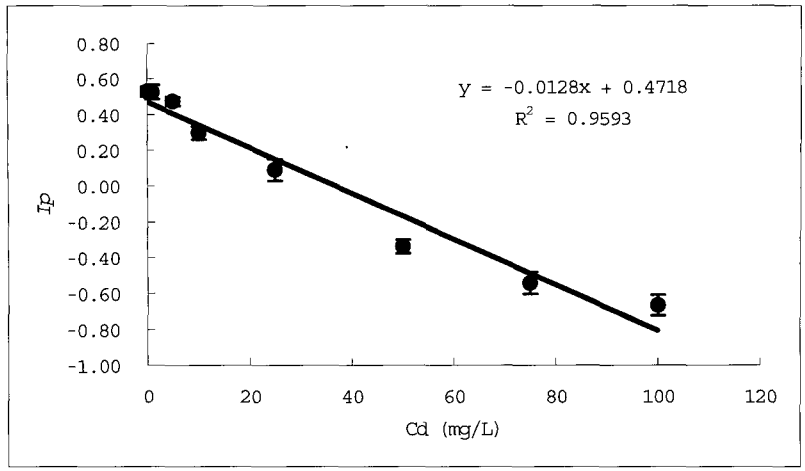

Fig. 1 Relationship between the phototactic index (*Ip*) of *Daphnia carinata* and the concentration of Cd in the solutions.

REFERENCES

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