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Evaluation of herbicide effects on micro algal cells by flow cytometric analysis

Satoru Ishihara[1)], Takeshi Horio[1)], Yuso Kobara[1)] and Atsushi Yokoyama[1)]

1) National Institute for Agro-Environmental Sciences (NIAES)

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Summary:
The effects of forty herbicides on cell morphologies of the freshwater microalgae such as *Pseudokirchneriella subcapitata* (green alga), *Achnanthidium minutissimum* (diatom) and *Merismopedia tenuissima* (blue green alga) were investigated by microscopic observation, measuring side scatter (SSC) intensity and autonomous fluorescence (AF_{610}) of chlorophyll a using a flow cytometry. Morphological changes and differences in chlorophyll a amount of these microalgae were induced by the exposures to high concentration (10 mg l^{-1} or water solubility) of herbicides. Especially, the responses on cell shape of *P. subcapitata* were greater than those of two other species and these reactions observed in *P. subcapitata* were classified into four types.
The cell volumes were greatly increased at the highest concentrations (6 to 12 times density of 72h-EC_{50}) of the five herbicides (bensulfuronmethyl, esprocarb, mefenacet, pretilachlor, and thiobencarb) and the blanching cells were observed in incubations with three herbicides (esprocarb, quinoclamine and thiobencarb). The recoverability from morphological changes of *P. subcapitata* cells was confirmed in exposure experiments with seven kinds of herbicides (bensulfuronmethyl, esprocarb, mefenacet, pretilachlor, quinoclamine, simetryn and thiobencarb). It is clear that every treated *P. subcapitata* population did not extinct in a short time (72h) exposures of high concentration of seven herbicides, and that the recoverability of *P. subcapitata* population is apt to decline with increasing the amount of blanching cells.

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