

Induction of Imposex in Rock Shell, *Thais clavigera*, Exposed to Tributyltin and Other Antagonistic Chemicals

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Many endocrine disruptors (*e.g.* nonylphenol) are known as feminizing chemicals, while TBT as a masculinizing agent for gastropod. Actually, other feminizing chemicals as well as TBT exist together in the marine environment. In this study, interactions of both feminizing and masculinizing chemicals in inducing imposex in gastropod was investigated with a long term exposure experiment. Imposex-free rock shell (*Thais clavigera*) were exposed to TBT and other antagonistic chemicals (nonylphenol and DDT), P450 inducer (phenobarbital) and natural sex hormone (estrogen) mixtures for 60 days. None of imposed-sexed-female were found in control, sham (ethanol) and testosterone exposure groups, on the other hand imposex was induced in the TBT exposure group and all the TBT + antagonist mixture groups. After 60-day exposure, frequency of imposex female ranged from 31 - 68%, and relative penis length index was 7.2 - 21.2%. Female mean penis length (FMPL) of imposed-sexed-female ranged from 0.87 - 2.58 mm. However, the degree of imposex induction was different among the exposure groups. The FMPLs of three exposure groups (TBT + estrogen, TBT + DDT and TBT + nonylphenol) were less than that of TBT exposure group, while TBT + phenobarbital exposure group was higher.

Ethoxyresorufin-O-deethylase (EROD) activities in gastropod decreased in the TBT and all the TBT + antagonist exposure groups compared to the control group. A negative correlation was obtained between TBT

body residue and EROD activity as well as degree of imposex in gastropod except for the TBT + DDT exposure group. Although TBT concentration was relatively high in the TBT + DDT exposure group, the TBT + DDT exposure group demonstrated low EROD activity and low degree of imposex. These results indicate that a certain antagonistic effect of DDT occurred in induction of imposex.