

عنوان مقاله:

Research Article: Effects of naproxen and titanium dioxide combination on the early life-stages of Zebrafish (*Danio rerio*): Acute toxicity, morphological defects, and gene expression

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خلاصه مقاله:

Zebrafish (*Danio rerio*) early-life stages of larvae were used to investigate behavioral, genetical and neurochemical changes promoted by the aquatic toxicity associated with the widely used medicines including naproxen (NPX) and titanium dioxide (TiO_2), individually or in combination. Zebrafish as a biological model system genetically very similar to human. This study was carried out with a control (C) group and six treatments including TiO_2 at 2 (2T) and 4 mg/L (4T), 50 $\mu\text{g/L}$ (50N) and 100 $\mu\text{g/L}$ (100N) of NPX, 2 mg/L TiO_2 +50 $\mu\text{g/L}$ NPX (2T50N) and 4 mg/L TiO_2 + and 100 $\mu\text{g/L}$ NPX, (4T100N). Approximately 48 hours post-fertilization (hpf), the groups exposed to 4 mg/L TiO_2 individually or in combination of 100 $\mu\text{g/L}$ NPX induced large suites of symptoms in zebrafish (*D. rerio*) early-life stage, including hatching inhibition particularly in 50 and 100 $\mu\text{g/L}$ exposed groups (10.0% and 10.3%, respectively), increased mortality specially in the group 4T100N (39.6%), high heart-beat, and few morphological abnormalities. At approximately 168 hpf, severing of the yolk sac and pericardium oedema, severe swim bladder inflation, short tail with axial malformation, and small eyes were other significant occurrences in *D. rerio* exposed particularly to 100 $\mu\text{g/L}$ NPX, which can be collectively referred to as pigeon chest deformity. The results of mRNA expression of neurogenesis- and growth-associated genes of the targeted ones presented that gfap mitigated exception for 2T group compared to the control group. For mbp, fish of all groups showed downward gene expression, except for 100N group exhibited a normal expression compared to the control as well as the situation observed for AChE, although the fish showed relatively downward gene expression compared to the control group. The brain showed apoptosis as vacuoles in 4T and 50N groups. It is concluded that TiO_2 had low acute toxicity to the embryos and larvae of *D. rerio* compared to NPX and could be used in different industries with low-risk rate, while it was used at low concentration (2 mg/L or less). although exposure to higher concentrations (4 mg/L or more) resulted in the increase of susceptibility risk of diseases.

کلمات کلیدی:

Danio rerio, Naproxen, Titanium dioxide, Axial defects, gfap, mbp, AChE

