Genotoxic Effects of PCBs and Heavy Metals on Marine Mussels

Results from in vitro experiment

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OUTLINE

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- RESULTS & DISCUSSION
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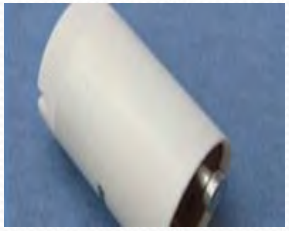
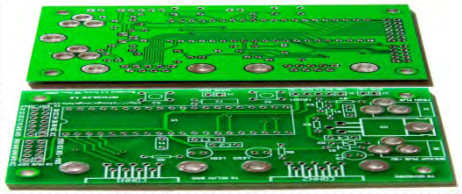
INTRODUCTION

- Rapidly increased industrialization causing serious environmental pollutions
- Organic pollutants, such as Polychlorinated biphenyls (PCBs) widely used in commercial products and industrial processes, can be toxic and persist in the environment
- Inorganic contaminants, such as heavy metals, at higher concentration are toxic
- Bioaccumulation of various pollutants through the food web can cause adverse effects to human health and environment

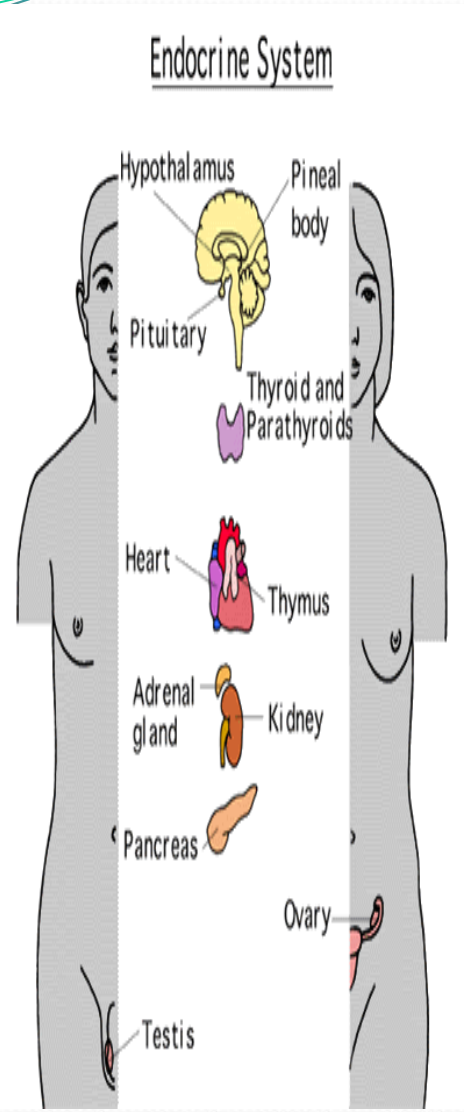




PCBs

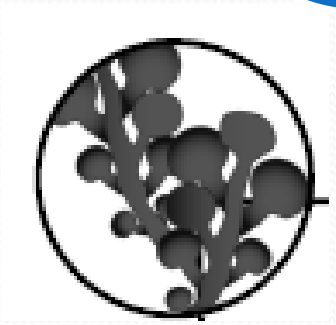
HOW DO PCBs GET TO AQUATIC ENVIRONMENT?

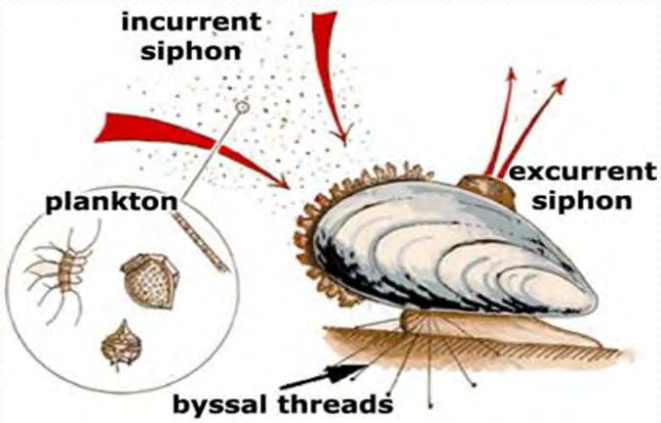
Major Concerns about PCBs:



- Rapidly accumulating in humans and animals
- Hormonal disruption
  - Effects on thyroid, estrogen and testosterone
- Developmental effects
  - Irreversible learning/behavioral effects in young animals
  - Decreased ovarian follicles, sperm counts
  - Recent Scandinavian study – maternal PCBs associated with genital birth defect in baby boys
- Cancer
  - Structures similar to known carcinogens (PBDEs, PBBs)
  - Environmental conversion to known carcinogens (dioxins and furans)

EXAMPLES OF BIOINDICATORS AQUATIC ORGANISMS





BIOMARKERS: fish, crustaceans, mollusks, plankton

- Strongly accumulate both organic and inorganic pollutants
- Organism biochemical and other biological processes
- Wide geographical distribution, their abundance
- Sessile life style feeding mechanism
- Accessibility (Ease to collect)

RESEARCH QUESTIONS

- Can PCBs, Cu and Zn induce adverse effect at cellular level *in vitro* ?
- Can DNA strand breaks detected by COMET assay efficiently assess the stress in mussel haemolymph after exposure ?
- Can *in vitro* COMET assay be used as a routine potential tool for ecotoxicology testing and pollution monitoring of PCBs and heavy metals together in marine organisms?

AIM OF STUDY

This study is aimed to apply marine mussels as model to investigate the genotoxic effects after exposed to PCBs, Cu and Zn concentrations either singly or in a combination.

MATERIALS AND METHODS

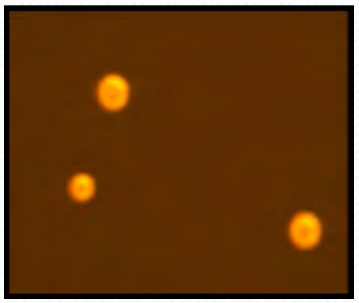
Extraction of haemolymph from mussels

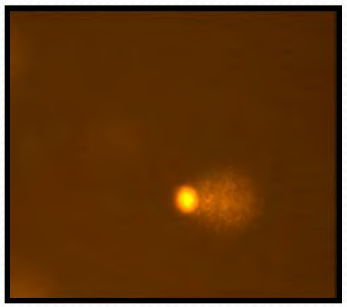
Exposure

Gel Immobilization

Lysing

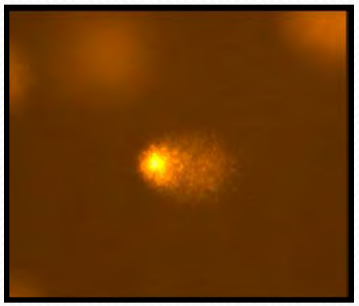
Alkali unwinding and Electrophoresis

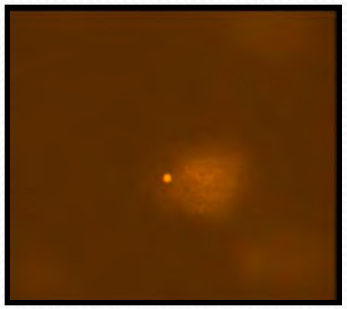




Neutralization

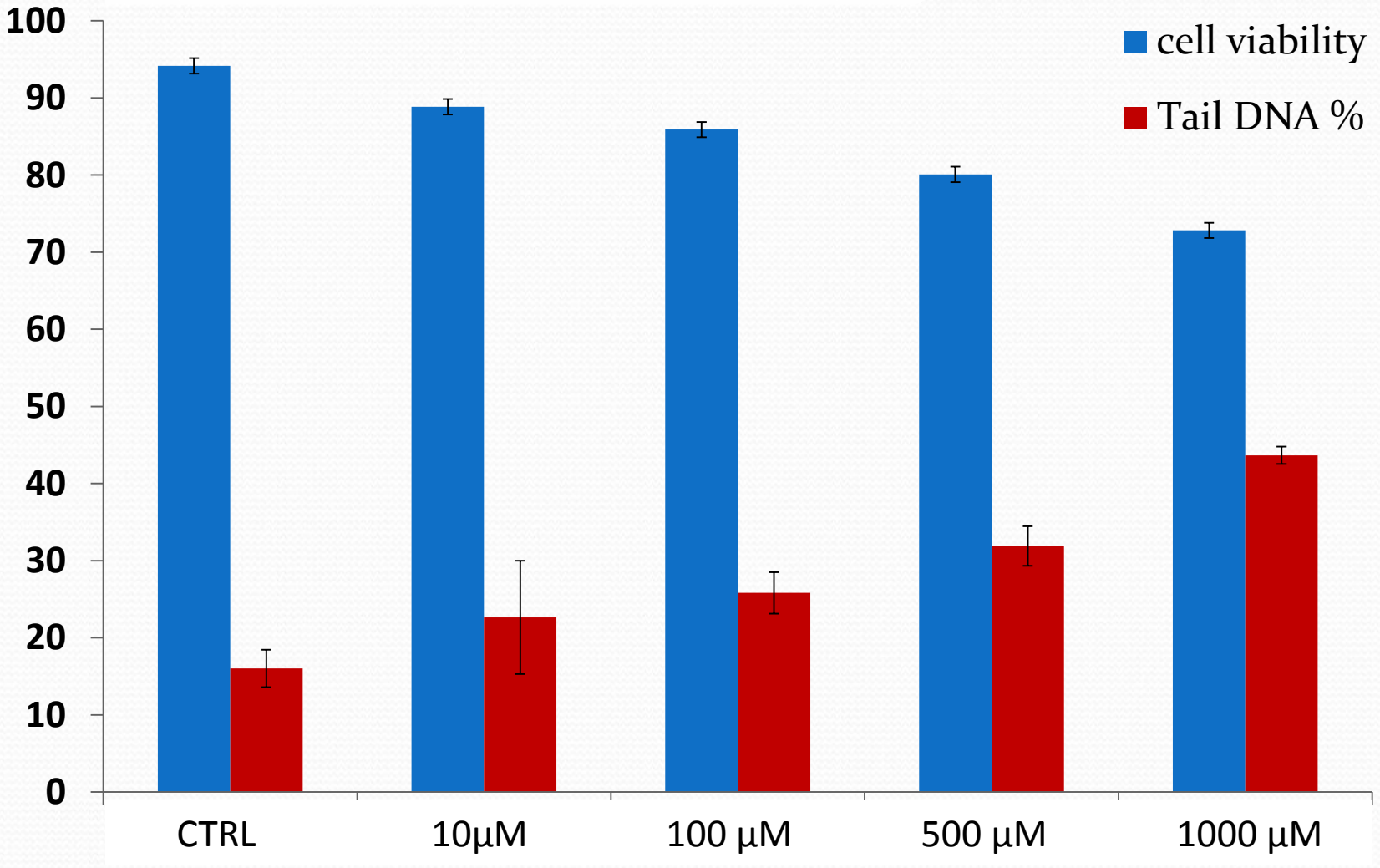
DNA staining and COMET visualization



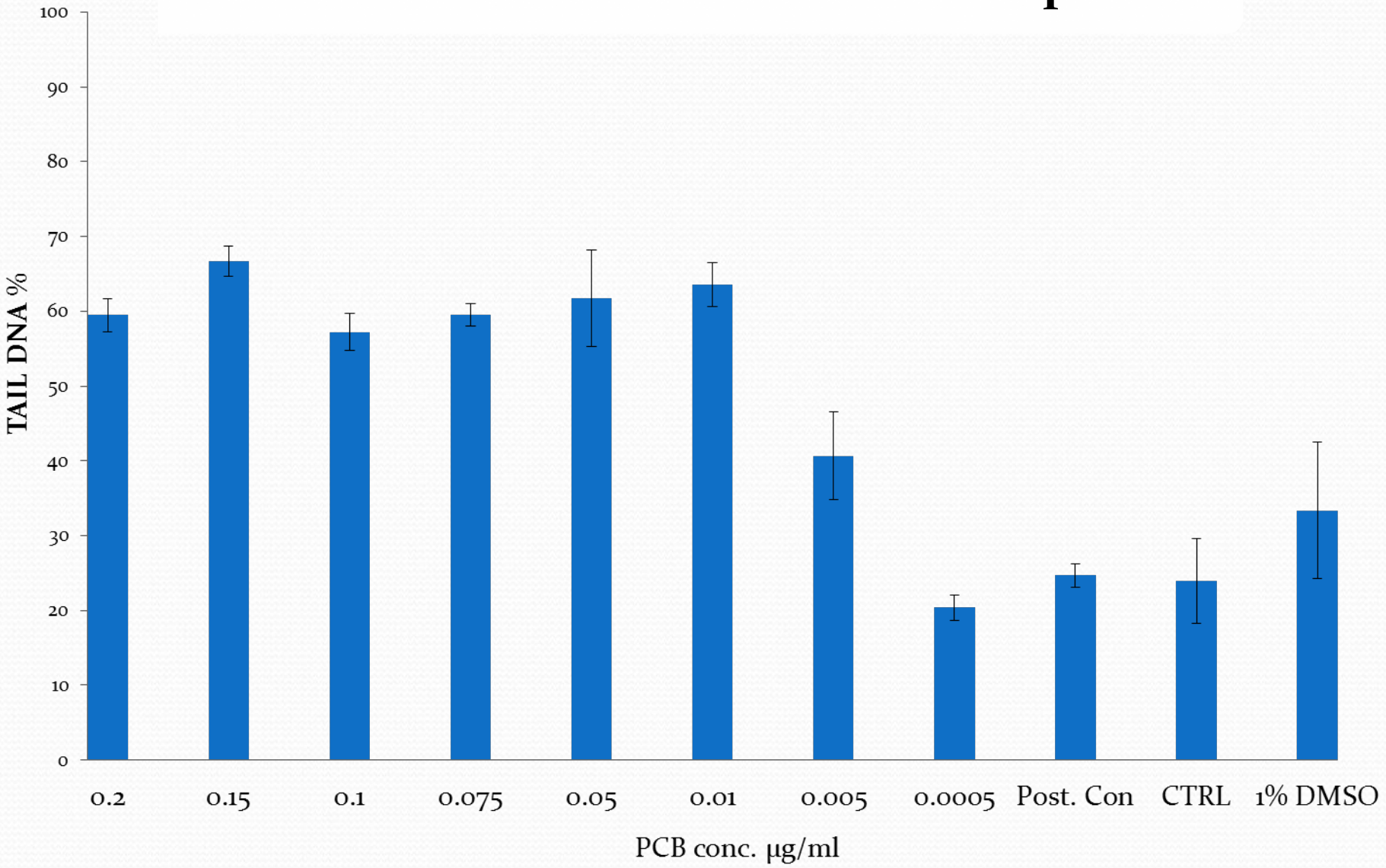


Scoring

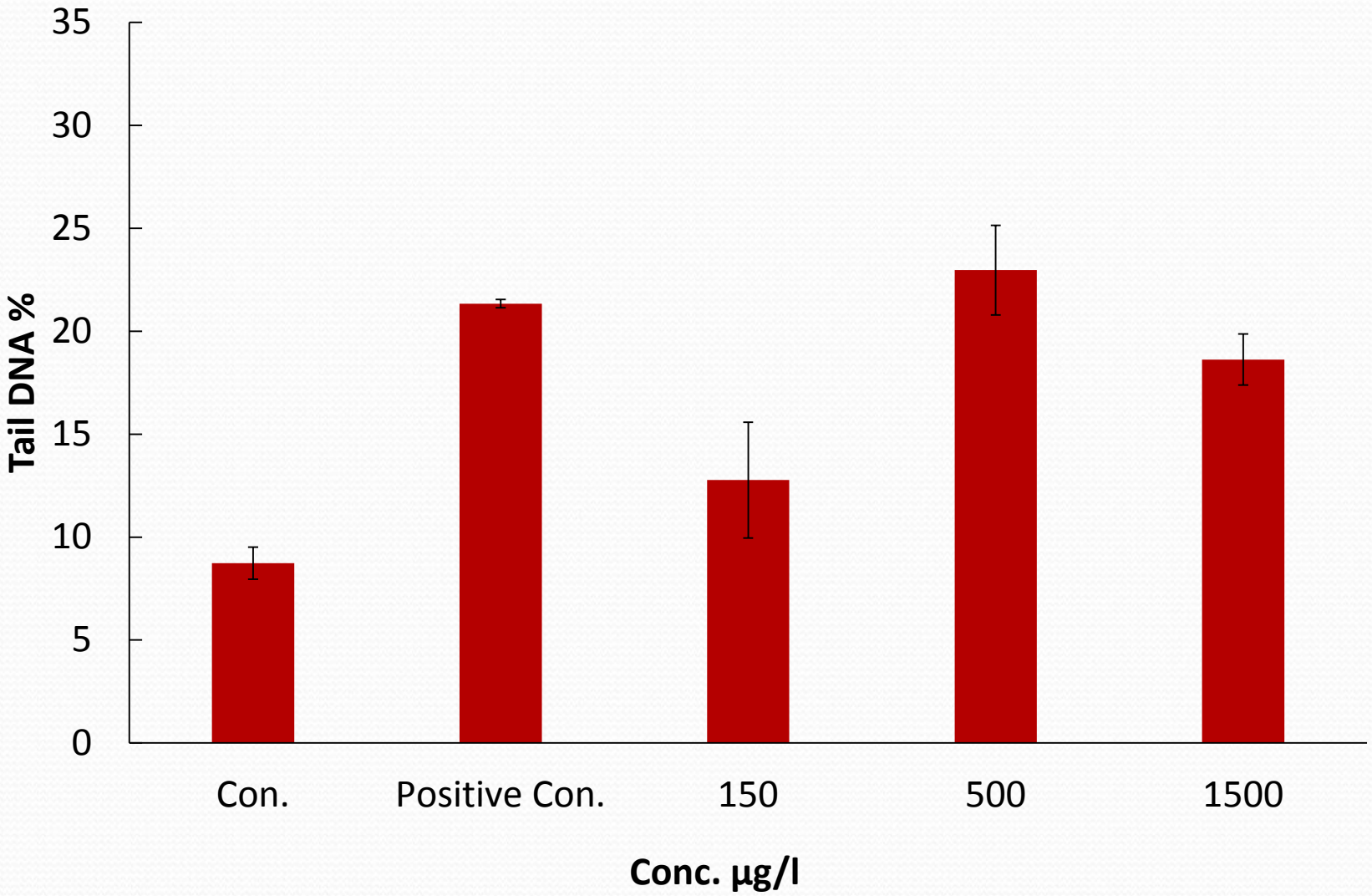
RESULTS AND DISCUSSIONS



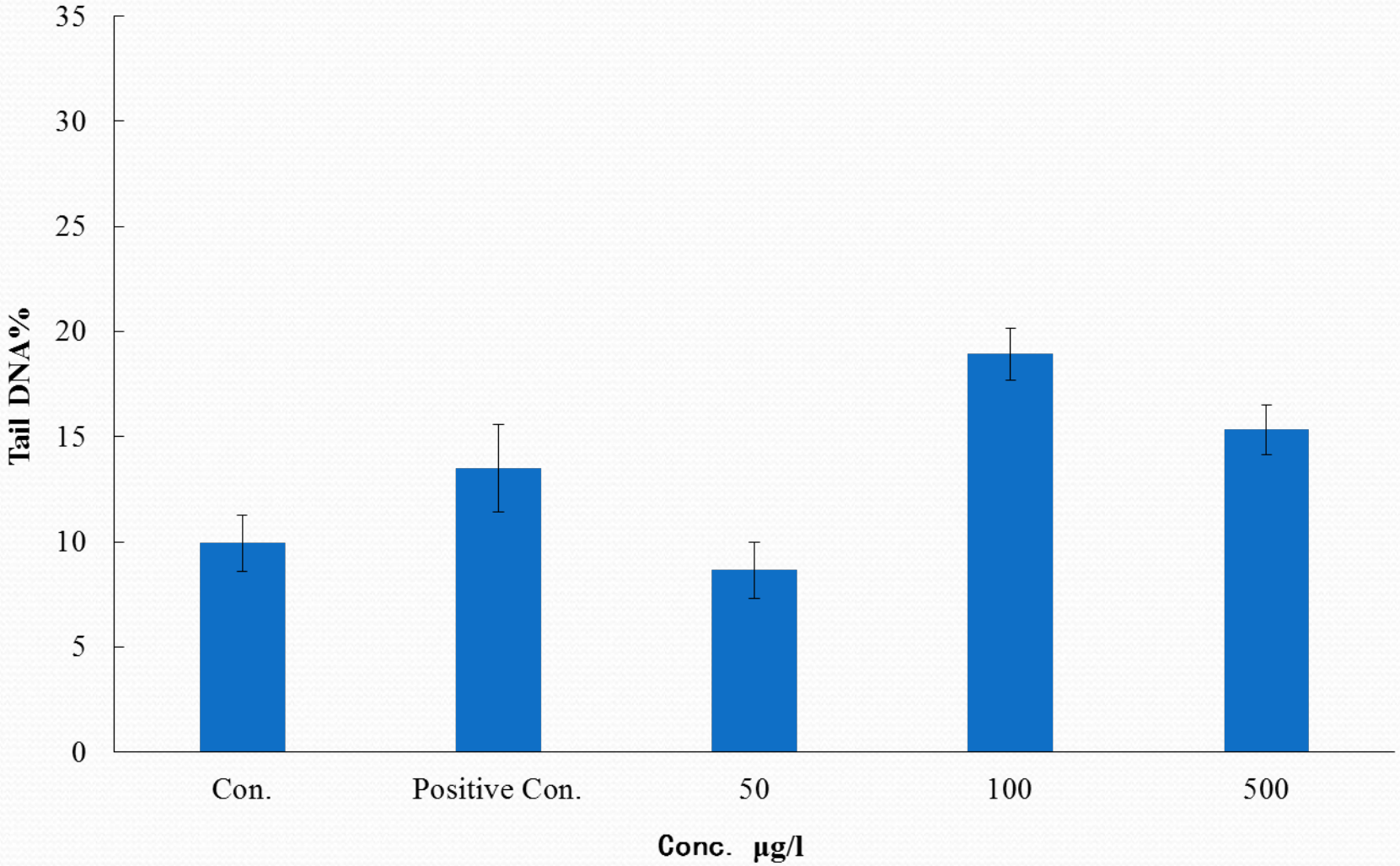
RESULTS AND DISCUSSIONS-PCBs exposure



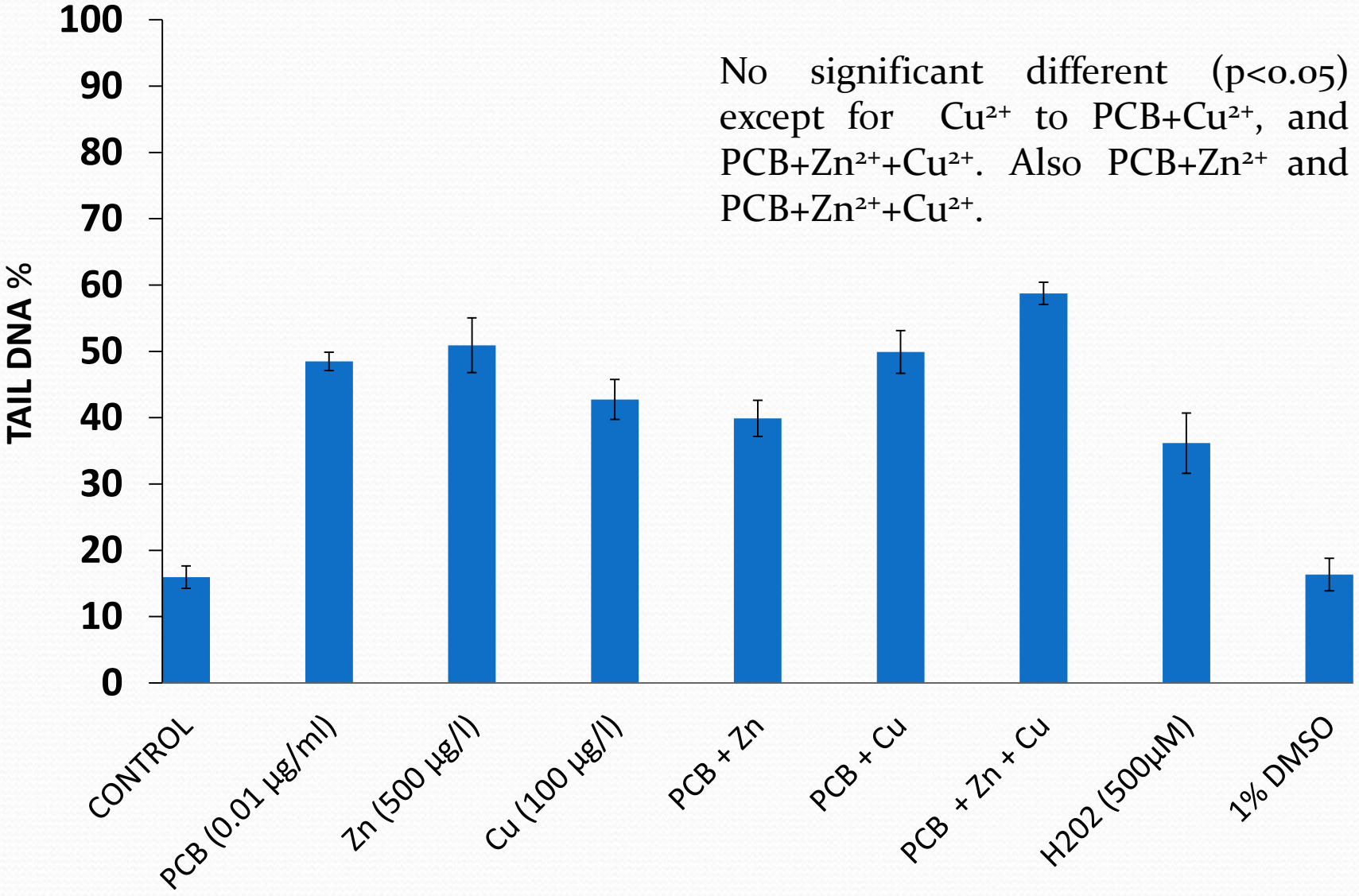
RESULTS AND DISCUSSIONS-Zn exposure



RESULTS AND DISCUSSIONS-Cu exposure



RESULTS AND DISCUSSIONS-Exposure in combination



No significant different ($p<0.05$) except for Cu^{2+} to PCB+Cu^{2+}, and PCB+Zn^{2+}+Cu^{2+}. Also PCB+Zn^{2+} and PCB+Zn^{2+}+Cu^{2+}.

CONCLUSION AND RECOMMENDATION

- This demonstrated the genotoxicity of PCBs, Cu and Zn in the sentinel species
- The irreversible DNA damage seems to be mainly caused by PCBs or a combination with Cu and Zn, also the concentrations may be easily reached in natural ecosystem
- The *in vitro* cellular response to exposure may be a rapid approach to indicate environment stress in marine organisms
- Further in-depth studies will carry out to elucidate the relationship among these chemicals using other biomarkers such as micronucleus test and red neutral assay
- Analysis of bioaccumulation of pollutant will also be carried to explain the actually *in vivo* dose-response in mussels haemolymph

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THANK YOU FOR LISTENING