

Endocrine disrupting compounds in water and soil of Olifants River in South Africa, and their effect on cell viability

(南アフリカのオリファンツ川の水と土壌中の内分泌かく乱物質、およびそれらが細胞生残率に及ぼす影響)

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Endocrine disrupting compounds (EDCs) are contaminants found in water that disrupt the functioning of hormones in organism. These include pesticides, plastic contaminants, metals, phthalates, dioxins and pharmaceuticals. Sources are from agriculture, mining and many other human activities. Studies have shown that these contaminants are present in water bodies; however, no treatment is put in place to eliminate them before water is certified safe for drinking. This study focuses on 5 EDCs as the target compounds. These are nonylphenol and four estrogen hormones namely estrone E1, 17 β -estradiol (E2), estriol (E3) and, 17 α -ethynylestradiol (EE2). These were selected due to the activities surrounding the Olifants River. This river and its tributaries are used by many industries, farmers and residential areas in South Africa. To clarify the effects of EDCs on human health in the Olifants River basin, concentrations of target EDCs in river, soil and tap water samples near Olifants River, the effects of target compounds on cell viability and DNA damages of PC 12 cells were measured. In addition, to reaffirm the impact on human health, semi structured interviews with nearby communities on their interaction with Olifants River were carried out.

Methodology: The samples were collected in August, 2019 from agriculture and residential area near Olifants River. These samples include river water, soil and drinking water from near taps in households. Liquid Chromatography Mass Spectrometry (LCMS) was used to measure the concentration of target compounds in the collected samples. PC12 cells were used to expose different concentration of target compounds so as to know the lowest concentration affecting cell viability, lactate dehydrogenase (LDH) activity and DNA. Statistical analyses were performed using single-factor analysis of variance (ANOVA) followed by unpaired Student's t-test. Semi structured interviews were conducted with nearby community to investigate their interaction with the river and therefore conclude on their likeliness of exposure.

Results and Discussion: The river samples detected nonylphenol concentration below 0.03 $\mu\text{g}/\text{mL}$, whereas the cell experiment indicated that there is significant in cell death from 10 $\mu\text{g}/\text{mL}$. This implies that the current nonylphenol level is below concentration that affects mammalian cells. The hormones investigated showed significant difference to the control in cell death at these concentrations: E1 at 80 mM E2 0.25 μM , E3 at 60 mM, and EE2 at 30 mM. However, these were below the detected concentration in river samples. The stream order of the Olifants River where samples were collected can be the reason for the low concentration detected. Samples might be diluted due to location on river stream and also due to season. It is concluded that there is no great concern of target EDCs in Olifants River.