

UNIVERSITY OF RUHUNA
BACHELOR OF SCIENCE IN FISHERIES AND MARINE SCIENCES DEGREE
Level III Semester I Examination
July 2015

LIM 3122 - Environmental and Human health risk assessment

Time: 02 hours

Answer all questions.

01. Human and veterinary drugs are continuously being released to aquatic systems mainly as a result of manufacturing process, improper disposal or metabolic excretion. Therefore, environmental risk assessment of pharmaceutical residues in wastewater effluents, surface waters and sediments are important to assess the risk of harmful effects to human health and ecological systems. Information gathered by a research group work on environmental risk assessment are given below.

You are asked to assess the environmental risk of pharmaceutical residues using the information given below.

Table 1. Different EC₅₀ values assessed for bacteria

Chemical type	EC ₅₀ (µg/L)
Diclofenac	13.5
Ibuprofen	12.1
Naproxen	13.1
Keptoproten	15.6
Ofloxacin	19.0

$$PNEC_{\text{water}} = \frac{EC_{50}}{1000}$$

$$PNEC_{\text{sediment}} = \frac{PNEC_{\text{water}} \times K_p}{d} \times 1000$$

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Sediment water partition coefficient (K_p) = 0.4

Sediment density (d) = 2.65 g/cm³

PEC in water = 10 mg/L

Criteria for toxicity characterization:

EC₅₀ < 1 mg/L = Very toxic

EC₅₀ 1.0 - 10.0 = Toxic

EC₅₀ 10.0 - 100 = Harmful to aquatic organisms

02. The human health effects of uranium can be divided into carcinogenic and non-carcinogenic based on radiological risk of radiation of uranium isotopes and chemical risk as a heavy metal.

Environmental Protection Agency (EPA) of USA has identified uranium as 'confirmed human carcinogen' (Group A). For uranium, prescribed Maximum Contaminant Level Goal (MCLG) is 0 (zero), Maximum Contaminant Level (MCL) is 30 $\mu\text{g/L}$ and strictly recommend reference level prescribe by World Health Organization (WHO) is 2 $\mu\text{g/L}$.

Analytical data collected for human health risk assessment due to consumption of groundwater with uranium are given in the following table. Assess the human health risk of uranium using the information given below.

Mean concentration of Uranium ($\mu\text{g/L}$)	Ingestion rate (Liters /day)	Exposure Frequency (days/years)	Average lifetime of the population (years)	Average body weight (kg)
0.17	2	350	76	61

Reference Dose (RfD) for uranium = 0.6 μg per kg per day
Uncertainty factor = 0.002 per day

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