

Exercises solution

Master's degree in environmental science and engineering

Occupational and environmental health

2.2 Chemical pollutants - toxicology

1) Gun's and roses

Folpet is a chemical agent used in the preventive treatment of vines (contact fungicide). The way it is used depends largely on the type of land in which it is applied. Three types of operations were observed during a visit to a farm on a treatment day.



Preparation. The product (powder) is weighed and mixed in an intermediate tank. It will then be pumped into a pipe feeding the gun (pressurized pipe).

Gun treatment (early in the day). The product is sprayed onto the vineyard by means of a high pressure watering system.



During the treatment, the worker is provided with respiratory protection and it can be estimated that the average concentration of Folpet in the inhaled aerosols is about $120\mu\text{g}/\text{m}^3$. The duration of the treatment is approximately one hour (one treatment per day). A hand rinse at the end of the working day shows that the surface contamination is $40\mu\text{g}/\text{cm}^2$.

The properties of Folpet are as follows:

N-(Trichloromethylthio)phthalimide

$\text{C}_9\text{H}_4\text{Cl}_3\text{NO}_2\text{S}$ MW = $296.55\text{ g}\cdot\text{mol}^{-1}$

Saturation vapor pressure: Pa = $1.3\cdot 10^{-3}$ (25°C)

Solubility in water: 0.8 mg/L at 25°C (considered insoluble)

LogKow 2.85

Hypothesis:

- the surface of a hand is about 450 cm^2 .

- assume a respiratory flow rate of 16 L/min.

Compare inhalation and dermal doses (assuming only hands are contaminated). What type of pollutant measurement would you recommend to quantitatively assess exposure?

2) Loaded breath

The half-life of perchloroethylene in exhaled air is 80 hours (first order kinetics). What would be its concentration (in ppm) in the exhaled air of a person at 7 am if he had, the day before when leaving his work at 5 pm, 15 ppm of perchloroethylene in his exhaled air?

3) Biological monitoring

A hygienist wishes to monitor the exposure of a worker exposed to a solvent X using biological monitoring. He takes blood samples at regular intervals after the end of the daily work shift and obtains the following results:

[B] T_0 (Immediately after exposure) :	12.1 [μ g/l]
[B] T_4 (4 hours after exposure) :	8.5 [μ g/l]
[B] T_{12} (12 hours after exposure) :	5.9 [μ g/l]

Characterize the kinetics of this decay. What will be the potential implications of such kinetics on the follow-up strategy of the exposed person ?