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Styrene in subcutaneous adipose tissue after experimental and industrial exposure

by JÖRGEN ENGSTRÖM, M.D. [1]

ENGSTRÖM, J. Styrene in subcutaneous adipose tissue after experimental and industrial exposure. *Scand. j. work environ. & health* 4 (1978): suppl. 2, 119—120.

Seven male subjects were exposed to 210 mg of styrene per cubic meter of inspired air (50 ppm) during 30 min at rest and three 30-min periods of work on a bicycle ergometer at the intensities of 50, 100 and 150 W. The mean uptake of styrene as measured by the Douglas bag technique was 490 mg. Needle biopsy specimens of subcutaneous adipose tissue were taken before exposure and 0.5, 2, 4, and 21 h after exposure. Samples were taken from four of the subjects for up to 13 d after exposure. The amount of styrene in the adipose tissue specimens was determined by gas chromatography. The mean weight of the specimens was 54.6 mg (range 8.8—137.7), and the least detectable concentration about 0.1 mg/kg of adipose tissue (at a specimen weight of 50 mg). The mean concentration was of the same magnitude 2, 4 and 21 h after exposure, i.e., 3.6, 3.7 and 3.5 mg/kg, respectively. The standard error of the mean was 0.8 mg/kg. In the four subjects followed for 7—13 d after exposure, the concentrations declined exponentially (fig. 1). The half-life of styrene in the adipose tissue of these subjects was 2.2—4.0 d.

The method of determining styrene in adipose tissue was applied to workers in a plant where styrene was used as a solvent and reactive monomer in the production of polyester tanks. During one week the concentration of styrene in the ambient air was measured in the breathing zone of three employees. The uptake in the organism was estimated by means of alveolar air sampling and measurement of ventilation with a Wright respirometer. The amount of body fat was estimated by an anthropometric method. Biopsy specimens of adipose tissue were taken from the

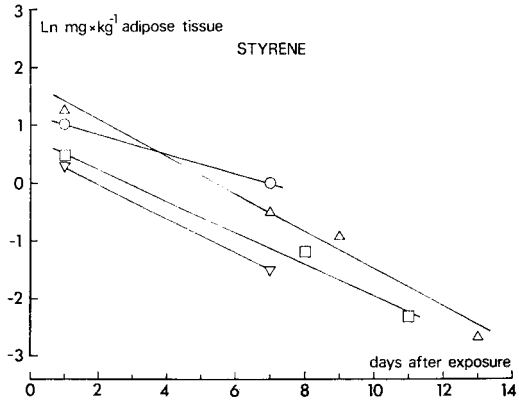

Fig. 1. Concentrations of styrene in subcutaneous adipose tissue of four subjects for 7—13 d after exposure to 210 mg/m³ (50 ppm) in inspired air for 2 h during rest and exercise.

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three subjects having 13 to 41 kg of body fat before and after the workshift on Monday, Wednesday and Friday. The time-weighted average of the concentration of styrene in ambient air was 7.6—20.2 ppm, and the calculated mean daily uptake 193—558 mg. On Monday morning the concentration of styrene in subcutaneous adipose tissue varied between 2.8 and 8.1 mg/kg; at the end of the week it varied between 4.7 and 11.6 mg/kg. The calculated half-lives of styrene in the adipose tissue of the two subjects employed for a long time was 2.8 and 5.2 d. Such a calculation is based on the assumption that the change in concentration during the week followed a steady-state pattern. If this assumption is valid, it would take about five weeks after the end of exposure before the concentration would reach the limit of detection in the subject with the slowest elimination.

QUESTIONS AND ANSWERS

Question to Dr. ENGSTRÖM

Dr. SEPPÄLÄINEN: How can you explain that there was actually a decrease in the styrene concentration during the work week especially on Wednesday and the actual increase happened only during Friday?

Dr. ENGSTRÖM: There was no significant decrease. The variations can be explained by the changes of the amount taken up in the body.