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MANUFACTURING CHEMISTS ASSOCIATION

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August 30, 1974

To: Technical Task Group on Vinyl Chloride Research

Subject: Percutaneous Absorption of Vinyl Chloride Monomer

Gentlemen:

The Dow Chemical Company has made available to the Task Group the attached preliminary report from their company-sponsored studies on the percutaneous absorption of vinyl chloride. These data suggest that, in the rhesus monkey, although percutaneous absorption does occur, it is (if my slide rule didn't stick) less than 0.1% as rapid as the take-up by the lungs from an atmosphere of equal VCM concentration.

Sincerely,

Kenneth D. Johnson

Kenneth D. Johnson, Ph.D.
Secretary
Technical Task Group on
Vinyl Chloride Research

KDJ/mb

Enclosure

cc: Dr. D. P. Duffield
Mr. A. W. Barnes
Dr. Tiziano Garlanda

PERCUTANEOUS ABSORPTION OF VINYL CHLORIDE (VCM) GAS IN THE RHESUS MONKEY

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The experiments described herein were designed to determine the degree to which vinyl chloride monomer (VCM) gas (Matheson Gas Products, Joliet, Ill., 99.9% purity) may be percutaneously absorbed. A male Rhesus monkey (Macaca mulatta) weighing 5 kg was used in the experiment. Prior to exposure, 30 mg/kg sodium pentobarbital was administered intravenously. An endotracheal catheter with an inflatable collar was inserted into and the trachea connected to a Harvard respiratory pump adjusted to deliver a volume of 20 ml of air at a rate of 28 to 38 cycles per minute. A catheter was placed in the saphenous vein of the left leg so that additional sodium pentobarbital could be administered during exposure. The body of the monkey was placed in a 191.5L plexiglas chamber with the head protruding from the chamber through a silastic rubber membrane. After the hair around the neck had been carefully removed with clippers the membrane was fitted around the neck and secured to the skin with tape, to provide an adequate seal. The body of the monkey rested on 3 large glass bell jars in the chamber. A slight vacuum was pulled on the chamber, and 1.5L of VCM gas was metered in to establish a VCM concentration of approximately 7000 ppm in the chamber. Chamber concentrations were periodically monitored by infrared analysis (10.9 μ).

To trap VC in the expired air, a pc ethylene tube filled with 0.5g of carbon made from saran beads was placed in the exhaust port of the respiratory pump. A similar tube placed on the intake port filtered any VCM from the air pumped into the monkey. The expired air traps were changed at 1/2 or 1 hour intervals while the intake traps were changed every 2 hours. The VCM from these traps was eluted with carbon disulfide at dry ice temperature and analyzed by gas chromatography. Additionally, a sample of control saran carbon was checked for VCM.

It was found that the VCM concentration in the exposure chamber declined more rapidly when a monkey was present than if empty, however, it was not possible to attribute this difference solely to percutaneous absorption. Comparison would be valid only if identical chamber conditions could be obtained. This is not possible since an empty chamber could not be made to simulate the leakage characteristics, adsorption to fur, and thermal mixing characteristics in the test solution.

A monkey was exposed to approximately 7000 ppm ^{14}C-VCM (specific activity 0.180 μCi/mg) for 2 hours. Immediately post-exposure the monkey was sacrificed and tissues (brain, heart, lung, liver, muscle, stomach, duodemum, thymus, spleen, mesenteric fat, testes, kidney) were sampled and homogenized. Urine was taken from the urinary bladder and bile

from the gall bladder. Aliquots of the tissue homogenates were combusted and the ^{14}C-CO_2 trapped in 2-methoxyethanol-monoethanolamine solution. The resulting CO_2-2-methoxyethanol-monoethanolamine solutions, as well as aliquots of urine and bile were counted in scintillation cocktails using a Mark II liquid scintillation counter. ^{14}C activity in excess of twice background was detected in only the bile, kidneys, and liver. 1792 DPM of ^{14}C activity was in the bile, 11,352 DPM in the kidneys, and 105,821 DPM in the liver, for a total of 118,965 DPM. Expired air samples contained a total of 182,709 DPM for the 2 hour exposure period, thus a total of 314,818 DPM or 0.024% of the VCM (3.28 g or 1,316,987,916 DPM) in the chamber was absorbed percutaneously over the 2-hour period. Of the total dose absorbed percutaneously, 39.4% was in the tissue, while 60.6% was in the expired air. The aforementioned experimental results demonstrate that small amounts of VCM are percutaneously absorbed by a monkey maintained under the described experimental conditions.

Assuming that the percutaneous absorption of VCM is proportional to the surface area of the body, extrapolating the amount absorbed by the monkey under the specified conditions to that which would be absorbed by a 6 ft, 90 kg