

THE ACTION OF METHYLCHLOROFORM VAPORS ON ANIMALS

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The chemical industry of the USSR produces many organic solvents which are widely used in different fields of the national economy.

One of the compounds being considered is the organochlorine solvent methylchloroform (MCh) - $C_2H_3Cl_3$ (1,1,1-trichloroethane, CH_3CCl_3). MCh is a substance with a narcotic activity and its inhalation toxicity is close to that of other organic solvents of the organochlorine type (CCl_4 , chloroform, methylene chloride, and others).

However, some authors regard MCh as a substance which is not very highly toxic (Browning, 1959; Adama et al, 1959).

We found that in white rats exposed to inhalation of MCh vapors once for a four hour period, the threshold concentration limits for biological changes are 1.0-5.0 mg/liter of air. Under longer exposure (4 hours daily for four months) it was 0.4 mg in cats and white rats.

While studying the threshold concentrations of MCh, we measured the biochemical (blood transaminase) and hematological (hemoglobin, red and white cells, and differential) parameters, and the conditioned reflex activity. We also examined the internal organs for abnormal morphology.
structure

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MCh in the concentration of 0.4 mg/l in the chronic experiment did not cause significant changes in the parameters studied; we could observe slight changes in the conditioned reflex activity in cats, in the differentiation reflex.

There were no gross signs of intoxication in the animals during the experiment. Nevertheless, the observed pathomorphological changes in the internal organs and in the brain of white rats made us consider the concentration of 0.4/l to be the threshold concentration.

We studied the organs of 20 rats: five animals were killed after 50 days of daily four-hour inhalation exposure, and five after 120 days of daily exposure. To study the reversibility of the morphological changes, five rats were killed 14 days after the experiment was discontinued. There were five rats in our control group.

As a result of the pathomorphological examination we can state that inhalation for four hours a day for 50 days at a concentration of 0.4 mg/l causes slight structural and dystrophic changes of the internal organs. We could observe muscle weakening moderate venous congestion in the liver, kidneys, cardiac muscle and lungs. We could see swelling of some groups of cells in the liver, but the bulk of the structure of the organ was preserved. In the kidneys we could see an increase in size and swelling of the epithelium of the convoluted tubules; in the cardiac muscle we could see insignificant foci of swelling of muscle fibers. In the lungs there was swelling of the bronchial epithelium and foci of emphysematous dilatation of some groups of alveoli distention & expansion air cells of lung

When the exposure to inhalation was prolonged to 120 days the structural changes were enhanced. In the lungs, emphysematous dilatation could be seen throughout the alveoli. The interalveolar septa were thin and torn in some areas. There was congestion and swelling of the walls of the vessels of small and average caliber. There was accumulation of lymphoid and histio-lytic cell elements and single plasma cells around many of the ^{disintegration of} tissue vessels. The mucous membrane of the bronchi was swollen and we could see some mucus and desquamated epithelial cells in the ^{shedded} bronchial lumen. Peribronchial lymph nodes were hyperplastic, ^{increased in size} tube. In the liver, kidneys and heart muscle signs of venous congestion and stasis were observed, with protein dystrophia of ^{stagnant flow of blood} cells of the liver parenchyma and of the epithelium of the ^{essential tissue of liver} convoluted tubules, as well as foci of swelling of muscle fibers.

In the brain and its membranes we could see venous ^{vein} stasis and perivascular edema. In the cells of the nervous ^{swelling around the veins} system in the deep layers of the cerebral cortex, Nissl stained sections showed central and marginal chromatolysis. In the ^{breakdown of Nissl bodies} subcortex, particularly in the nucleus caudatus, we could see ^{gray matter of corpus striatum} the same changes as in the cortical layer, as well as signs of neuronophagia. In the dentate nucleus of the cerebellum ^{nerve cell destruction} we found vacuolization of the cytoplasm of single cells. ^{tiny spaces} In parenchymatous ^{essential} organs and in the brain of the animals killed 14 days after discontinuation of MCh, we could find only residual signs of former disturbances of circulation and dystrophia.

Thus, frequent exposure to MCh in threshold concentrations causes reversible functional and morphological changes in the organisms of animals tested. The structural changes observed testify to the necessity of observing precautionary rules while working with methylchloroform.

No references

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