IRPTC

Scientific Reviews
of Soviet Literature
on Toxicity and Hazards
of Chemicals

Acenaphthylene

16

UNITED NATIONS ENVIRONMENT PROGRAMME

UNITED NATIONS ENVIRONMENT PROGRAMME (UNEP)

INTERNATIONAL REGISTER OF POTENTIALLY TOXIC CHEMICALS (IRPTC)

USSR STATE COMMITTEE FOR SCIENCE AND TECHNOLOGY (GKNT)

USSR COMMISSION FOR UNEP

Series "Scientific Reviews of Soviet Literature on Toxicity and Hazards of Chemicals"

Acenaphthylene

Edited by N. F. Izmerov
Corresponding Member,
USSR Academy of Medical Sciences

16

CENTRE OF INTERNATIONAL PROJECTS GKNT

Moscow 1982

Compiled by G. N. Zaeva , Cand. of Sci (Med.)

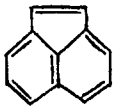
The series represents a comprehensive study of Soviet literature on toxicity and hazards of Chemicals and is published by Centre of International Projects, USSR State Committee for Science and Technology under the USSR–UNEP/IRPTC Project "Control of Hazards Posed by Chemicals to Human Health and the Environment" implemented in cooperation with the Research Institute of Industrial Hygiene and Occupational Diseases, USSR Academy of Medical Sciences.

Information carried by the review is in line with the data profile structure elaborated by the International Register of Potentially Toxic Chemicals.

The series is intended for toxicologists, higienists and all those responsible for evaluation and control of harmful effects of chemicals to human health and the environment.

ACENAPHTHYLENE

Acenaphthylene is a product of chemical processing of coal tar. By chemical structure, acenaphthylene ($C_{12}H_8$) is referred to cyclic hydrocarbons with condensed rings.



Acenaphthylene is a yellow cristallized powder with molecular weight being 152.2. It melts at the temperature of 92–93°C; boils at T. 265–275°C with decomposition. Nonsoluble in water. Easily soluble in organic solvents and oils, as well as in ethanol and ether; in acetic acid it can be solved at a rate of 17 g of the substance per 100 ml at T 20°C, in chloroform – 33.9 g and toluene – 76 g. It is oxidized into naphthalic acid; is easily polymerized [1].

PRODUCTION PROCESS (ES)

Acenaphthylene is obtained from acenaphthene ($C_{12}H_{10}$) and its derivatives. Acenaphthylene is made by way of catalytic dehydrogenation of acenaphthene [1].

USE

Acenaphthylene is used in organic synthesis chemistry. Acenaphthylene is one of the most essential semiproducts in manufacturing plastics, dyes, ion-exchange resins; of naphthalic acid and other synthetic materials [1, 2].

MAMMALIAN TOXICITY ARRAY

Acenaphthylene's toxicity was studied in the experiments on mice, rats and rabbits given different pathways of the substance into the organism and different duration of exposure.

The average lethal dose (LD_{50}) of acenaphthylene when administered in the stomach of albino mice equals 1,760 (2,800÷1,100) mg/kg (LD_{16}= 325 mg/kg, LD_{84}=5,250 mg/kg) [2].

When lethal doses of acenaphthylene were administered, the clinical picture of intoxication was characterized by depressions, infrequent respiration, pareses of hind extremities. Mice died 2–4 days after the administering of the substance.

The postmortem examination of test animals revealed cardiac disfunctions, hemostasis and haemorrhages in internal organs. Alterations of the type of reactive state were observed in liver.

The average lethal dose of acenaphthylene administered intraperitoneally was established for albino rats, which equals 1,700 ± 200 mg/kg. Single intraperitoneal administering of acenaphthylene brought about a drop in the body temperature of animals. The observation conducted for 13 months over the survived rats did not reveal any essential changes of indicators characterizing the functional state of the organism [3, 4].

When acenaphthylene was administered once into rats' trachea, the drop in body temperature was also observed. One month after the exposure, some animals were found to have anemia [3, 4].

One month after acenaphthylene was administered once into rats' trachea in the form of a solution in sunflower oil and the powder injected into the mouth, test animals were observed to have tracheo-bronchitis, alterations in the mucous membranes of trachea and bronchi (hyperemia and edema), as well as necrosis of trachea and bronchi epithelium accompanied by ulcer development [2].

In the case of intraperitoneal and intratracheal administering of acenaphthylene, lesions of similar type such as vascular disturbances and dystrophia developed in test animals' internal organs and the central nervous system; inflammatory changes were observed in lungs. It has been found that lesions in lungs are more grave in the case of intratracheal administering and in liver – when acenaphthylene is administered intraperitoneally [3].

Probably, acenaphthylene's cumulative activity is not high. When acenaphthylene in the form of solution in sunflower oil was administered in albino mice's stomach at a rate of 1/10 LD_{50} every other day in the course of two months, test animals were depressed and were losing in weight, still none of them died. During pathomorphological examination of mice's internal organs stasis-like congestions in parenchymatous organs and protein dystrophia of liver were registered. Most serious changes were observed in lungs – haemorrhages accompanied by interalveolar septum destruction and focal bronchopneumonias, and in some cases multiple suppurative foci were detected [2].

The inhalatory effect of acenaphthylene has been studied in one-time and chronic experiments.

Single inhalation of saturated vapours of acenaphthylene did not cause rats' death [3].

The inhalation of acenaphthylene vapours at a rate of 18 mg/m^3 for 4 hours a day 6 times a week in the course of 5 months led to the development of chronic intoxication which in the initial period of the experiment was characterized by a lower content of vitamin C and sugar in blood, the increased concentration of nucleic acids in rats' liver. Subsequently, test animals were found to have disturbances in the respiratory system (hurried breathing, greater oxygen consumption). During pathomorphological investigation of rats' internal organs, the graver

lesions with predominating proliferatory-cellular reaction against the background of sharp circulatory and dystrophic alterations were observed in lungs. The pathologic process took place within alveolar parenchima, bronchi, intralung blood vessels and elastic hull. These changes in combination with exudation and excessive proliferation of cellular elements in alveolar lumens, desquamation of alveolar epithelium cells, focal bronchitis accompanied by hyperplasia of metaplasia of bronchial epithelium testified to nonspecific lung inflammation [3, 4].

The toxic effect of acenaphthylene dust was also studied.

When rats inhaled acenaphthylene aerosol at a rate of 0.5–1.25 mg/m^3 (the duration of the experiment was 4 months, daily exposure lasted 4 hours), the retarded growth and drop in arterial pressure was observed 3 weeks after the beginning of the exposure. After the recovery period lasting one month the body weight of test animals did not reach that in the control group. During pathomorphological examination of rats' lungs, haemorrhages, focal bronchitis, perebronchitis with bronchiolization of alveols, metaplasia of bronchial epithelium were registered [2].

SPECIAL TOXICITY STUDIES

C a r c i n o g e n e s i s. Carcinogenecity of acenaphthylene was studied in experiments on rats.

Pathomorphological investigation of rats' internal organs (more than 20), which was made 13 months after a single intraperitoneal administering of acenaphthylene at a rate of LD_{50} revealed no signs of malignant tissues [3, 4].

In chronic experiment, when test rats were inhaled acenaphthylene at a rate of 18 mg/m^3 in the course of 5 months, no symptoms of malignant growth were detected [3].

Inhaling acenaphthylene dust at a rate of 0.5–1.25 mg/m^3 in the course of 4 months brought about in rats' lungs changes like chronic nonspecific pneumonia, which some authors took for different degrees of malignization. In less pronounced cases, bronchial metaplasia was observed in the animals' lungs. In grave ones – desquamation of alveolar and bronchial epithelium as well as papillary growth of epithelium were detected. Three animals turned out to have sections of just forming carcinoma in the form of epithelial cells' cord [2].

P r i m a r y I r r i t a t i o n. Acenaphthylene has weakly pronounced local irritating effect on rabbits' skin and mucous membranes of eyes. When acenaphthylene was applied on rats' skin, no indicators showing that it penetrated through skin were detected [4].

SAMPLING/ PREPARATION/ ANALYSIS

The determination of acenaphthylene in the air is carried out using photometric technique. This method is based on acenaphthylene's reaction with diluted nitric acid in the acetic acid medium which is accompanied by rose-orange solutions resulting from the interaction of the pro-

ducts of reaction with alkali. The sensitivity of the technique is 0.4 mcg/ml.

Determination is not hindered by the presence of naphthaline. β – methylnaphthaline, fluorene and diphenylenoxide as well as acenaphthene and α – methylnaphthalene, the concentration of which in the sample does not exceed 50 mcg.

In order to determine acenaphthylene dust, the air under analysis is blown through the AFA-HA-18 filter at a velocity of 10 l/min, after which the filter is dissolved in a glass filled with 3 ml of acetic acid. Acenaphthylene vapours are adsorbed at a rate of 0.25 l/min by 2 successively connected adsorbents with porous membrane containing 3 ml of ice acetic acid.

For doing the analysis, each adsorbent and solution obtained from filter processing, is taken separately at the rate of 0.1 ml. 2 ml of diluted nitric acid is added to each sample, after which both samples are mixed and placed in water bath for 10 minutes at a temperature of 85°C. After cooling them down, 2 ml of caustic soda is poured into the samples. The colour intensity of orange-rose solutions is measured after cooling, using photoelectrocolorimeter at λ_{max} = 508 mmc in a vessel with a layer 10 mm thick. The acenaphthylene concentration in the sample is determined by the calibrating graph [5,6].

RECOMMENDATIONS/ LEGAL MECHANISMS

When dealing with acenaphthylene one should take care that vapours or dust of this preparation do not get into the air, respiratory or intestinal tract and on skin.

This is achieved by using individual protection means, such as goggles PO-1, the type A industrial gas mask with a filter, such respirators as "Lepestok", "Astra-2", F-62, PY-60M and the like [1].

REFERENCES

1. Noxious substances in industry. Ed. by N. V. Lazarev and E. N. Levina. The Khimia Publishers, 1976, vol. 1, pp. 134–135.
2. Yu. S. Rotenberg, F. D. Mashbits. Toxicological characteristics of acenaphthylene. Gigiena truda i professionalnye zabolevania, 1965, № 8, pp. 53–54.
3. A. L. Reshetyuk, E. I. Talakina, P. A. Elyashev. Toxicological assessment of acenaphthene and acenaphthylene. Gigiena truda i professionalnye zabolevania, 1970, № 6, pp. 46–47.
4. A. L. Reshetyuk. Toxicological assessment of acenaphthene and acenaphthylene. In the collection: Proceeding of the Republican Conference of Industrial Sanitary Doctors and Scientific Session of Kharkov Research Institute of Hygiene of Labour and Occupational Diseases. Kiev, 1968, pp. 69–70.

5. L. V. Chubar. The characteristic of alloxatine reaction with acenaphthene and acenaphthylene. In the collection: Questions of Labour Hygiene and Occupational Pathology in Coal, Mining and Metal Industries. Kiev, 1968, pp. 39–41.

6. N. T. Yarym-Agayeva, L. V. Chubar. Photometric technique for the determination of acenaphthylene in the air. Gigiena truda i professionalnye zabolevania, 1969, № 10, pp. 60–62.

Printed by PIK VINITI
Зак. 9381