one part of phosgene per million of air. Phosgene is said to be detectable in the field by its so-called tobacco reaction (2). Smokers notice a peculiar flat metallic taste while smoking when phosgene is present in the atmosphere even in very low concentrations. Feigl (6) refers to the detection of phosgene by its conversion to diphenyl carbohydrazine which in turn gives a violet color with copper salts. This test is said to be especially useful for the determination of carbonyl chloride in commercial chloroform and carbon tetrachloride.

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CHLORINATED DIPHENYL AND THE CHLORONAPHTHALENES

Characteristics

Chlorinated diphenyl is prepared by the direct replacement of one or more of the hydrogen atoms of diphenyl, $C_6H_5 \cdot C_6H_5$, by chlorine. Chlorination may proceed until all the hydrogen atoms have been replaced. The greater the amount of chlorine introduced, the higher the melting point, and the more the substance becomes resinous or waxy in nature. The chlorinated naphthalenes vary in physical state from a thinly fluid, mobile liquid to a crystalline or amorphous wax and vary in properties according to the degree of chlorination. The above chlorinated waxes are free from moisture, do not absorb water, are neutral and noncorrosive to metals, do not support combustion, are high in dielectric strength, and have an extraordinary specific inductive capacity. They are marketed under such trade names as "Arochlor", "Halowax", and "Seekay." The melting points of

the chlorinated naphthalenes vary from 87° to 130°, and the boiling points from 288° to 371° C. The specific gravity ranges from 1.4 to 1.7. They are soluble in many organic solvents and oils, especially when heated together.

Industrial Uses

These substances have wide application in industry, chiefly owing to their special insulating and water resistant properties, their chemical stability, and their flame resistance. They are especially used in condensers and in the insulation of wires and cables used in war ships. To a certain extent they are used as solvents for rubber or aniline, as well as for varnish, gums, and resins when mixed in the molten state.

Toxicity

Poisoning by the chlorinated naphthalenes may take the form of acne, particularly of the face, or of toxic jaundice produced by necrosis of the liver. As early as 1918, an acne-form eruption of the skin noted among workers handling chloronaphthalene was ascribed to this substance. Jones has pointed out that in the absence of cleanliness, chloronaphthalene irritated the sebaceous glands causing an excess of cell growth and secretion followed by plugging of the gland and possible secondary infection (1). Schwartz in 1936, discussed dermatitis of workers in the chloronaphthalene and chlorodiphenyl industry. He reported a further outbreak of "Halowax acne" or "cable rash" among electricians installing heat and flameproof cables on ships in 1943 (2, 3).

Systemic poisoning from these chlorinated substances usually follows the inhalation of fume rather than from the handling of the dry hydrocarbon waxes. Damage is severe and occasionally fatal. Acute yellow atrophy of the liver is generally associated with serious exposure to the chlorinated naphthalenes and diphenyl fumes. Three fatalities were reported in 1936–1937 (4, 5). In 1939, three additional cases were reported by Greenburg, Mayers, and Smith (6) and a further case by Collier in 1943 (7). While acne may be taken as a warning sign in workers handling this material it is not invariably present and systemic poisoning may occur in the absence of this sign. Hunter recommends the medical supervision of all such workers with special care regarding the hygienic conditions of employment and with adequate ventilation (8). Precautionary measures were suggested for workers handling chlorinated naphthalenes and diphenyl compounds in 1943 by Greenburg (9). The maximum allowable concentration value for chlorinated diphenyl accepted by the American Conference of Governmental Industrial Hygienists for 1949 was one milligram per cubic meter.

Analysis

The fume content of the or chlorinated naphthalen position of this material fo chloride formed. In such the composition of the chl more of a whole series of ch be present. In the pres method can only be taken present.

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THE CHLORI

Characteristics

The four chloronitroparaf are listed together with the

Industrial Uses

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Analysis

The fume content of the air following the heating of chlorinated diphenyl or chlorinated naphthalenes may be determined by the catalytic decomposition of this material followed by suitable determination of the inorganic chloride formed. In such cases, however, the chlorine content and hence the composition of the chloro derivative in use must be known since one or more of a whole series of chloro compounds of varying chlorine content may be present. In the presence of more than one chloro-derivative, this method can only be taken as a rough index of the amount of contaminant present.

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THE CHLORINATED MONONITROPARAFFINS

Characteristics

The four chloronitroparaffins which are of some industrial importance are listed together with their physical properties in Table 3.

Industrial Uses

The four chloronitroparaffins listed above are more active as solvents than the straight nitroparaffins. 1-Chloro-1-nitropropane will dissolve many synthetic rubbers, including Buna N, Chemigum, Hycar O. R., and