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The flow sheet shown in Fig. 8 indicates the steps in processing raw materials to synthetic Buna rubber. Organic reactants were stored in tanks and handled by pipe line throughout. The polymerization reaction was accomplished in emulsion, usually in soap water. The reaction vessel was closed and under pressure up to 60 pounds per square inch. In the three plants visited, no attempt was made to recover excess acrylonitrile, so that the reacted mixture was transferred directly from reactor to a semi-enclosed vat where addition of electrolytes caused coagulation. From this point to the drier, there existed potential exposure to excess acrylonitrile, since operations were either open or semi-enclosed. Some variation in procedure was seen in the three plants, for example, the lack of a drying step in one of them.

No attempts were made to obtain air samples for acrylonitrile since no adequate method existed. Observation of the process, however, indicated several points at which precautions should be taken when acrylonitrile is used:

(a) Leaks or breaks in pipe lines carrying acrylonitrile would be serious hazards. Personnel should leave the affected area immediately, and those who return to close valves and remove the residue should be equipped with gas masks approved by the U. S. Bureau of Mines for protection against organic vapors. Spilled nitrile should be washed down drains with copious amounts of water. Contact with the liquid should be prevented by use of rubber footwear and gloves, as it may be absorbed through the skin.

(b) Cleaning of reaction vessels after each batch operation is a severe potential hazard. Before a man enters the vessels, it should be purged by ventilation through a duct extending to the bottom of the vessel. The volume of air purged should be at least twenty times that of the container. In addition, the man entering the reactor should be equipped with a life-line manipulated by another person outside the tank, and rubber footwear and gloves to prevent skin contact with the sludge and loose material in the tank.

(c) Under normal operating conditions, some vapor exposure was possible in operations from the coagulator to the final press baling. To expedite inspection of the material, part of the top or inspection openings of the coagulator were usually left open. The vat should be equipped with sufficient suction ventilation to create an inward draft of about 100 f.p.m. through such openings to prevent escape of unreacted vapors.

Dewatering and washing operations at the separator may produce vapor exposure. Either enclosure of filters or adequate local exhaust should be provided. Centrifuges, particularly, may produce considerable displacement of air and vapor into the surrounding atmosphere, and adequate exhaust ventilation should be provided at the periphery of the basket. Additional general ventilation may be required also.

Ventilation of enclosed conveyor driers is essential for the removal of water vapor and other residues evaporated from the stock. To prevent escape of these materials into the workroom, ventilation should be sufficient to provide an inward air velocity of 150 f.p.m. at all openings of the drier.

As far as is now known, the dried product presented no further hazard, and the final baling operations was innocuous. However, if baling or milling is done on the undried product, as noted in one plant, some vapor may be evolved from heat of compression. In such case, local exhaust ventilation should be provided to remove contaminants from the mill or press.

Conclusion

Increasing use of synthetic rubber may intensify the use of toxic solvents in rubber fabrication. Operations now performed with petroleum fractions may require aromatic solvents, or others of equal toxicity. Such changes must be considered as introducing industrial hygiene problems, whose solution should be made an integral part of the planning program so that production will not be hampered at a later date by illness or psychological disturbances among the operators.

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Minimum Requirements for Safety and Industrial Health in Contract Shipyards

The U. S. NAVY Department and the U. S. Maritime Commission have collaborated on the development of minimum requirements for safety and industrial health in contract shipyards. A manual of tentative standards was developed following a survey of the greater number of shipyards throughout the United States by experts in safety and in industrial health assigned to the U. S. Maritime Commission. These tentative standards were discussed in detail at a national conference conducted under the auspices of the Navy and the Maritime Commission held in Chicago December 7 and 8, 1942. The tentative standards with recommended changes were unanimously agreed upon at this conference and have now been published by the Government Printing Office. The regulations having to do with industrial health are given below.

In the development of these standards it has been recognized that it is vitally important to conserve manpower and promote the physical welfare, health and safety of what shortly will amount to one million workers in shipyards.

In carrying out the requirements of these minimum standards, JOHN ROCHE is serving as Chief Safety Consultant and PHILIP DRINKER as Health Consultant. Mr. Roche has a staff of four full-time men, one in each regional district, and Prof. Drinker has two industrial hygienists and a doctor on the Atlantic and west coasts, and an industrial hygienist in the Gulf and Great Lakes area.

The fact that the majority of these shipyards are built on made-land may introduce hazards which are difficult to avoid. Most of the yards include only a minute percentage of experienced workers, which also adds appreciably to the difficulty of the safety and health problems.

The introductory message to these requirements addressed to all contractors constructing ships for the Navy and the Maritime Commission, as signed by Frank Knox, Secretary of the Navy and E. S. Land, Chairman, U. S. Maritime Commission, is as follows:

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