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HEALTH PROBLEMS IN THE MANUFACTURE AND USE OF PLASTICS

BY

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The increasing variety of plastic materials produced during the last few years is due mainly to the ability of the modern chemist to synthesize the chemical compounds from which plastics are made. The basis of most plastics today is the synthetic polymer and its introduction has made available many substances hitherto unknown in industry. Modern plastics are manufactured to serve specific purposes so that the synthetic polymers can no longer be regarded as substitutes for those found naturally as cellulose, rubber, and proteins. A wide range of materials can be made from them and so designed as to meet the actual properties required for any particular application.

In addition to the polymer, synthetic plastic materials contain varying amounts of other chemicals as catalysts, accelerators, stabilizers, hardeners, pigments, and so on, which are added to assist and regulate polymerization or to influence the properties of the final material, such as colour and flexibility. Most polymers are chemically inert and under ordinary circumstances the final plastic material should be comparatively harmless. It is admittedly difficult, however, in practice to effect complete polymerization and traces of free monomer or other chemicals may be present which can sometimes produce pathological conditions such as dermatitis.

Polymerized chemicals may be broadly divided into two groups, condensation and addition polymers. They may also be divided into thermoplastic or thermosetting types depending upon whether the polymer is softened or hardened by heating. The change that takes place on heating the thermosetting materials is irreversible.

CONDENSATION POLYMER PLASTICS

Condensation polymers are usually formed by the linkage of molecules with the elimination of water or some other compounds.

Formaldehyde Products

The thermosetting types in this group are those formed by the condensation of phenol, cresol, urea, or melamine with formaldehyde. In the manufacture and use of resins, glues, and moulding powders of this type free formaldehyde may be liberated under certain circumstances, the amount depending on such factors as the ratio of the ingredients, the degree of condensation, and the addition of other chemicals such as hexamethylenetetramine. For the sake of simplicity these products are discussed below in two separate sections depending upon whether they mainly affect the human body externally or internally.

Effects on the Skin.—Formaldehyde and hexamine are well known as primary irritants of the skin and mucous membranes and many factories handling resin glues have had cases of dermatitis at some time or another (Factory Department, 1943). Schwartz, Peck, and Dunn (1943) mention a factory of 800 employees where 600 cases of glue dermatitis occurred during the first six months of operation. In a small leather factory the incidence of dermatitis was highest (28%) in the section where "notorious sensitizers such as formaldehyde, lacquer and Bismarck Brown were used" (Squire, Cruickshank, and Topley, 1950). It has been stated that the actual substance responsible for hexamine and formaldehyde dermatitis is formic acid (Schwartz, Tulipan, and Peck, 1947).

There is another factor that should be considered in assessing the predominant cause of dermatitis as the result of handling some of these products. In their usual commercial form, for example, these formaldehyde glues and resins will adhere to the skin and rapidly harden on contact with it, and Little (1950) considers this to be the primary cause of the more serious outbreaks of dermatitis from them.

Mayers and Silverburg (1936) stress the great variation in the length of time ranging from a few

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