per sq. in. and a temperature of 150 degrees C. for one hour. The article produced was hard, insoluble, clear, transparent and free from fractures.[9]

Interpolymerization products of allyl crotonate and unsaturated alkyd resins are suitable for coatings or moulded articles. They are formed from allyl crotonate and at least one unsaturated alkyd resin.

Example: Allyl crotonate, 10 parts, and diethylene glycol maleate, 90 parts, yielded a hard, tough, insoluble and infusible interpolymer when co-polymerized for 2 hrs. at 80 degrees C. in the presence of 0.5 part benzoyl peroxide. When the proportions of allyl crotonate and diethylene glycol maleate were reversed, a white, opaque, non-flowing gel was obtained after 24 hrs.' heating at 80 degrees C. and a fairly hard gel with rubbery characteristics after heating for 144 hrs.[7,10]

Co-polymers with Vinyl or Vinylidene Compounds

To illustrate the variation in properties of co-polymers of vinyl compounds and unsaturated allyl esters and ethers, vinyl acetate may be mixed with 1/25th, 1/10th, 1 and 3 per cent. of allyl crotonate, 1 per cent. of benzoyl peroxide being added in each instance, and heated in completely filled iron flasks for 90 hrs. at 35 degrees C., the soft, flexible polymers being removed from the flasks and hardened by heating in air for 15-30 mins. at 100-120 degrees C.

A product prepared in this manner from vinyl acetate alone is hard at room temperature, but is so soft at 120 degrees C. as to be almost liquid, and is easily soluble in acetone. The products containing allyl crotonate are equally hard at room temperature, but much less plastic and soluble, the product containing 1/25th per cent. being a soft plastic at 120 degrees C. and dissolving slowly in acetone. The product containing 1/10th per cent. being still plastic at 120 degrees C., but only partly soluble in acetone; those containing 1 or 3 per cent. are elastic but not plastic at 120 degrees C., and swelling somewhat in acetone without dissolving.[11, 8]

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CELLULOSE ACETATE PLASTICS

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Mottles can be simply made by blending two batches of stock of different viscosity and different colour at the rolling stage and then pressing as before. Another method is to drop dice cut from a blanket of one colour into stock of another colour whilst on the rolls, again followed by sheeting and pressing, etc. This type of treatment, however, can only produce simple and comparatively uncontrolled colour effects. In some cases alternate sheets of different colours are pressed together, sliced, and the sliced sheets cut down and stacked on end and rewelded into a block.

For moire-type variations, the block would then be cut, restacked and welded for a third time. Grained-ivory finishes can be made by welding a block made up of alternate thin hides of different shades of ivory, followed by slicing, cutting down, stacking vertically and rewelding. Finishes such as imitation mother-of-pearl and tortoiseshell are easy to make when only a rough imitation is required, but to produce a really first-class sheet, closely resembling the natural product, great skill is required; the exact method of producing these materials is kept a close secret.

(*To be continued.*)

Health Hazards for P.V.C. and Acrylics?

Some medical aspects of handling rubber and plastics, in manufacture or in use, are surveyed by Dr. George Blaine, of the Strangeways Research Laboratory, Cambridge, in the issue of "Chemical Products" for Nov.-Dec., 1947. By kind permission of that journal we give the following extracts.

THE basic property to be considered from the medical point of view for any material which is in contact with human tissues, or to which such tissues are exposed, is the reaction elicited by it. A material can be safely handled or used only if it is proved by suitable experiments that it does not give rise to toxic reactions. If the material is both indispensable and somewhat toxic, precautions have to be devised to minimize damage to health.

The fact that rubber manufacture is subject to the Dangerous Trades Regulations under Section 60 of the Factories Act is due to the solvents and accelerators which are used.

Skin irritation and resulting dermatoses are the most common sequels of exposure to these solvents and accelerators. The toxicology of handling polyvinyl compounds is similar to that of rubber processing. Processing shops in the plastics industry, however, are, on the whole, of newer design than rubber factories and the hazard of dustborne irritants and fumes is therefore reduced.

An investigation of polyvinyl chloride compounds in the course of the last year revealed that the majority of well-cured and produced products have a good tissue tolerance. The tissue reaction elicited by polyvinyls is always a local one; it is marked by a defensive reaction on the part of the tissue into which it is embedded. Material containing no dye elicited the least amount of tissue reaction. The dyes and plasticizers used separately in control experiments, were strong protoplasmic poisons. The tissue reaction thus depends definitely on the contents of the plastic mix.

Polyvinyl chloride is extensively used in the production of anæsthetic airways, etc., in medical practice. Stoppers of penicillin solution containers can also be made in p.v.c. provided the least reactive type of material is used; with some polyvinyl stoppers rapid loss of penicillin potency has been recorded.

The hazards of manufacture for acrylics are of a different kind. The methyl methacrylate monomer is a strong respiratory irritant, and good ventilation is essential to reduce the risk of exposure. In larger concentrations it may cause irritation and inflammation of the respiratory passages. Inhaled, it may act as a narcotic and convulsant. Persons not used to it are liable to get headaches when exposed to minimal concentrations. It has little local action on the skin and few cases of dermatitis are on record. The polymer, however, produces no reaction whatsoever.

Methyl methacrylate is used on a large scale in dental laboratory practice. Since the dental technique involves handling and mixing into a doughy or paste-like mass, and is a process often done by hand, the lack of cases of dermatitis is good evidence of its non-toxicity. In animal experiments, too, acrylic plastic was found to be the least irritant of all plastics, creating only a minimal tissue reaction; there is no reaction from the fully polymerized material.

Further evidence of the non-toxicity of methyl methacrylate is afforded in brain surgery with a new method of using this plastic. Monomer and polymer mixed in suitable proportions, rapidly become tacky and soon after become fully plastic, in which stage the mixture can be moulded. This whole process can be done under sterile conditions,

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made the easier by the strong antiseptic properties of the monomer. Such plastic masses have been implanted into skull gaps and the skin sewn over them whilst the moulded mass was still comparatively soft. Rapid polymerization takes place under normal conditions inside the body tissues, and during this process some free monomer escapes. There were, however, no general reactions on the part of the patients thus treated.

Adhesive films for surgical use are also made from acrylics. Here there does not seem to be any contra-indication to the use of such films, other than irritable or inflamed skin.

The cellulose plastics were among the first known plastics used as surgical appliances and dental prostheses. They set up a fairly marked irritant reaction, but it must be kept in mind that solvents and plasticizers are apt to create the reaction. The risks, however, are both a general and a local type of reaction, as with rubber solvents and accelerators; the precautions to be taken with regard to dust, fume and gas control are the same and the need for effective barrier creams or emulsions cannot be too strongly emphasized.

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