
In this communication concern was expressed regarding the potential damage that might result from the use of PVC pipes in the various programs of the water sector of the Region; a request was also made to CEPIS for any information in regard to this problem; and finally a suggestion was made that CEPIS might consider a research project on the matter.

Analysis of the problem

The articles sent by Eng. Donaldson refer to the danger of poisoning from PVC pipe. All the cases mentioned are occupational health problems which resulted in angiosarcoma of the liver in workers at PVC plants. The cause of the poisoning is not the polyvinyl-chloride (PVC) itself, but rather the vinyl chloride (VC) monomer which is used to produce the PVC plastic. No indication was given that the vinyl chloride monomer would present any problem to consumers of potable water delivered in PVC pipe. Information available at this time in CEPIS does not indicate that vinyl chloride should present a problem to users of PVC pipe.

Another problem with PVC pipe could be significant, however. This refers to the problem of lead stabilizers used in the manufacture of PVC pipe. The formulated compound from which PVC pipe is made contains pigments, lubricants and stabilizers in addition to the basic polymer, polyvinylchloride. Stabilizers are incorporated in PVC compounds because the temperatures used
for extrusion and injection molding (100 to 200°C) are such that detrimental decomposition of PVC takes place with the liberation of hydrogen chloride. In the presence of oxygen the reaction is autocatalytic, but it can be reduced to a slow uniform rate by the incorporation of a substance that can effectively remove the hydrogen chloride as it is formed. Whitelead, for example, a basic lead carbonate that is commonly used as a stabilizer, has been shown to react in this way. During the heat processing of PVC compounds, it is converted to lead chloride.

Many other substances have been used as stabilizers including compounds of lead, cadmium, boron, tin, calcium, and zinc. In contrast to the polymers, pigments, and lubricants, which in general are physiologically and chemically inert, many of these stabilizers are toxic or suspect.

Lead stabilizers are by far the most widely used in PVC extrusion generally, but are not used in the United States in pipe intended for potable water use. Lead stabilizers are used, however, in pipe manufactured in Europe and Japan and intended for potable water use. Tin stabilizers are the leading ones, in frequency of use, for water supply pipe manufactured in the United States. Their cost per pound is about four times that of lead stabilizers.

Numerous investigators have shown that lead stabilizers and their reaction products can transfer to and dissolve in water in contact with PVC.

References:


An additional general reference from which much of the material presented in this report has been derived is:

"The Role of Plastic Pipe in Community Water Supplies in Developing Countries". Agency for International Development. 1971.

Other publications regarding the use of PVC pipe in the region are:


Instituto de Ingeniería, UNAM (Mexico). "Normas de Calidad y Métodos de Prueba para Tuberías de Policloruro de Vínilo", patrocinado por la Oficina Sanitaria Panamericana, enero de 1969.
Conclusions and Recommendations

The vinyl chloride monomer is not a problem in PVC pipe for potable water. However, the presence of vinyl chloride in the production of PVC pipe has been found to be a serious occupational health hazard, causing liver damage to workers. CEPIS does not possess data concerning the extent of this problem or potential problem in the Latin American and Caribbean countries.

Another problem of PVC pipe might well be important in the Region. This concerns the presence of lead stabilizers in PVC pipe, which can be leached out when the pipe is put into use. Further study of the seriousness of this problem in Latin America would seem advisable. This study should include a preliminary part to determine the amount of PVC pipe produced with lead stabilizers as well as the production quality control requirements of the countries in the Region. Detailed studies by laboratories could then be undertaken in those countries where problems occur. And finally some recommendations could be made in accordance with the analyses of the problems.