

Comments on Green Paper concerning environmental issues of PVC

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PVC represents developments in technology, economy and culture during the last century; as a result it is found in museum collections in every country in Europe. PVC has been used to manufacture furniture and vehicle upholstery, flexible toys, electrical cable insulation, credit cards, fashion and protective clothing—all such objects are present in museum collections.

In 1998 the National Museum of Denmark realised that many of the PVC-containing objects in their Modern Danish collections were beginning to deteriorate. A research project was initiated to establish the cause and extent of the deterioration, and the possibilities of slowing its progress. The research involved preparing plasticised PVC containing a range of concentrations of di-2-ethyl hexyl phthalate (DEHP) and comparing its behaviour with that of real objects from the collections.

A spectroscopic technique has been used to determine the amount of DEHP at the surface and scanning electron microscopy was used to obtain images of the PVC objects at high magnification. The research was carried out solely for the purpose of preserving museum objects containing PVC for future generations.

Based on the findings of this research, I wish to comment on two subjects discussed in the Green Paper, the prediction of the useful lifetime of PVC and the loss of phthalate plasticisers from plasticised PVC.

1. Prediction of the useful lifetime of PVC

Many industrial studies predict the useful lifetime of PVC by artificially accelerating the ageing process. Because museums have a responsibility to maintain their collections for future generations, they are in a good position to document the actual lifetime of PVC.

Section 4.1 'current situation and future developments', of the Green Book states that lifespans for PVC can reach up to 50 years for unplasticised applications and, from this data, concludes that a significant increase in PVC waste is expected to start around 2010. However, examination of the condition of plasticised PVC objects during real time ageing in museums, suggests that they exhibit an advanced state of deterioration within 20 years, a much shorter period than that predicted. Such observations suggest that the baseline scenario of a significant increase in waste PVC starting from 2010 is inaccurate; it will happen earlier than predicted.

2. Loss of phthalate plasticisers from plasticised PVC

The Green Paper states that phthalates used in large quantities in PVC applications evaporate into the air and leach out from certain applications (section 3.3, 'Plasticisers'). Also mentioned is the fact that phthalates leach out from toys and childcare articles when sucked by small children.

Depending on application, PVC formulations contain between 15% (eg folders to keep papers in order) and 50% (eg rubber boots) by weight. Phthalates, DEHP in particular, have been the most commonly used plasticizers since the 1950s. The results of research at the National Museum of Denmark suggest that there is a limit of compatibility between DEHP and PVC at concentrations above 30% by weight. As a result, PVC formulations containing more than 30% DEHP are losing plasticiser by evaporation and migration into adjacent materials, from the day they are manufactured.

In addition, although phthalates are poorly soluble in water, water droplets can penetrate PVC surfaces and 'push' plasticiser from the bulk of the product to the surface. Here it is available for evaporation to the air and adsorption by other materials. Such an environment is likely in a landfill situation.

Initial results from research at the National Museum of Denmark also indicate that the useful lifetime of plasticised PVC and the rate of migration of phthalate plasticisers are directly related. When the plasticiser leaves, the PVC polymer is likely to degrade faster than in the original formulation.

*Further details of the project in Polymer Preprints, American Chemical Society, Volume 41, Number 2, August 2000, pages 1796-1797.