Plastics Industry Pipe Association of Australia Limited ACN 086 511 686

Industry Guidelines

MEASURING THE PVC CONTENT IN PVC PIPES AND FITTINGS

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Pipelines Integrity For a Cleaner Environment

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MEASURING THE PVC CONTENT IN PVC PIPES AND FITTINGS

INTRODUCTION

The Australian Standards for PVC pipes and fittings specify a minimum PVC content, which is normally demonstrated using process control. There are however no specific test methods identified in these Standards for determining the PVC content. Therefore PIPA has identified the following test method as being suitable.

BACKGROUND

To ensure the quality and fitness for purpose of non-pressure PVC pipes and fittings, the standards for PVC-U Drain, Waste and Vent (DWV) pipes and fittings (AS/NZS 1260) and PVC-U Stormwater pipes and fittings (AS/NZS 1254) specify minimum PVC content requirements of 80% and 75% by mass respectively.

Whilst PVC resin is the main component in all types of PVC pipes, the resin cannot be processed by itself and must be blended with a range of additives before processing. These additives include products such as fillers (typically calcium carbonate), heat stabilisers, lubricants, impact modifiers, processing aids and pigments. Use of these additives can change certain physical properties of the pipe. For instance, fillers increase the stiffness of the pipe whilst reducing the raw material cost. Impact modifiers increase the ductility and impact resistance. Heat stabilisers improve the thermal properties of the PVC resin enabling it to be processed, whilst to a lesser extent improve the UV stability. Lubricants and processing aids are important additives during the extrusion or injection moulding processes when the pipe or fitting is manufactured. Pigments determine the final colour of the pipe or fitting. Rutile Titanium Dioxide pigment is added at a minimum required loading of 1.5 parts per one hundred parts of PVC resin to give the pipe or fitting protection from UV radiation during storage, a requirement of the standards.

With PVC pressure pipes and fittings, where strength is the most important feature, lower levels of additives are used and the PVC content may be as high as 94%. However, with non-pressure pipes and fittings, where stiffness and impact resistance are the most important features, much higher additive loadings can be used and it is possible to produce pipe with PVC content as low as 60%. This is normally achieved by increasing the loading of filler. As the filler level is increased, some physical properties of the pipe or fitting such as strength and impact resistance are negatively affected. Excessive filler content can make pipe brittle and susceptible to damage during and after installation. Hence the minimum PVC content requirements to ensure the fitness for purpose of the pipe or fitting.

METHOD FOR MEASURING PVC CONTENT

From the PIPA research, it was found that one of the most suitable techniques to measure chlorine content is Chlorine Microanalysis. The Chlorine Microanalysis method is based on a method reported in the publication Mikrochimica Acta in 1969. The method is basically a wet chemistry procedure involving pyrolysis of the sample, followed by titration with an indicating solution. The summary of the method states "For simplicity and rapidity in operation, the proposed method has a decided advantage over more conventional ones. It is also quite reliable." Experience has found the method to be accurate, quick and low cost.

Evaluation of the method by PIPA using the University of Otago in Dunedin, New Zealand on a range of PVC pipe formulations determined that the method was accurate to within the ±0.3%.

Chlorine Microanalysis, by the method reported in Mikrochimica Acta, is a suitable method for determining the amount of chlorine present in high chlorine containing products such as PVC pipes or fittings. The method is therefore suitable for confirming whether products comply with the minimum PVC content specified in the composition clauses of the product Standards.

REFERENCE:

Mikrochimica Acta (Wein) 1969, 441 - 448