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Adulterating Polypropylene Containers: Not a Clear Open and Shut Case

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Abstract

Clear polyethylene and polypropylene containers with securely fitting lids provide not only usefully sturdy and stackable storage media for museum specimens but can also provide some buffering to changes in external environmental conditions. However, a range of containers used in museums analysed in the 1990s were found to be releasing volatile organic compounds, especially when new. Therefore to reduce the likelihood of adulteration, natural history specimens in particular should only be stored in containers that have had time to 'off-gas'. It is recommended that the lidded Gratnell containers now used widely in museums should also be investigated for volatile organic compounds and that when empty they should be stored with their lids removed.

Introduction

In the 1990s the author and colleagues undertook research into lidded polyethylene and polypropylene containers frequently used in museums for storing specimens, including the ubiquitous 'Stewart boxes'. This was to investigate how the containers compared in terms of providing a barrier or buffer to external changes in relative humidity (RH) (Larkin *et al*, 1998) and what volatile organic compounds (VOCs) they were emitting (Larkin *et al* 2000). The results were published in two papers summarised below. However, in the last decade a new type of lidded polypropylene container - the 'Gratnell' (Figures 1 and 2) - has become very widely used in museums, and certainly seems popular for the storage of natural history collections. For example Milly Farrell, in a recent edition of NatSCA News (Issue 19, 2010), describes the 'lock-lid transparent plastic boxes' used for re-housing the Primate Odontological Collection at the Royal College of Surgeons, with a photograph of the containers in use. They are also being used for the storage of some natural history specimens in, for example, Cambridge University Museum of Zoology, Plymouth City Museum and Art Gallery, Royal Cornwall Museum, Truro, and the Hunterian Museum at the Royal College of Surgeons. Whilst these Gratnell containers are undoubtedly useful and are available in a range of sizes it is unfortunate that, considering all polyethylene and polypropylene containers off-gas VOCs to varying extents and duration after manufacture, no research has yet been published about the chemical suitability of the Gratnell containers that are now used so widely in museums. Considering that many natural history specimens stored within these containers may be sampled for biomolecules in the future and in the meantime the specimens may be suffering from some adulteration, ideally the Gratnell containers should be tested for VOCs *etc* if funding could be found for the project.

Fig. 1. Lidded Gratnell containers with 'locking handles' in the collections area of Cambridge University Museum of Zoology. Note the three useful sizes.

Fig. 2. Lidded Gratnell containers (housing mineral specimens), in metal racks at Plymouth City Museum & Art Gallery. (Image reproduced with permission from Plymouth City Museum & Art Gallery).

Analyses of lidded polyethylene and polypropylene containers pre-2001

Many museums store their sensitive archaeological metalwork and some problematical palaeontological material in 'air-tight' plastic containers (such as 'Stewart boxes') along with a desiccant in an attempt to stabilise the relative humidity (RH) surrounding the specimen and provide a barrier to extreme changes in the RH of the storage area outside the container. However, several manufacturers had changed their container material from polyethylene to polypropylene by the mid-1990s and the seal between the new polypropylene containers and their lids did not seem as secure. If this was the case, it would reduce their effectiveness as a barrier to changes in RH. To ascertain any extra risk to museum specimens from the new polypropylene containers, a study was undertaken with dataloggers to test the performance of both the old polyethylene containers (some 'new' unused old-style polyethylene containers were sourced) and the new polypropylene containers. Whilst all the containers tested did provide a partial barrier to changing external RH, the differences between their apparent effectiveness was not great. The old style polyethylene Stewart containers were found consistently to out-perform the others tested albeit by a very small amount (Larkin *et al*, 1998).

In a follow-up investigation, the air inside a number of empty and unused polypropylene and polyethylene lidded containers was sampled for VOCs, and standard Oddy tests (Oddy, 1973) were undertaken on the container materials to ascertain any extra risk to museum specimens from the new polypropylene containers (polypropylene being inherently less stable than polyethylene). In the Oddy tests, lead coupons were consistently the most affected by the container materials, and polypropylene material appeared only slightly more problematic than polyethylene. The containers were sampled for VOCs using passive sampling diffusion tubes, and many VOCs were identified as being present such as short-chain aliphatic hydrocarbons, aromatic molecules, oxygenated species and aldehydes - the first time they had been recorded in this context (for a full list, see Larkin *et al,* 2000). Although at the time none of the compounds identified were considered as likely to be particularly reactive or harmful to most museum specimens, it was recognised that anything stored in these containers for a long time might potentially be adulterated by the compounds, possibly creating problems for the biomolecular study of the specimens in the future. Significantly, it was found that the greatest concentrations of these compounds occurred soon after manufacture, and that they can remain at high levels in sealed containers for several years. Therefore it was recommended that until more data are gathered on the identified species and their interactions with various museum specimens are analysed, such containers should be stored with the lids removed for at least several months between purchase and use with collections (Larkin *et al*, 2000).

Discussion and conclusions

The Gratnell lidded containers currently seem to be preferred for storing specimens in museum collections partly for their 'stackabilty', partly for their (apparently) secure 'sealing' handles that snap over the lid and partly because of their cost. Some museums may be using them to provide what it presumed to be a more controllable microclimate to prevent problems such as pyrite decay in mineral and fossil specimens (Larkin, 2011). These containers are apparently made from '20% talc-filled polypropylene - the talc is in there as a buffer to stabilise the container for chemical storage in school chemistry labs' (personal communication, Matt Williams). They also contain an unidentified antistatic additive. In the absence of knowing exactly what VOCs or additives the Gratnell containers might be off-gassing, it is at least reassuring to know that these containers do not seem to be sold with their lids attached. It would seem prudent to make sure that they are also stored with their lids removed until they are put to use.

As these containers seem to be increasingly used for the storage of natural history specimens that will become of greater use to science as further biomolecule retrieval techniques are developed and refined, further research is required, if funding can be found, into the potential for plastic containers generally and Gratnell boxes in particular to adulterate specimens over time.

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References

Farrell, M. 2010. News from the Royal College of Surgeons: a new habitat for the Odontological Collection Primates. NatSCA News, 20, pp 25–27.

Larkin, N., Makridou, E. and Comerford, G. 1998. Plastic containers: a comparison. *The Conservator*, 22.

Larkin, N., Makridou, E. and Blades, N. 2000. Analysis of volatile organic compounds in plastic containers used for museum storage. *The Conservator*, 24.

Larkin, 2011. Pyrite decay: cause and effect, prevention and cure. *NatSCA News*, 21, 35–43.

Oddy, W. A. 1973. An unsuspected danger in display. *Museums Journal*, 73, pp 27-8.