Why not bottle in plastic?

AND OTHER FACTS ABOUT THERMOPLASTIC ELASTOMER DEGRADATION

Plastic is cheaper and lighter, making it easier to handle and reducing shipping costs. Why does Natural Immunogenics not bottle in plastic, then? These savings would come at the expense of product quality, as it may compromise purity over time, and poses potential health risks. We choose to produce a quality product and bottle in glass to afford the maximum care and protection available.

PURITY

One reason for using glass bottles is the absence of organic impurities. Glass is an inorganic material. When a glass bottle is molded, it is heated to more than 1000°F. Organic material is destroyed under this condition. Thus, a glass bottle contains no potential carcinogens, or organic toxins.

Plastic bottles are made of organic materials. Bottles may contain traces of the monomer from which the plastic is made, plasticizers or mold release compounds (a chemical that allows the bottle to be easily removed from the mold into which it was blown). Many of these compounds have been listed as cancer suspect agents, or as having other possibly hazardous properties. Some of the potential problems caused by these organic materials are described below.

LEACHING

Leaching has been observed in a variety of plastics over time, including Bisphenol A (BPA)[1] from polycarbonate, Bis(2-ethylhexyl) phthalate (DEHP) from polyethylene terephthalate (PET or PETE), hormone-disrupting chemicals from polyvinyl chloride (PVC), and styrene from polystyrene (PS), just to name a few[2]. PET water bottles are sometimes made with antimony, which is a contaminant responsible for both acute and chronic health problems. Studies have shown that antimony can leach into the beverage contained in a PET bottle, which is especially true when the bottle's temperature increases[3] (as occurs when putting a warm drink into a plastic container, or leaving it a hot car, for example). In a series of experiments, a comparison was made between three brands of water, available in both glass bottles and PET bottles. The water bottled in PET plastic contained up to 30 times more antimony. The researchers also found that the amount of leached antimony grew the longer the water was stored in plastic PET bottles.

STABILITY

Some of the leeched molecules or molecules formed by the degradation of the plastic will have two silver binding groups, one at each end of the molecule. These molecules can form a bridge between two different silver nanoparticles. This effect is called cross linking and leads to instability of the nanoparticle suspension, which may cause some of the silver to precipitate (fall out of solution or suspension). Low quality plastics are also porous, allowing silver particles to be absorbed into the plastic. These two factors typically result in a shorter expiration date when bottling in plastic.

[1] http://www.ncbi.nlm.nih.gov/pubmed/18799442
[2] http://www.pvc.org/en/p/Health_concerns_about_Phthalate_plasticisers
[3] http://www.ncbi.nlm.nih.gov/pubmed/17707454

DEGRADATION

Glass does not degrade with time. Plastics, on the other hand, are subject to degradation caused by exposure to oxygen in the air, light (especially UV light from natural sunlight), heat and humidity. These degradation processes produce reactive and potentially hazardous chemicals.

This topic was expounded upon in Chapter 12 of the reference book *Handbook of Polymer Degradation*[4], which deals with the numerous mechanisms of degradation of plastics from light and heat. According to the author, one important mechanism for plastic degradation is autoxidation which, in the absence of light, reactive oxygen species formed during the molding and fabrication of plastic bottles can cause the plastic to degrade and produce reactive organic aldehydes, ketones, etc. Because of their reactivity, these materials can pose health hazards. Another major factor is photochemical degradation, wherein light breaks the plastic down into small, reactive molecules and causes certain organic molecules to break down into highly reactive free radicals. These free radicals break down into hydroperoxides, alcohols, ketones, carboxylic acids and esters – reactive organic molecules that often pose health risks. *Traces of metals and metal ions greatly speed up the degradation process*, which is why colloidal solutions or suspensions should never be stored in plastic for considerable lengths of time.

ADDED PROTECTION

Plastic bottles are permeable to atmospheric gasses, such as oxygen and carbon dioxide. These gasses can slowly pass through the walls of a plastic bottle and bring about chemical changes in a product contained within it. Glass is not permeable to these gases so the quality of the product does not degrade with time.

IN CONCLUSION

Most colloidal chemistry experts agree that a glass bottle is the most ideal for storing a colloidal solution or suspension, and that a glass dropper is preferable to use.

Although the FDA claims BPA to be safe at very low levels, they acknowledge leaching of this material can pose health risks, therefore there is every reason to limit exposure.

GOING ONE STEP FURTHER

To ensure that no harmful impurities get into our product, we routinely screen for carbamates, pesticides, toxic metals, solvents and other hazardous contaminants, including those listed by the Office of Environmental Health Hazard Assessment (OEHHA, CA Prop. 65). Samples are regularly tested for purity and always show absence of these contaminants, even at exceedingly low levels.

[4] Handbook of Polymer Degradation: Second Edition, revised and expanded. Ed. S H Hamid. Dekker, New York, 2000, ISBN 0-8247-0324-3. Chapter 12 by Peter P. Klemchuk of the University of Connecticut, Institute of Material Science: Environmental Degradation of Polymers