Drug Incompatibility with IV Containers & Tubing: Non-PVC & Non-DEHP Terminology

Background

Intravenous (IV) containers (including IV bags, medication ports, and administration ports) and IV tubing are made of plastic materials, most commonly polyvinyl chloride (PVC). Pharmacy and nursing staff, however, are often advised to use *non-DEHP* IV containers and tubing for the preparation and/or administration of certain injectable drugs. Because the differences between the materials used for IV containers/tubing are not commonly understood, the terminology used to identify those differences creates confusion for staff.

What plastic materials are used in IV containers and tubing?

Polyvinyl chloride (PVC) is one of the most-used plastic materials due to its durability and versatility. It is a rigid plastic that must be softened with the addition of a plasticizer. Alternative (non-PVC) types of plastic, which are naturally flexible and do not require a plasticizer, are also used.

Plastic Material	Description	Examples
PVC	Rigid, requires plasticizer to make it flexible	**PVC** = polyvinyl chloride
Non-PVC	Flexible, does not require plasticizer	**Polyolefin** Family of thermoplastics made from simple olefins (alkenes) Examples: polyethylene, polypropylene
		EVA = ethylene vinyl acetate A copolymer made from ethylene and vinyl acetate

Why PVC may be an issue for drug compatibility?

Some drug products may irreversibly adhere to (adsorption) or absorb into (absorption) the PVC material, particularly if they are lipophilic (e.g., amiodarone, carmustine, thiotepa). As a result, the full dose of the drug may not be delivered to the patient. Therefore, these drug products are generally considered incompatible with PVC. To prevent adsorption/absorption to PVC material, these drug products should be prepared and administered using non-PVC containers/tubing (Appendix).

What are plasticizers and why are they used in IV containers and tubing?

A plasticizer is a substance added to some types of plastic material (such as PVC) to make that material more flexible, resilient, and easier to handle. There are dozens of plasticizers in commercial use. Diethylhexyl phthalate (DEHP) is the most-used plasticizer in PVC containers/tubing.

Plasticizer	Description	Examples
DEHP	Widely-used plasticizer	**DEHP** = diethylhexyl phthalate
Non-DEHP	Phthalate plasticizers	**DINP** (diisononyl phthalate) **DEHT** (di-[2-ethylhexyl] phthalate)
	Non-phthalate plasticizers	**TOTM** (trioctyl trimellitate) **DINCH** (di-isononyl cyclohexane-1,2-dicarboxylate)

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Reviewed by: P4C (endorsed: 17 Dec 2025) and Regional Pharmacy Educators

Why DEHP plasticizer is an issue for drug compatibility?

Some drug products (e.g., etoposide) interact with the DEHP plasticizer that has been added to the PVC used in IV containers/tubing. This can cause DEHP to leach from the PVC material into the drug solution where it will be administered to the patient. DEHP is possibly carcinogenic (IARC Group 2B) and presumed toxic to human reproduction (EC Category 1B) based on estimated risks from lifelong continuous exposure.

For adult patients, the impact of DEHP exposure from IV administration of affected drug products is likely limited because food is considered the primary source of exposure to DEHP. Nevertheless, as a precaution, it is recommended that drugs that can leach DEHP from PVC are prepared and administered using containers/tubing made of plastic materials without added DEHP plasticizer (*non-DEHP* containers/tubing) to avoid unnecessary exposure to DEHP (Appendix).

PVC containers/tubing that are made with alternative plasticizers (such as TOTM) do not contain DEHP and can, therefore, be used for drug products that leach DEHP.

Why PVC and DEHP are NOT synonymous?

Non-PVC is usually non-DEHP

PVC containers and tubing usually contain DEHP as the added plasticizer. This makes them unsuitable for drugs that can leach DEHP from the PVC.

In contrast, most non-PVC materials (e.g., polyolefin, EVA) do not require added plasticizer. Therefore, non-PVC containers/tubing are usually designated as *non-DEHP*, and their packaging is often labelled as both **non-PVC** and ***non-DEHP***.

Non-DEHP is NOT always non-PVC

To be considered non-PVC, containers/tubing should be made of non-PVC materials (e.g., polyolefin, EVA). Some are made of PVC but are still designated as *non-DEHP* because:

- they use alternative plasticizers (e.g., TOTM) or
- they are lined with non-PVC materials (e.g., polyolefin) that prevents the drug from interacting with the PVC material.

In these examples, the packaging is labelled only as ***non-DEHP***.

References

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Appendix: Quick Guide to Drug Incompatibility with IV Container & Tubing Materials

Drug Requirements	IV Container & Tubing Materials *				
	PVC with DEHP	**Polyolefin †**	**EVA**	**PVC with alternative plasticizer ‡**	**PVC with polyolefin lining**
Non-DEHP §	No	Yes	Yes	Yes	Yes
Non-PVC ¶	No	Yes	Yes	No	Yes
Non-DEHP, Non-PVC	No	Yes	Yes	No	Yes

***** If unclear from the packaging label, confirm with IV container/tubing manufacturer that all components along the fluid path of the container/tubing are made of compatible materials, including medication and administration ports

† e.g., polyethylene, polypropylene

‡ e.g., TOTM, DINCH, DINP, DEHT

§ e.g., blinatumomab, cabazitaxel, DOCEtaxel, etoposide, ixabepilone, mirvetuximab soravtansine, PACLitaxel, temsirolimus, teniposide

¶ e.g., thiotepa

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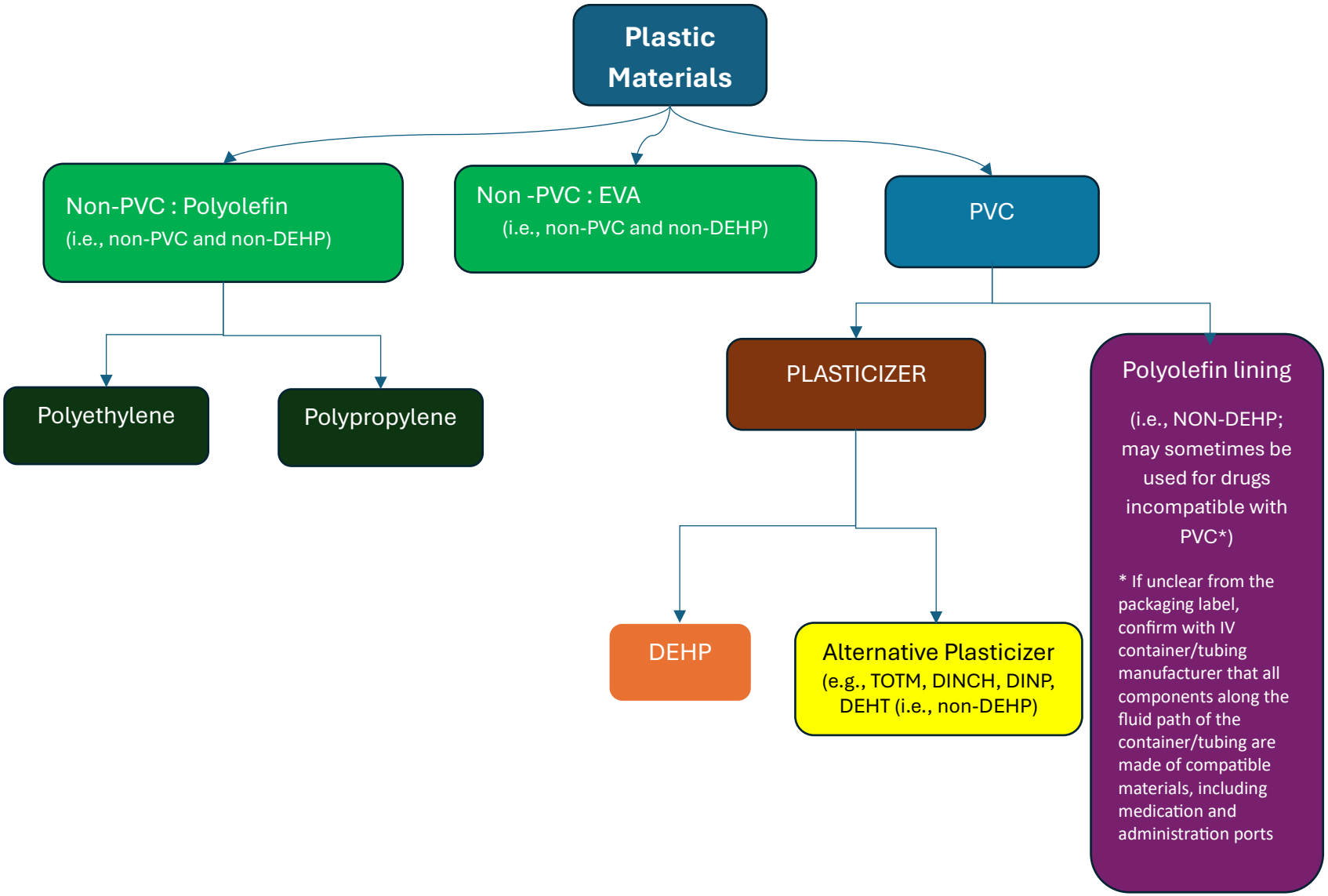
Appendix - Figure 1: Plastic Materials



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