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Technical Note

The Differences in Diisononyl Phthalate (DINP)

Phthalates are a heated topic of concern in the analytical field. The regulations and methods from around the world regulate or ban various common phthalate plasticizers have forced analytical laboratories into refining their methods for testing consumer products for these banned or restricted phthalates. The restricted phthalates in children's toys in the United States include Diethylhexyl phthalate (DEHP), Di-n-butyl phthalate (DBP), Benzylbutyl phthalate (BBP), Di-n-octyl phthalate (DNOP), Diisononyl phthalate (DINP), and Diisodecyl phthalate (DIDP).

The analytical challenges begin when an analyst realizes that their search for six compounds yields eight different CAS numbers. The phthalates designed as DINP and DIDP are not single compounds but groups of branched isomers. DINP and DIDP are designations with multiple possible isomeric ratios within the actual product depending on the alcohol structure(s) used to produce that phthalate.

DINP is the common designation for a class of dialkyl phthalate esters that represents a group of branched C-9 (predominately) isomers. DINP is the acronym for three compounds which are differentiated by their CAS number and by their method of manufacture.

DINP-1 (Figure 1) also referred to as '1-2-Benzenedicarboxylic acid, di-C8-C10 branched alkyl esters' (CAS #68545-48-0) is manufactured in a 'Polygas' process from octane that is converted to alcohol moieties (primarily 3,4, -4,6-, 3,6-, 3,5-, 4,5-, and 5,6-dimethyl-heptanol-1). (Produced as Jayflex by ExxonMobil.)

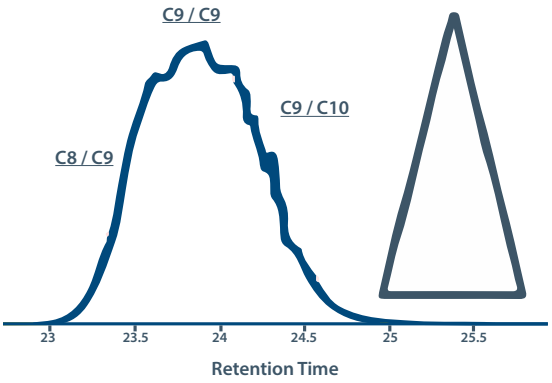


Figure 1. DINP-1 Branched ExxonMobil Chromatogram Distribution

DINP-2, also referred to as '1,2-benexedicarboxylicacid, diisononyl ester' (CAS #28553-12-0) is manufactured from n-butene that is converted to methyloctanols and dimethylheptanols. (Produced as Palatinol N by BASF.)

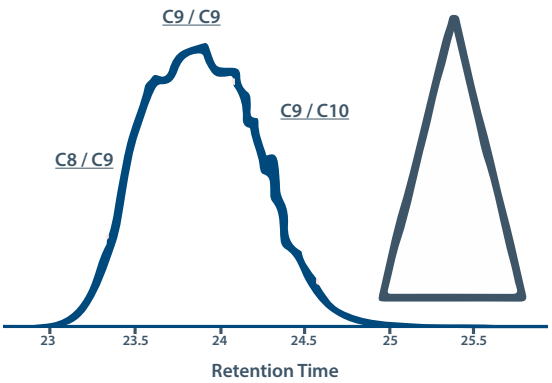


Figure 2. DINP-2 BASF Chromatogram Distribution

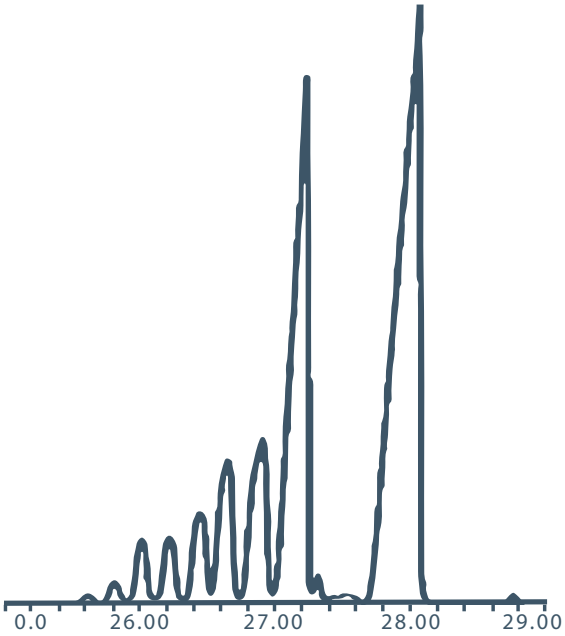
The CAS #28553-12-0 can also represent DINP-3 manufactured from n-butene and isobutene that are converted to alcohols, the majority of the alcohols being methylethyl hexanols. The commercial product ion DINP-3 was halted in 1995.

Although DINP acronym can designate multiple sources of manufacture, the Chemical Manufacturers Association considers DINP-1 & DINP-2 as commercially interchangeable products.

Table 1. Estimated chain structures of DINP

	EM	BASF	EM
Alcohol Branching	**DINP-1**	**DINP-2**	**LP9**
Straight Chain	< 1	4	72
Mono Branched	15	50	28
Di-branched	66	44	< 1
Tri-branched	18	2	< 1

There is also confusion about linear dinonyl phthalate which is ric in C9 alcohols as well and sometimes is interchanged or coelutes with Diisononyl phthalates. (Produced as Jayflex DL9P).



DINP is most often used as a general purpose plasticizer for PVC. A broad range of products from children's toys to construction materials contain DINP plasticizers.