

C₁₀ Oxo Alcohols (92S1)

Oxo alcohols in the C₆-C₁₁ range are used mainly to produce plasticizers for the production of flexible PVC. Esters of C₈-C₁₀ alcohols with phthalic anhydride account for the bulk of these applications given their low price and readily available feedstocks.

Diethyl phthalate (DEHP) produced from 2-ethylhexanol (2-EH), a C₈ alcohol, has been the workhorse of the plasticizer industry for many years. Its properties are acceptable across a wide range of PVC applications. However, manufacturers are moving away from the concept of an all-purpose plasticizer and are selecting "differentiated" phthalates with performance tailored to specific end uses.

Union Carbide Chemicals and Plastics Company (UCC) and Davy Process Technology (Davy) are now licensing technology based on a new catalyst system to produce 2-propylheptanol (2-PH), the C₁₀ analogue of 2-EH. The preferred feedstock for this process is the raffinate-2 by-product from MTBE plants.

This report describes the existing oxo alcohol technologies including the new, not yet commercialized UCC/Davy's 2-PH process. It also reviews existing capacity and C₈-C₁₀ alcohol markets including the availability of the key feedstocks, and assesses the comparative production economics of 2-EH, isodecanol, isononanol from raffinate-2, and 2-PH from raffinate-2 under a given price scenario.

Diisononyl phthalate (DINP) is produced from C₉ oxo alcohols and has plasticizing properties similar to DEHP. Its higher molecular weight results in improved high temperature performance and resistance to extraction. A variety of C₉ phthalates are produced with different degrees of linearity depending on the "iso-index" (average number of methyl groups per molecule) of the octene feedstock. The more linear C₉ plasticizers offer improved properties (except electrical) and can obtain a premium price. Higher linearity results in better low temperature performance and improved processability due to lower viscosity.

Diisodecyl phthalate (DIDP) produced from C₁₀ oxo alcohols exhibits superior high temperature performance compared to both DEHP and DINP because of its higher molecular weight and therefore lower volatility. DIDP has excellent electrical properties because it is highly branched.

Between 1984 and 1990 consumption of higher alcohols for phthalate plasticizers grew at a compounded annual rate of more than 10 percent, while 2-EH consumption remained virtually unchanged. This represented an increase in the market share for higher alcohols from 27 percent in 1984 to 40 percent in 1990.

Four separate cases have been considered for production of C₈-C₁₀ plasticizer oxo alcohols at the same capacity (220 million pounds per year) and under a consistent U.S. Gulf Coast 4th quarter 1992 price scenario. The selected cases are:

- 2-Ethylhexanol produced in a stand-alone plant using the LP Oxo process developed by UCC/Davy/Johnson Matthey.
- Isononanol produced by hydroformylation of octenes in the classic oxo process using an unmodified cobalt catalyst.
- Isodecanol produced by hydroformylation of nonenes in the classic oxo process using an unmodified cobalt catalyst.
- 2-Propylheptanol (UNOXOL™ 10) produced in a stand-alone plant using the LP Oxo process developed by UCC/Davy.

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