

2-Propyl Heptanol

2-Propyl Heptanol (2-PH) is the precursor to Di-propylheptyl-phthalate (DPHP): a similar component to Di-ethylhexyl-phthalate (DEHP) and Di-octyl-phthalate (DOP) which is made from 2-Ethyl Hexanol (2-EH).

Since the 1990's, the use of higher carbon chain plasticisers has increased in Europe and North America with legislation driving the trend of moving away from the use of DEHP/DOP in PVC. With the growing middle class in Asia, this is driving global consumption of plasticiser alcohols. In the past, there has been restricted availability of higher carbon chain plasticisers in Asia, which has in turn resulted in continued high usage of DEHP/DOP. However, this trend is now changing. This has resulted in 2-PH having the highest growth rate in the higher carbon global alcohol market since 2006.

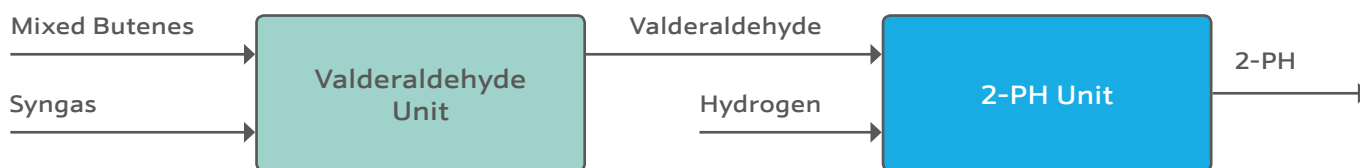
In anticipation of growing demand for higher alcohols and building on the learning of the successful propylene to 2-EH technology, in the 1990's, Johnson Matthey (JM) and The Dow Chemical Company (Dow) jointly developed a low-pressure process for producing mixed C5 aldehydes and 2-PH, using LP OxoSM Technology. The majority of the world's 2-PH is made from the LP OxoSM Process: JM and Dow have granted licenses for production of more than 400 kTPA mixed C5 aldehydes for conversion to 2-PH of which more than 300 kTPA is in operation.

The LP OxoSM Process is the Dow/JM rhodium based low pressure hydroformylation process which is primarily used to convert propylene and synthesis gas to butyraldehydes which are then reacted to form 2-EH and/or butanols. For the production of 2-PH, the LP OxoSM Process converts C4 olefins with syngas to produce mixed C5 aldehydes which are further reacted by aldolisation and hydrogenation to produce excellent quality 2-PH (Figure 1).

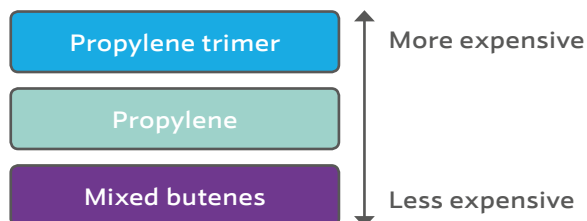
2-PH LP OxoSM Technology uses a simple flowsheet, ensuring excellent plant reliability and a high onstream factor. The active LP OxoSM and hydrogenation catalysts provide high feedstock efficiency and low utility usage, and ensure a consistently excellent quality 2-PH product.

Compared to the conventional high-pressure technologies used to make higher oxo alcohols, the LP OxoSM process represents a paradigm shift in plant design and operation, with enhanced safety from operating at substantially lower pressures and temperatures: less than 30 bar and 170°C, compared to more than 250 bar and 200°C for the high pressure alternatives.

Figure 1



One of the key advantages to 2-PH made by the LP OxoSM Process is that it can be produced from a mixed butene feed as one of the major costs of producing the alcohol is the olefin feedstock cost. The use of mixed butene represents a major OPEX advantage in comparison to other plasticiser alcohols, as mixed butenes are essentially fuel value. For example, isodecanol (IDA) uses propylene trimer as feed; and 2-EH uses propylene as feed, and typically the olefin feedstock price is:



Butene-1 streams may also be used as a feed to LP OxoSM 2-PH plants, however, it is generally more expensive than polymer grade butene-1, which is used as a co-monomer in the production of polyethylene (PE).

Mixed butenes are available from steam crackers and refineries, but they are typically limited in availability as they are often used in upgrading motor fuels. Methanol-to-olefins (MTO) plants, Fischer-Tropsch (FT) plants, and ethylene oligomerisation, offer new viable sources of mixed butenes (Figure 2).

As well as providing a cost improvement, phthalate esters prepared from 2-PH for flexible PVC applications also offers many other advantages:

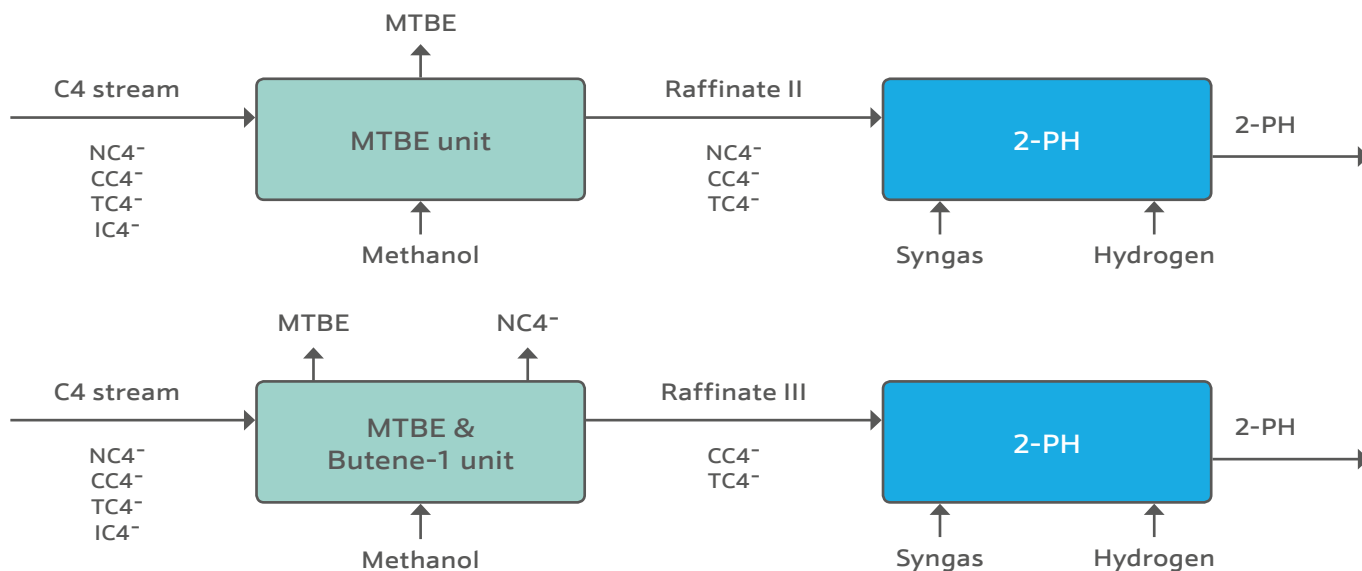
- More environmentally friendly than lower molecular weight phthalate esters, such as DEHP/DOP;
- Low volatility in vinyl for automotive products;
- Long-term property retention;
- Excellent outdoor performance properties.

The major end-use markets include construction and automotive production. Additionally, there are emerging uses of 2-PH such as surfactants, acrylate esters and lube additives, as well as possibly nitrates and other higher value specialities in the future.

We predict that there will be a continued shift to higher oxo alcohols in all international markets. In markets where there is currently overcapacity for DEHP / DOP, existing 2-EH producers with access to mixed butenes could consider producing 2-PH for DPHP, to reduce their feedstock costs.

For existing LP OxoSM licensees who currently produce 2-EH, it is possible to make relatively minor modifications to their plant to make 2-PH. These modifications could enable campaign production of 2-PH or 2-EH, so that producers can maximise their profitability as market requirements change.

Figure 2



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For further information on Johnson Matthey, please contact your local sales representative or visit our website.

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