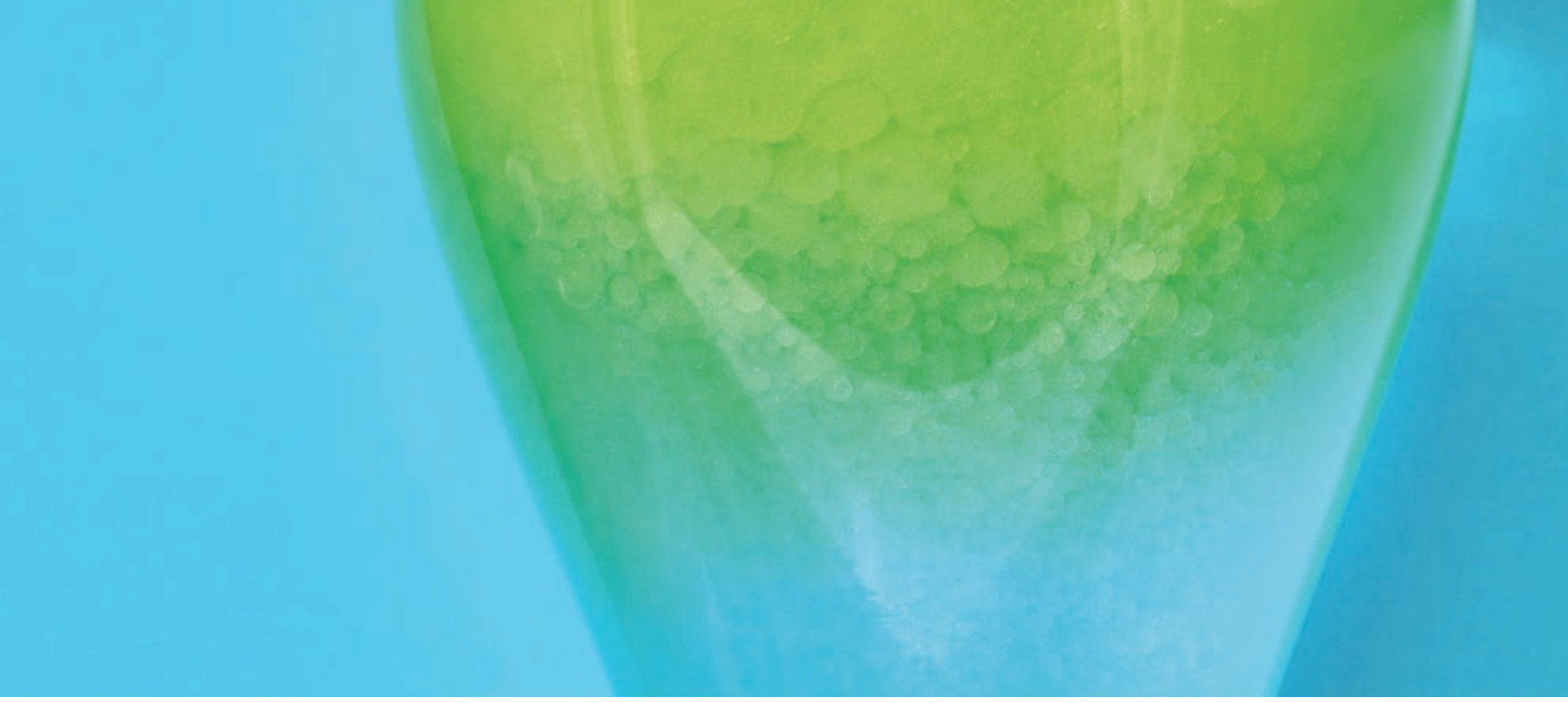
JM

DAVY butanediol and co-products process

Johnson Matthey
Inspiring science, enhancing life



Butanediol and co-products

Johnson Matthey (JM) are the provider of the leading DAVY™ technology for butanediol (BDO) plants worldwide.

We offer a more economical process by using low-cost raw materials, producing BDO from butane via maleic anhydride (MAH), or from sugar via succinic acid (SAC), with the latter process making bio-based BDO possible.

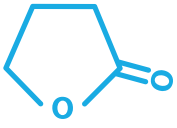
The **DAVY** process is also designed with an esterification step prior to hydrogenolysis. This achieves greater efficiency, and a higher-quality product.

In addition, our process can make BDO's derivatives, tetrahydrofuran (THF) and γ-butyrolactone (GBL), in variable ratios which are adjustable according to market need.

This flexible product output enables our licensees to respond quickly to changing market conditions by manufacturing the right product at the right time for the polymers and solvents industries.

1,4 - butanediol
(BDO)

tetrahydrofuran
(THF)

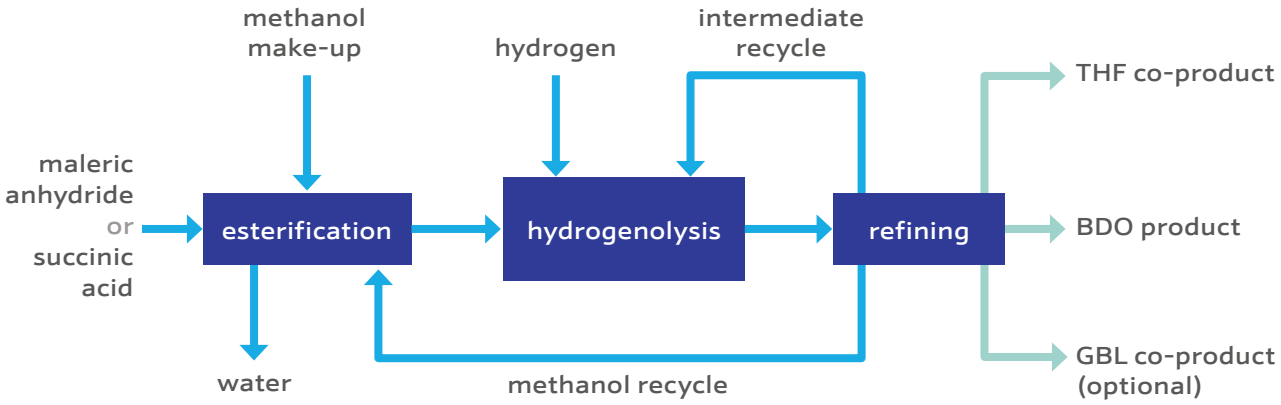


gamma-butyrolactone
(GBL)

Process description

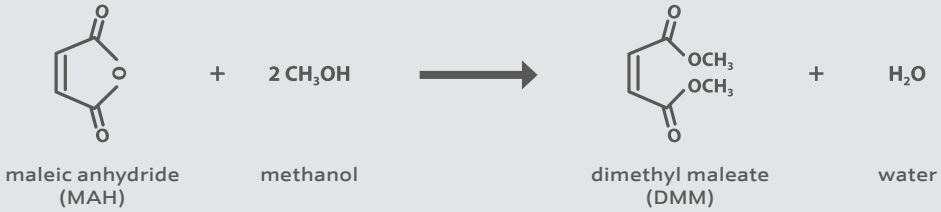
BDO and its derivatives are produced in two stages: maleic anhydride or succinic acid is first esterified to dimethyl maleate/succinate and then hydrogenolysis converts this intermediate to the crude BDO/THF/GBL product mix.

The purpose of the esterification step is to convert the acidic feed to a non-acidic intermediate ester, which is much easier to convert to butanediol compared to an acidic feed. In addition, our esterification reaction system removes the reaction water produced prior to hydrogenolysis, enhancing process efficiency.



Process Chemistry

Esterification converts maleic anhydride/succinic feed to dimethyl maleate/succinate intermediate.

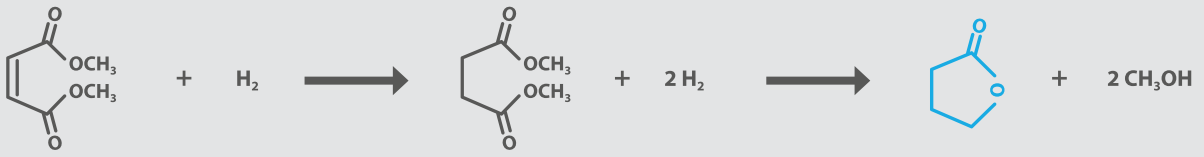


maleic anhydride (MAH) | methanol | dimethyl maleate (DMM) | water

succinic acid (SAC) | methanol | dimethyl succinate (DMS) | water

A series of vapour-phase hydrogenolysis/hydrogenation reactions then produces the three final products:

starting with MAH: | starting with SAC:



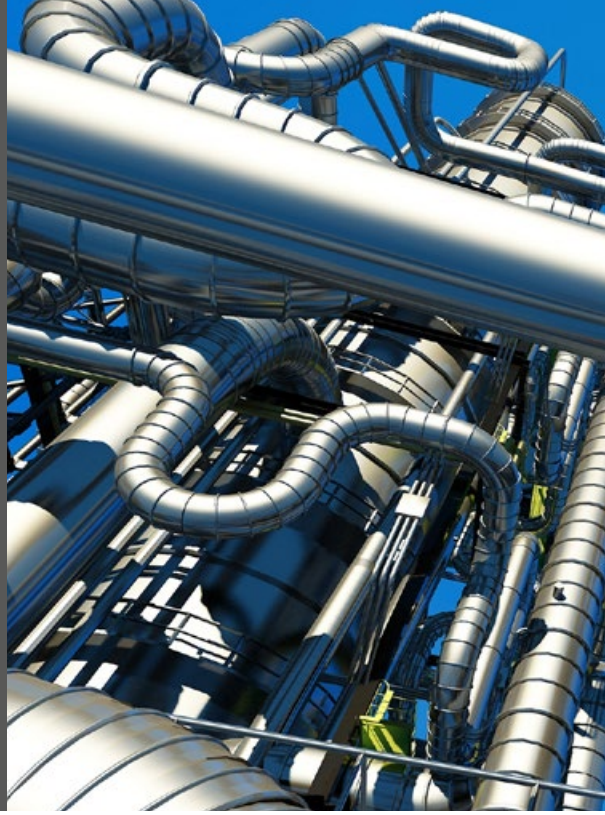
dimethyl maleate (DMM) | hydrogen | dimethyl succinate (DMS) | hydrogen | y-butyrolactone (GBL) | methanol

y-butyrolactone (GBL) | hydrogen | butanediol (BDO)

butanediol (BDO) | tetrahydrofuran (THF) | water

DAVY technologies and licensed processes

At JM, we develop and license chemical processes and technologies for the oil, gas, petrochemical and biochemical industries. We not only provide process design packages to suit our clients' needs, we also deliver engineering know-how and ongoing support, right up to plant acceptance and beyond, to help our clients reach optimum plant performance.



The **DAVY** technology advantage

JM's use of an esterification step prior to hydrogenation has transformed BDO production. The benefits of this innovation are numerous, from reduced capital costs to milder, safer operating conditions and improved conversion.

Flexible product ratios

Our technology produces BDO and its derivatives in variable ratios according to market need.

Low material and equipment costs

The esterification step neutralises the acidic feed. This enables the hydrogenolysis and refining systems to be made of inexpensive carbon steel.

Net savings over conventional processes

The combined savings of cheaper construction materials and catalysts more than compensate for the cost of the added esterification step.

Simplified catalysis, process efficiency

The esterification and hydrogenolysis catalysts remain in their respective reaction vessels, eliminating the need for catalyst separation and neutralisation at any stage of the process. The esterification catalyst can also be changed at 100% load without any downtime or loss of production.

Low-cost, higher-performance catalyst

The non-acidic hydrogenolysis environment also allows use of a base-metal catalyst instead of a high-grade precious metal catalyst. This delivers superior performance at lower cost.

	DIMETHYL ETHER (DME)	NATURAL DETERGENT ALCOHOLS (NDA)
	DIMETHYLFORMAMIDE (DMF)	ETHYL ACETATE
	OXO ALCOHOLS	GAS-TO-LIQUIDS (GTL)
	PROPYLENE GLYCOL	BIODIESEL
	METHANOL	PURIFIED TEREPHTHALIC ACID (PTA)
BUTANEDIOL (BDO) & CO-PRODUCTS	METHYLAMINES	SUBSTITUTE NATURAL GAS (SNG)
CHOLINE CHLORIDE	MONOTHYLENE GLYCOL (MEG)	VINYL CHLORIDE MONOMER (VCM)

LICENCED PROCESSES

DAVY

CORE TECHNOLOGIES

ESTERIFICATION	METHANATION	FISCHER TROPSCH (FT)
NOVEL REACTORS	ALDOLISATION	HYDROCHLORINATION
OXIDATION	AMINATION	
REFORMING (SMR, ATR, GHR)	DEHYDRATION	
REFORMING (COMPACT REFORMER)	DEHYDROGENATION	
SYNTHESIS	HYDROGENOLSIS	
HYDROGENATION	HYDROFORMYLATION (LP OXO^{SM})	

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