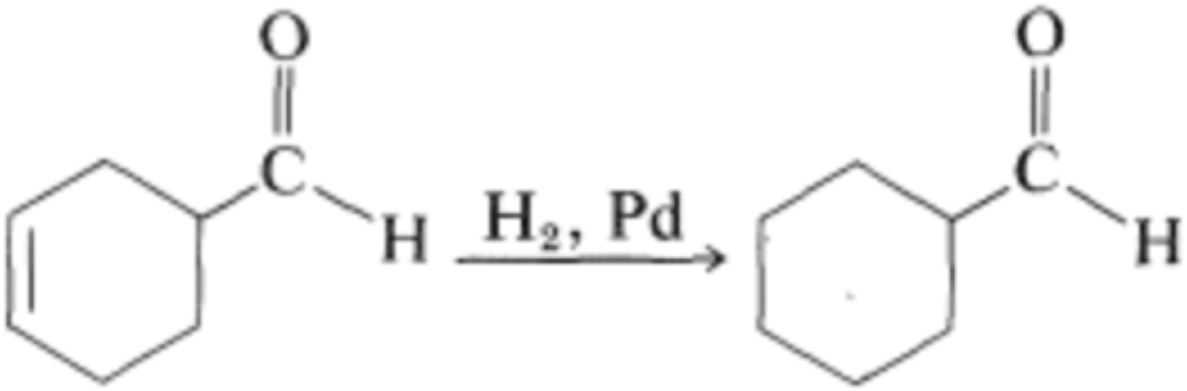
LabTech India

Hydrogenation Reactions



LabTech Analytical Pvt. Ltd.

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Introduction:

Catalytic hydrogenation is one of the most reliable and widely executed reduction methods in Active Pharmaceutical Ingredient (API) synthesis. By adding molecular hydrogen (H2) across double or triple carbon-carbon bonds—or reducing functional groups like nitro, carbonyl, and imine groups—it enables high atomic efficiency with minimal chemical waste (often yielding water as the sole byproduct).

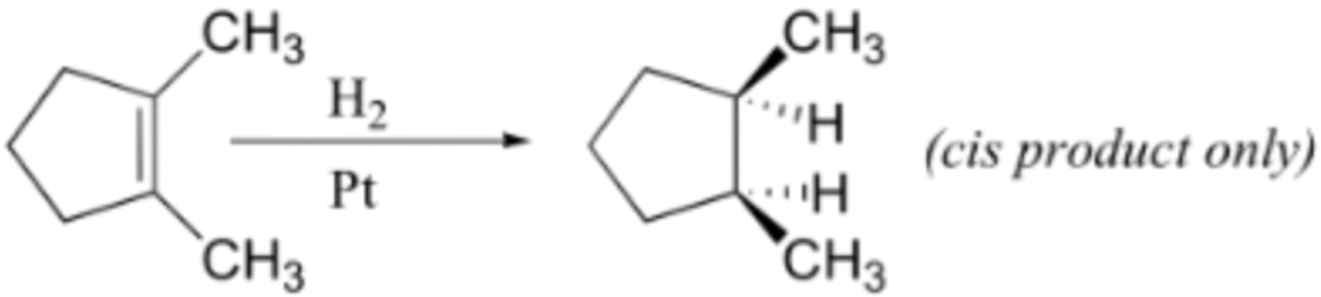
Core Mechanism: Surface Catalysis

Heterogeneous hydrogenation proceeds through a series of surface-mediated steps on transition-metal catalysts such as palladium on carbon (Pd/C), platinum oxide (PtO_2, Adams' catalyst), and Raney nickel (Raney-Ni).

The process can be broadly described as:

- **Adsorption & H_2 Dissociation:** Hydrogen molecules adsorb onto the catalyst surface and dissociate into activated, surface-bound hydrogen species.
- **Substrate Adsorption**: The unsaturated substrate binds to the catalyst surface, positioning the reactive bond for hydrogen addition.
- **Sequential Hydrogen Transfer**: Activated hydrogen species are transferred from the catalyst surface to the adsorbed substrate, reducing the unsaturated bond.
- **Product Formation & Desorption:** The hydrogenated product forms and subsequently desorbs from the catalyst surface.

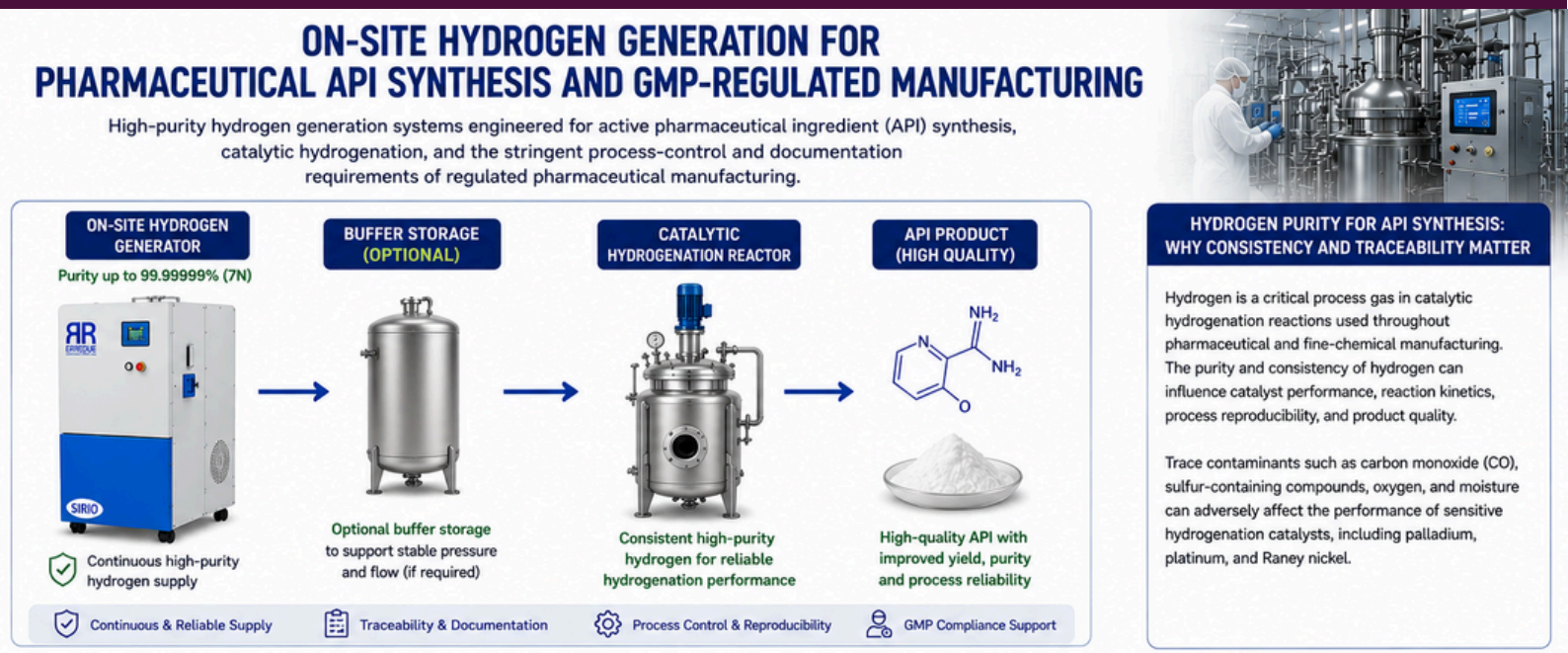
For many alkene hydrogenation reactions, hydrogen is delivered from the catalyst surface to the same face of the adsorbed substrate, resulting in syn addition of hydrogen.



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Hydrogen Quality Parameters

Hydrogen is a critical process gas in catalytic hydrogenation reactions used throughout pharmaceutical and fine-chemical manufacturing. The purity and consistency of hydrogen can influence catalyst performance, reaction kinetics, process reproducibility, and product quality. Trace contaminants such as carbon monoxide (CO), sulfur-containing compounds, oxygen, and moisture can adversely affect the performance of sensitive hydrogenation catalysts, including palladium, platinum, and Raney nickel.

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LabTech Range of Products

Hydrogen Gas Generator from ErreDue S.P.A



Sirio Hydrogen System

ErreDue develops and manufactures Ultra-pure hydrogen generators with PEM & Alkaline technology and has PSA/TSA drying technology. Powered simply by electricity and deionized water or Alkaline Solution

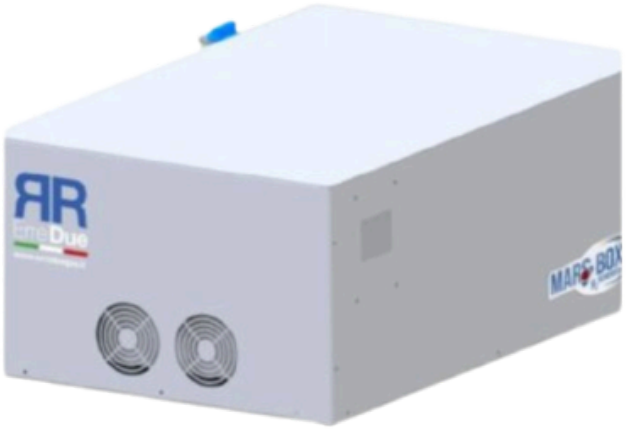
Specifications:

- Flow rate from 0.5Nm3/hr to 200Nm3/hr
- Available on PEM & Alkaline Technology
- Output gas purity up to 99.99999%
- Output gas pressure is 15 bar (optional 30 bar)
- Colour touchscreen
- Ethernet - Modbus TCP/IP connections available
- Average power consumption is 4.6kW/m3

Mars Box Gas Generator

Specifications:

- Flow rate from 1200ml to 3600 ml/min
- Output gas purity up to 99.99999%
- Output gas pressure is 10 bar (optional 15 bar)
- 3.5" colour touchscreen
- RS485 & Ethernet connections available
- Maintenance Free TSA Regenerating Dryer System



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