

UNIT 7 • ALCOHOLS, PHENOLS AND ETHERS

Commercially Important Alcohols: Methanol and Ethanol

Production pathways, biochemical properties, and the critical mechanisms of toxicity and fermentation.

Wood Spirit

The historical, common name for methanol, which was originally obtained through the destructive distillation of wood.

Denaturation

The industrial process of rendering commercial ethanol intentionally unfit for drinking by mixing in toxic or highly repulsive chemical additives.

Zymase & Invertase

The specific biological enzymes found in yeast responsible for catalyzing the multi-step anaerobic fermentation of natural sugars into ethanol.

Methanol (CH₃OH) Production



Catalytic hydrogenation (High Temp/Pressure) • Catalyst: ZnO-Cr₂O₃

Boiling Point

337 K

Physical Trait

Colorless liquid,
highly poisonous.

Primary Industrial Use

Chiefly used to
manufacture
formaldehyde.



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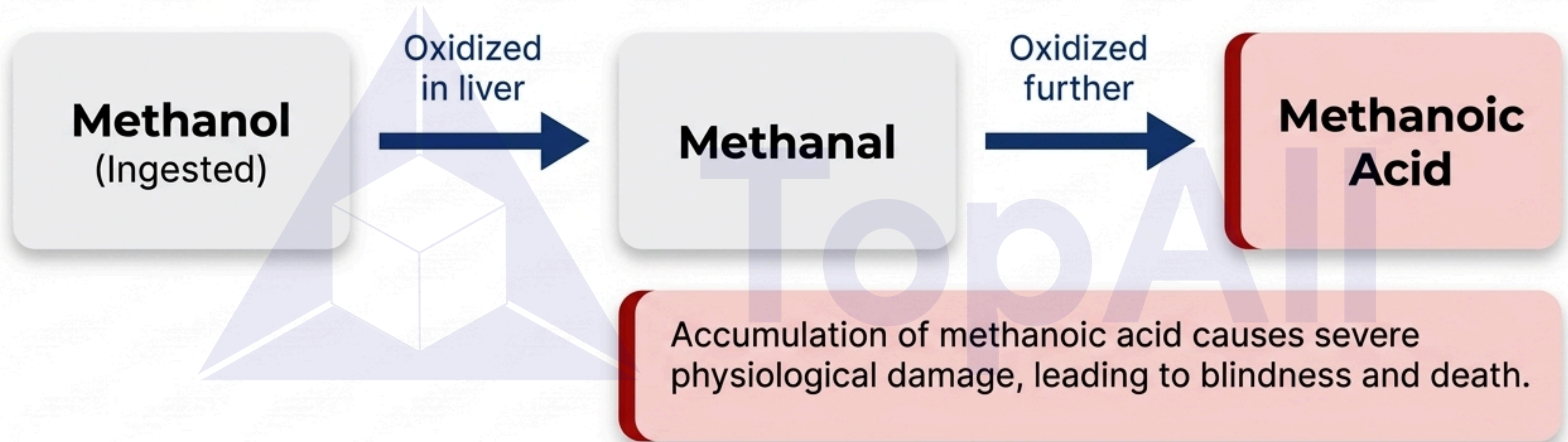
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Key Highlights

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The Toxicity Cascade: Methanol Poisoning



Treatment Note: Treated via intravenous infusion of diluted ethanol, buying time for the kidneys to excrete the methanol unchanged.

Commercial Ethanol ($\text{C}_2\text{H}_5\text{OH}$) via Fermentation

Sugars (e.g., Sucrose) + H_2O

Enzyme: Invertase

Glucose + Fructose ($\text{C}_6\text{H}_{12}\text{O}_6$)

Enzyme: Zymase
(Anaerobic conditions)

$2 \text{ C}_2\text{H}_5\text{OH}$ (Ethanol) + 2 CO_2

The action of zymase is naturally inhibited once the alcohol concentration exceeds **~14%**.

Fact: Boiling point 351 K.

Denaturing Commercial Alcohol

Large quantities of industrial ethanol are made intentionally unfit for drinking to prevent misuse.

Copper Sulphate (CuSO_4)



Added to give the liquid a distinct blue color for instant visual identification.

Pyridine



Added to give the alcohol a highly repulsive, foul smell.

Watch for this: The Antidote Mechanism



Assuming that injecting ethanol to treat methanol poisoning works by simply “flushing out” or diluting the poison in the bloodstream.

Ethanol is infused to **saturate the exact same oxidative enzyme** that converts methanol into toxic methanoic acid. Because the enzyme is “swamped” processing the ethanol, the methanol is left unoxidized, buying the kidneys time to excrete it safely.

Key Takeaways

- ✓ **Methanol:** Synthesized via catalytic hydrogenation of CO ($\text{ZnO-Cr}_2\text{O}_3$, 337K). Highly toxic; poisoning is treated with ethanol infusion to competitively block oxidation into deadly methanoic acid.
- ✓ **Ethanol:** Fermented from sugars using invertase and zymase (capped at 14% yield in anaerobic conditions, 351K). Denatured for industrial use by adding CuSO_4 (color) and pyridine (smell).



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