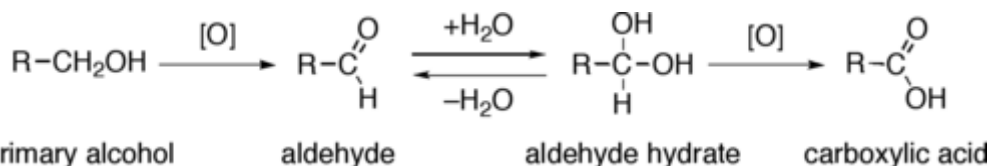


# Alcohol oxidation

**Alcohol oxidation** is an important organic reaction.

The indirect oxidation of primary alcohols to carboxylic acids normally proceeds via the corresponding aldehyde,

which is transformed via an **aldehyde hydrate** ( $\text{R-CH(OH)}_2$ ) by reaction with water. The oxidation of a primary alcohol at the aldehyde level is possible by performing the reaction in absence of water, so that no aldehyde hydrate can be formed.



Mechanism of oxidation of primary alcohols to carboxylic acids via aldehydes and aldehyde hydrates

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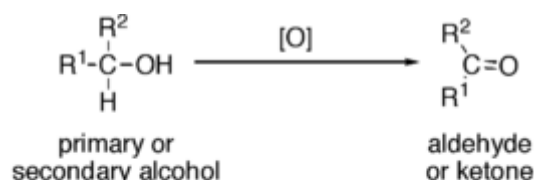
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## Oxidation to aldehydes

Oxidation of alcohols to aldehydes is partial oxidation; aldehydes are further oxidized to carboxylic acids. Conditions required for making aldehydes are heat and distillation. In aldehyde formation, the temperature of the reaction should be kept above the boiling point of the aldehyde and below the boiling point of the alcohol.

Reagents useful for the transformation of primary alcohols to aldehydes are normally also suitable for the oxidation of secondary alcohols to ketones. These include:

- [Chromium-based reagents](#), such as [Collins reagent](#) ( $\text{CrO}_3 \cdot \text{Py}_2$ ), [PDC](#) or [PCC](#).
- [Sulfonium species](#) known as "activated [DMSO](#)" which can result from reaction of [DMSO](#) with [electrophiles](#), such as [oxalyl chloride](#) ([Swern oxidation](#)), a [carbodiimide](#) ([Pfitzner-Moffatt oxidation](#)) or the complex  $\text{SO}_3 \cdot \text{Py}$  ([Parikh-Doering oxidation](#)).
- [Hypervalent iodine compounds](#), such as [Dess-Martin periodinane](#) or [2-Iodoxybenzoic acid](#).
- [Catalytic TPAP](#) in presence of excess of [NMO](#) ([Ley oxidation](#)).
- [Catalytic TEMPO](#) in presence of excess [bleach](#) ( $\text{NaOCl}$ ) ([Oxoammonium-catalyzed oxidation](#)).



[O]= chromium-based reagent, activated DMSO, hypervalent iodide compound, TPAP or TEMPO

R<sup>1</sup>= alkyl or aryl substituent

R<sup>2</sup>= hydrogen, alkyl or aryl substituent

Oxidation of alcohols to aldehydes and ketones



[oi.org/10.1021%2Fjacs.8b08748](https://doi.org/10.1021%2Fjacs.8b08748)). PMC 6645702 (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6645702>). PMID 30400740 (<https://pubmed.ncbi.nlm.nih.gov/30400740>).

2. Stevens, Robert; Chapman, Kevin T.; Weller, Harold N. (1980). "Convenient and inexpensive procedure for oxidation of secondary alcohols to ketones". *Journal of Organic Chemistry*. **45** (10): 2030–2032. doi:10.1021/jo01298a066 (<https://doi.org/10.1021%2Fjo01298a066>).

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