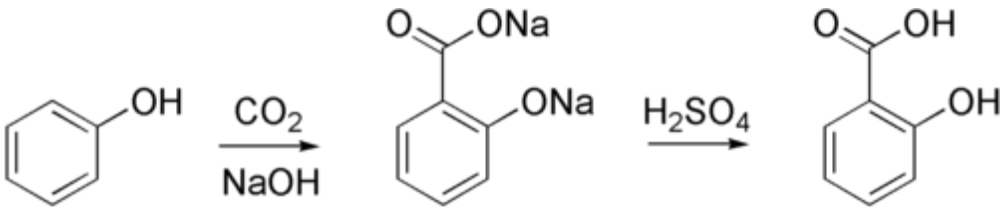
Kolbe–Schmitt reaction

The **Kolbe–Schmitt reaction** or **Kolbe process** (named after Hermann Kolbe and Rudolf Schmitt) is a carboxylation chemical reaction that proceeds by heating sodium phenoxide (the sodium salt of phenol) with carbon dioxide under pressure (100 atm, 125 °C), then treating the product with sulfuric acid. The final product is an aromatic hydroxy acid which is also known as salicylic acid (the precursor to aspirin).[1][2][3][4]

Kolbe–Schmitt reaction	
Named after	Hermann Kolbe Rudolf Schmitt
Reaction type	Addition reaction
Identifiers	
Organic Chemistry Portal	kolbe-schmitt-reaction
RSC ontology ID	RXNO:0000182

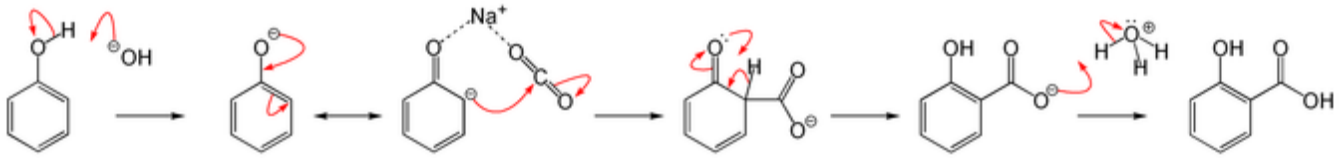


By using potassium hydroxide, 4-hydroxybenzoic acid is accessible, an important precursor for the versatile paraben class of biocides used e.g. in personal care products.

The methodology is also used in the industrial synthesis of 3-hydroxy-2-naphthoic acid. The regiochemistry of the carboxylation in this case is sensitive to temperature.[5]

Reaction mechanism

The Kolbe–Schmitt reaction proceeds via the nucleophile addition of a phenoxide, classically sodium phenoxide ($NaOC_6H_5$), to carbon dioxide to give the salicylate. The final step is reaction of the salicylate with acid to form the desired salicylic acid.



References

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salicylic acid]. *Annalen der Chemie und Pharmacie*. **113** (1): 125–127. doi:10.1002/jlac.18601130120 (https://doi.org/10.1002%2Fjlac.18601130120).
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3. A. S. Lindsey and H. Jeskey (1957). "The Kolbe-Schmitt Reaction". *Chem. Rev.* **57** (4): 583–620. doi:10.1021/cr50016a001 (https://doi.org/10.1021%2Fcr50016a001). (Review)
4. R. T. Morrison and R. N. Boyd (1983). *Organic Chemistry* (https://archive.org/details/organicchemistry04morr/page/976) (4th ed.). Allyn and Bacon. p. 976-7 (https://archive.org/details/organicchemistry04morr/page/976). ISBN 0-205-05838-8.
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External links

- [1] (http://www.mjlphd.net/translations.html) English Translation of Kolbe's seminal 1860 German article in Annalen der Chemie und Pharmacie that describes the discovery of this reaction. English title: 'On the syntheses of salicylic acid'; German title "Ueber Synthese der Salicylsäure".
- [2] (https://commons.wikimedia.org/wiki/File:K_S_startAnimGif.gif) An animation of the reaction mechanism.
