

# Sinapine: Nature's Multi-Purpose Compound

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Sinapine hydrogen sulfate is a natural compound found in mustard plants (genus Brassica) and belongs to the class of phenolic compounds known as sinapates. It is primarily found in the seeds and leaves of mustard plants, including Indian mustard (*Brassica juncea*) and brown mustard (*Brassica nigra*). Sinapine hydrogen sulfate, also known as sinapine or sinapoylcholine, is a conjugate of choline and sinapic acid. It is typically present in mustard seeds as a salt form, with hydrogen sulfate (sulfate) being the most common counterion.

## Characteristics features

### Chemical Structure

Sinapine hydrogen sulfate has the chemical formula  $C_{20}H_{23}NO_6S$  and a molar mass of approximately 413.46 g/mol. It consists of a choline molecule esterified with sinapic acid and a sulfate group.

### Biological Role

Sinapine is involved in the defense mechanisms of mustard plants. It plays a role in protecting the seeds against pathogens, pests, and environmental stressors. It has antimicrobial and antifungal properties, which help in seed protection.

### Health Benefits

Sinapine has gained attention for its potential health benefits. It exhibits antioxidant properties, which can help neutralize harmful free radicals and protect against oxidative damage in the body. Additionally, sinapine may have anti-inflammatory and anticancer properties, although further research is needed to fully understand its effects on human health.

### Food and Industrial Applications

Sinapine is predominantly present in mustard seeds, and its content can vary among different mustard varieties. In the food industry, mustard seeds are commonly used as a spice, condiment, or as a source of mustard oil. Sinapine may contribute to the flavor and aroma of mustard products.

## Distribution of Sinapine in oilseeds brassica

It's important to note that these are general estimates, and the actual sinapine content may vary among different cultivars and growing conditions. Additionally, sinapine levels can be influenced by various factors such as agronomic practices, geographic location, and seed developmental stage.

***Brassica napus* (rapeseed/canola):** Sinapine content in rapeseed can range from approximately 0.1% to 2% of the seed weight, with some cultivars having higher levels.

***Brassica juncea* (Indian mustard):** Indian mustard seeds generally have higher sinapine content compared to rapeseed. Sinapine levels in Indian mustard can range from about 1% to 3% of the seed weight.

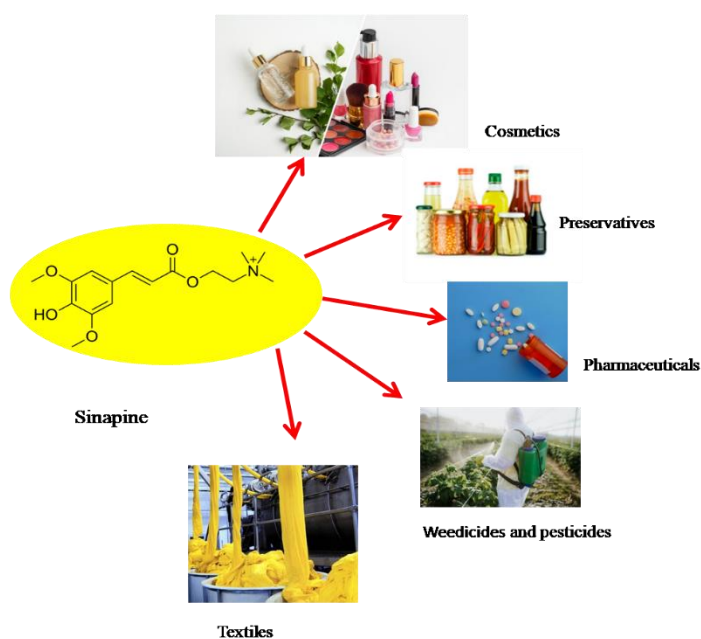
***Brassica rapa* (turnip rape):** Sinapine content in turnip rape can vary, but it is generally lower compared to rapeseed and Indian mustard. The estimated range is around 0.1% to 1% of the seed weight.

***Brassica carinata* (Ethiopian mustard):** Ethiopian mustard seeds are known to have relatively higher sinapine content compared to some other Brassica species. The estimated range is around 1% to 3% of the seed weight.

***Brassica nigra* (black mustard):** Black mustard seeds typically have higher sinapine content compared to other Brassica species. The estimated range is around 1% to 3% of the seed weight.

***Brassica hirta* (white/yellow mustard):** White/yellow mustard seeds generally have lower sinapine content compared to black mustard. The estimated range is around 0.5% to 1.5% of the seed weight.

***Brassica campestris* (field mustard):** Sinapine content in field mustard can vary, but it is generally lower compared to black mustard. The estimated range is around 0.5% to 1.5% of the seed weight.



Outline on the value products of sinapine

**Selected references**

Uzunova, M., Stefanova, V., & Georgieva, V. (2015). Study on the chemical composition of rapeseed (*Brassica napus* L.) seed meal from Bulgarian cultivars. *Journal of Agricultural Science and Technology*, 17(3), 653-662

Singh, S., Singh, P., & Sharma, T. R. (2014). Biological Activities of Sinapine Derivatives: A Review. *International Journal of Food Properties*, 17(6), 1180-1193.

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Table 1: Value added products of Sinapine

Value added products		References
<b>Cosmetic Industry</b>	Sinapine is utilized in cosmetic formulations for its skin-brightening and anti-aging effects.	Lee, S.Y. et al. (2015). Effect of sinapine on melanogenesis in B16F10 melanoma cells. <i>Biological and Pharmaceutical Bulletin</i> , 38(3), 405-411.
<b>Food and Beverage Industry</b>	Sinapine is used as a natural antioxidant and antimicrobial agent in food preservation and packaging.	Wei, H. et al. (2017). Antioxidant and antimicrobial activities of sinapine extracted from <i>Brassica napus</i> L. <i>Journal of Food Science and Technology</i> , 54(3), 604-611.
<b>Pharmaceutical Industry</b>	Sinapine exhibits potential therapeutic effects, including anti-inflammatory, anticancer, cardioprotective, and neuroprotective properties.	Wang, T. et al. (2013). Sinapine, a potential anti-inflammatory agent, attenuates colon inflammation in a mouse model of acute colitis. <i>Food and Chemical Toxicology</i> , 59, 533-541
<b>Agricultural Industry</b>	Sinapine can be used as a biopesticide or allelopathic compound to control weed growth and protect crops from pests.	Zhu, Z. et al. (2015). Allelopathic effects of sinapine on the germination and growth of wheat ( <i>Triticum aestivum</i> ) and radish ( <i>Raphanus sativus</i> ). <i>Pesticide Biochemistry and Physiology</i> , 118, 9-14.
<b>Textile Industry</b>	Sinapine can be used as a natural dye for textile coloring due to its yellowish-brown colour.	X. et al. (2019). Dyeing properties and fastness of sinapine extracted from rapeseed meal. <i>Textile Research Journal</i> , 89(2), 283-293.

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