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Application Note

As published in "The Handbook of Analytical Methods for Dietary Supplements"

0034 - Boswellia for Boswellic Acids by HPLC

Botanical Name: *Boswellia serrata*

Common Names: Boswellin, Indian frankincense

Parts of Plant Used: Gum resin

Uses: Treatment of inflammatory and arthritic disease; as anticancer agent

Modes of Action:

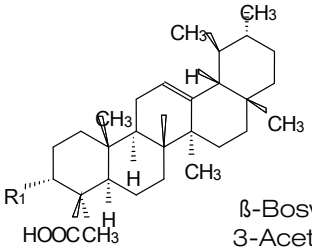
Promising results were found in clinical trials in patients with bronchial asthma, chronic colitis, Crohn's disease, osteoarthritis of the knee, rheumatoid arthritis, and ulcerative colitis.[1–5] The pentacyclic triterpene acids, namely boswellic acids, in the gum resin are believed to be the anti-inflammatory components. Boswellic acids were found to suppress leukotriene synthesis via inhibition of 5-lipoxygenase, which was considered as the main mechanism for its anti-inflammatory activity.[6–8] Recently, the gum was found to be an anticancer agent and to trigger apoptosis.[9–14]

Chemistry and Chemical Markers for Quality Control:

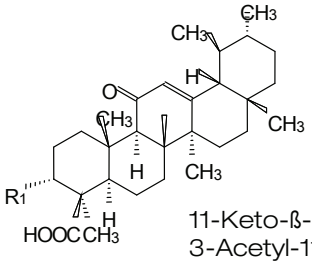
Boswellic acid type pentacyclic triterpene acids are the major components in boswellia gum, the identified boswellic acids include α-boswellic acid, ß-boswellic acid, 11-keto-ß-boswellic acid, 3-α-acetyl-11-keto-ß-boswellic acid, 3-acetyl-α-boswellic acid, 3-acetyl-ß-boswellic acid, 3-α-acetyl-20(29)-lupene-24-oic acid, 3-α-acetyl-9,11-dehydrox-ß-boswellic acid, and 3-α-acetyl-9,11-dehydro-α-boswellic acid.[15–18]

Other compounds purified from boswellia gum included tetracyclic triterpenes, diterpene (serratol), and saponins.[19–21] The essential oil from gum was found to contain d-α-thujene and p-cymene as the main components. Other minor compounds (ß-pinene, d-limonene, linalool, terpineol, methylchavicol, terpinyl acetate, cadinene, geraniol, and elemol) were also isolated from the oil.[22] As the boswellic acids are the bioactive components in *Boswellia*, they are used as marker compounds for quality control of boswellic gum; usually, six boswellic acids are analyzed: α-boswellic acid, ß-boswellic acid, 11-keto-ß-boswellic acid, 3- -acetyl-11-keto-α-boswellic acid, 3-acetyl-α-boswellic acid, and 3-acetyl-ß-boswellic acid.

Major Boswellic Acids in *Boswellia*:



ß-Boswellic acid: R_1=OH
3-Acetyl-ß-boswellic acid: R_1=OAc



11-Keto-ß-boswellic acid: R_1=OH
3-Acetyl-11-keto-ß-boswellic acid: R_1=OAc

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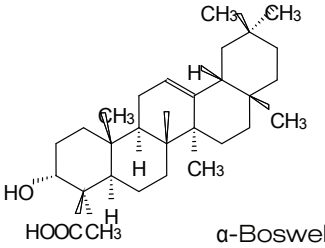
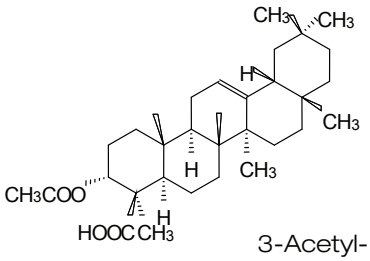


α-Boswellic acid



3-Acetyl- -boswellic acid

Methods of Analysis:

Very few methods have been officially published for analysis of *Boswellia*. One accepted HPLC method and several TLC methods have been published for analysis of boswellic acid content in boswellia gum.[18,23,24]

Method 1:

The HPLC method of Ganzera and Khan[18] can be used to analyze six boswellic acids: α-boswellic acid, ß-boswellic acid, 11-keto-ß-boswellic acid, 3-α-acetyl-11-keto-ß-boswellic acid, 3-acetyl-α-boswellic acid, and 3-acetyl-ß-boswellic acid.

Sample Preparation:

Sonicate 100 mg of pure resin or 500 mg of market product in 3 mL of methanol for 10 minutes. Centrifuge and take out the supernates, and repeat the procedures two times. Transfer the supernates to a 10-mL volumetric flask and dilute to 10 mL with methanol.

Chromatography:

Column: Phenomenex Synergi MAX-RP-80 A, 4-µm, 150 × 4.6 mm.
Mobile phase: Solvent A = water (containing 0.05% phosphoric acid), solvent B = acetonitrile (containing 0.05% phosphoric acid).
Gradient: 0 to 7 minutes isocratic 35%A and 65%B, then in 28 minutes to 10%A and 90%B and keep this composition for 5 more minutes. Follow by 100%B washing for 5 minutes.
Flow rate: 1.0 mL/minute
Injection volume: 10 L
Detection wavelength: 210 nm
Column temperature: 60°C

Validation Data:

Linearity: 8 to 500 mcg/mL with a correlation coefficient of 0.999 for all six compounds.
Accuracy: The percent recovery was between 97.2 and 100.1 for six marker compounds.
Precision: Maximum RSD was 3.28%.
Selectivity: Peak identification was determined against standards.
Ruggedness: Not specified
Robustness: Not specified
LOD/LOQ: The limit of detection was at least 0.90 mcg/mL or lower.

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