

Various extraction and analytical techniques for isolation and identification of secondary metabolites from *Nigella sativa* seeds

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Abstract

Nigella sativa L. (black cumin), commonly known as black seed, is a member of the Ranunculaceae family. This seed is used as a natural remedy in many Middle Eastern and Far Eastern countries. Extracts prepared from *N. sativa* have, for centuries, been used for medical purposes. Thus far, the organic compounds in *N. sativa*, including alkaloids, steroids, carbohydrates, flavonoids, fatty acids, etc. have been fairly well characterized. Herein, we summarize some new extraction techniques, including microwave assisted extraction (MAE) and supercritical extraction techniques (SFE), in addition to the classical method of hydrodistillation (HD), which have been employed for isolation and various analytical techniques used for the identification of secondary metabolites in black seed. We believe that some compounds contained in *N. sativa* remain to be identified, and that high-throughput screening could help to identify new compounds. A study addressing environmentally-friendly techniques that have minimal or no environmental effects is currently underway in our laboratory.

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