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The role of volatile sulphur compounds in the flavour profile of rapeseed oil and application in variety selecting and processing

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Background:

Rapeseed (*Brassica napus*) oil is enjoyed for its unique aroma. Flavor attributes are one of the most important criteria for consumers. Sensory evaluation, including nutty, burnt, pickled, pungent, green, and fatty-like notes were confirmed as the main aroma notes of fragrant and cold-pressed rapeseed oil. However, the characteristic of aroma-active compounds and changes during oil processing is still unclear.

Objective:

It is necessary to apply the research methods of molecular sensory science to the flavour analysis of rapeseed oil. The aim was to analyse the flavour composition of rapeseed oil by combining conventional and unconventional methods to identify the key odorant. In addition, the impact of varieties and processes on key aromas were investigated.

Methods:

Conventional analyses of aroma-active compounds by solvent-assisted flavour evaporation, HS-SPME combined with GC×GC-TOFMS, and GC-O were performed. An innovative method was established for the quantitation of volatile sulphur compounds by sulphur chemiluminescence detection. Meanwhile, the contribution of important volatile sulphur compounds (VSCs) to the whole flavour was determined by OAV calculation. All the aroma-active compounds were further taken through a dilution analysis (AEDA), and aroma reconstitution. Key odorant differences between different *B. napus* oils also with cold-pressed and fragrant pressed rapeseed oil were compared.

Results:

Ninety-three odorants were identified as aroma-active compounds with flavour dilution (FD) factors ranging from 1 to 6561. Moreover, 63 key compounds exhibited their odour activity values (OAVs) to be greater than 1. Similarities in rapeseed oil recombinant systems were of 83−87%, hence, neglected sulphur compounds were detected via SCD method. Some new sulphur compounds were found such as methyl furfuryl disulphide, phenylmethanthiol, 3-sulfanyl-1-hexanol, 2-methyl-3-furanthiol et al. Rapeseed oils enriched with higher sulphur compounds presented stronger pungent and pickled notes. The key odour differences were primarily attributed to the concentration of 3-butenenitrile, 4-(methylsulfanyl)butanenitrile, 5-(methylsulfanyl)pentanenitrile, 3-isothiocyanato-1-propene, dimethyl trisulfide, and others. In the types of fragrant rapeseed oil production, microwave can effectively promote the formation of sulphur compounds, thereby exacerbating the sensation of pickled and pungent-like.

Conclusions:

Flavour generation of the rapeseed oil depends on certain isothiocyanates, nitriles, alcohols, aldehydes, acids, ketones, pyrazines, and small-molecule sulphur-containing compounds. 2,5-dimethylpyrazine, dimethyl trisulfide, 3-ethyl-2,5-dimethylpyrazine, 3-butenyl isothiocyanate, and other substances have been shown to impart the unique flavour of rapeseed oil. However, the pathways for volatiles formation are complex. Volatile glucosinolate degradation and sulfur compounds still play an important role in the aroma notes in rapeseed oil and determine the attributes and profiles of flavour. Specially, thiols (phenylmethanthiol, 3-sulfanyl-1-hexanol, 2-methyl-3-furanthiol, and 2-furylmethanthiol) were newly identified in microwaved rapeseed oil, and cause sesame, roasted meat, and garlic odors. Further, perceptual interactions between volatile thiols and characteristic odor were evaluated by Feller's addition model and S-curve method, which revealed that 2-methyl-3-furanthiol, 2-furylmethanthiol, phenylmethanthiol, and 3-sulfanyl-1- hexanol present a positive effect with pyrazine. This allows different varieties to produce different flavor types. This study provides deep insights into the impact of sulfur-containing compounds on the aroma of rapeseed oil.