



## **Analysis of volatile compounds in fermented soybeans prepared by *Bacillus subtilis* and *Rhizopus oligosporus***

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Fermented soybeans are traditional foods widely consumed in many countries (*i.e.*, *Natto* in Japan, *Jang* in Korea, *Kinema* in India, *Douichi* in China, and *Thua Nao* in Thailand). In this study, an attempt was made with an expectation to improve the fermentation process using a co-culture of *Bacillus subtilis* and *Rhizopus oligosporus*. Initially, the raw soybeans were washed, sterilized by autoclaving, and inoculated with two inocula; for this, three different ratios between *B. subtilis* and *R. oligosporus* used were 100:0, 50:50, and 0:100. The fermentation was then carried out at 30°C for 3 days. The volatile compounds in the non-fermented and the fermented soybean products were extracted using a solid phase microextraction (SPME) fiber assembly DVB/CAR/PDMS and determined by gas chromatography/mass spectrometry (GC/MS) with two replicates. In total, 165 compounds were identified in the non-fermented and the fermented soybean products. For the non-fermented products, the predominant volatile compounds were alcohols (26%), aldehydes (14%), acids and esters (8%), furans (6%) and ketones (1%). In contrast, the major volatiles compounds presented in the fermented soybeans were as follows: i) The treatment of 100:0 consisted of acids and esters (36%), alcohols (15%), aldehydes (9%), ketones (5%), pyrazines (5%), and furans (4%); ii) 50:50 comprised of acids and esters (56%), alcohols (16%), aldehydes (8%), pyrazine (4%), ketones (3%), furans (2%), and aromatic compounds (1%); and iii) 0:100 included acids and esters (67%), alcohols (15%), aldehydes (3%), ketones (3%), furans (2%), aromatic compounds (2%), and pyrazines (1%) respectively.

**Keywords:** *Bacillus subtilis*; fermented soybean; *Rhizopus oligosporus*; volatile components