Volatile aroma components of Thai fish sauce in relation to product categorization

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ABSTRACT: Numerous investigations on aroma characteristics of fish sauce in particular samples have been conducted extensively; however, the relation of those volatile aroma profiles and aroma characteristics to quality and categorization of the product have never been reported. This study explored the contribution of volatile aroma components on product quality categorization of 52 Thai fish sauce samples. First, odour-active compounds were investigated by dynamic headspace gas chromatography–olfactometry (GC-O) from eight selected samples with four different qualities, including mature–unblended samples, premium-grade samples, first-grade samples and second-grade samples. Eleven odour-active compounds, i.e. acetic acid, propanoic acid, 2-methylpropanoic acid, butanoic acid, 3-methylbutanoic acid, dimethyl trisulfide, 3-(methylthio)propanal, 1-octen-3-ol, 2-butanol, trimethylamine and n-propanol, contributed to the aroma characteristics of Thai fish sauce. A combination score was assigned to express the integration of flavour dilution on dynamic headspace dilution analysis and intensity of odour perceived on GC-O. The combination scores were analysed with principal component analysis to categorize these eight selected samples. Furthermore, these odour-active compounds detected as released volatile compounds from 52 fish sauce samples were applied for categorization of 52 samples. As a result, both combination scores and relative concentrations of these odour-active compounds could discriminate the fish sauce products according to their conventional grading which is based on total nitrogen of the sample. Copyright © 2011 John Wiley & Sons, Ltd.

Keywords: fish sauce; volatile aroma profiles; odour-active compounds; gas chromatography–olfactometry; principal component analysis

Introduction

Fish sauce is protein hydrolysate derived from fermenting fish with salt for several months and consumed as a condiment. During fermentation, fish protein is gradually digested by indigenous proteolytic enzymes (i.e. cathepsins, pepsin, trypsin, chymotrypsin, and elastase) originated from fish tissues and proteinase from microflora.[1,2] Apart from protein hydrolysis, various biochemical and chemical changes (e.g. lipid degradation, breakdown of carbohydrates, amino-carbonyl reaction) and microbial metabolism occur.[3–5] These lead to the formation of the characteristic aroma of fish sauce. Thus, the aroma of the product depends on raw material fish and process conditions as well as environmental climate. Fish sauce is produced in various Asian countries such as Thailand, Japan, Korea, China, the Philippines, Indonesia, Malaysia, Vietnam, Cambodia and Myanmar.[6,7] Among these countries, Thailand is the major fish sauce producer and various qualities of the fish sauce products are available in the market.[6,7]

Thai fish sauce, or Nampla, is traditionally and commercially made by mixing three parts of small whole fish (Stolephorus or Sardinella species) with one or two parts of marine salt, and then transferred to a large concrete tank. The fish are preserved with ice and marine salt since catching and while delivering to fish sauce manufacturers. The mixture is further heavily topped with salt and left to naturally ferment for 8 to 12 months to obtain its distinctive aroma. The mature fish sauce obtained by filtration is bottled as finished goods or blended with some ingredients to obtain finished products. Salt brine can be added to a left-off mash for up to three leachings and aged to produce lower quality fish sauce.[7] In practice, the quality and price of Thai fish sauce are determined by its nitrogen content.[8,9] The standard of Thai fish sauce is officially graded into first and the second grade based on total nitrogen content above 20 g/l and 15 g/l, respectively.[9] Moreover, premium grade, as claimed by some manufacturers, is the product with a nitrogen content above 20 g/l and fermented for more than 18 months. Apart from the nitrogen content, aroma characteristics relevant to the quality standard of Thai fish sauce are of interest because consumers can differentiate the aroma of high quality fish sauce.[7,10] The possibility of using volatile aroma components as parameters for product categorization was investigated because aroma profiles are directly related to the aroma characteristics of fish sauce.[5–7] Up to now, various studies have clarified fish sauce aroma characteristics in particular samples, but there is no report on how these volatile aroma characteristics relate to product quality and categorization. This work investigated volatile aroma components of each quality grade of fish sauce, and demonstrated the product categorization of fish sauce based on odour-active compounds.