

INFLUENCE OF SPICE EXTRACTS ON THE BIOGENIC AMINE FORMATION OF HARBIN DRY SAUSAGE

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I. INTRODUCTION

Biogenic amines (BAs) are by-products of deliberate and accidental bacterial contamination, such as fermented and spoiled food. The excess of BAs in the food will be hazardous to the nervous and cardiovascular systems. Therefore microbial contamination in food should be avoided to reduce the production of BAs. Spice extracts, such as cinnamon, clove, and anise are well known for their antimicrobial activity[1], which can be used to inactivate microorganisms. Therefore, the purpose of this study investigate the inhibition of spice (cinnamon, clove, and anise) alcohol extracts on BA accumulation in dry sausage.

II. MATERIALS AND METHODS

Harbin dry sausages were prepared according to Sun et al. [2]. Four groups of dry sausages were prepared. The control group did not contain spice extracts, and the other three groups received alcohol extracts of cinnamon, clove, and anise. Analysis of the BAs by HPLC was performed according to the procedure developed by Sun et al. [3]. The confidence interval was set at 95% ($P < 0.05$). Principal component analysis (PCA) was performed using SPSS 22.0. Physicochemical properties, microorganism and sensory quality used in the principal component analysis have been given in another ICOMST paper [3].

III. RESULTS AND DISCUSSION

Six BAs (cadaverine, putrescine, tyrosamine, 2-phenylethylamine, histamine, and tryptamine) were detected and quantified during fermentation (Fig. 1). The cadaverine content in sausages with spice extracts was less than that in the control ($P < 0.05$), with cinnamon being the most effective in inhibiting the formation of cadaverine ($P < 0.05$). The addition of spice extracts inhibited the formation of putrescine (Fig. 1B), especially cinnamon extract, which significantly reduced the production of putrescine by 18.93% compared to the control at 9 days ($P < 0.05$). What's more, spice extracts showed good inhibitory effects on histamine, and sample with cinnamon extract was 21.89% lower than that of the control ($P < 0.05$) at 9 days. Changes in tyramine, 2-phenylethylamine and tryptamine contents showed a similar trend.

The results of PCA revealed that the first two principal components explained 98.99% of the total variance in date (90.39% PC1 and 8.60% PC2). As shown in Fig 2, the control distributed on the positive side close to tyramine, putrescine, cadaverine, histamine, 2-phenylethylamine, tryptamine, total aerobic bacteria, LAB, enterobacteriaceae, moisture, water activity, pH, TVB-N, and TBARS, suggesting high levels in the control. While cinnamon, anise, and clove were scattered on the negative side, indicating low levels of the above parameters in them. This confirms the speculation that spice extracts effectively inhibited the accumulation of BAs. Furthermore, putrescine, cadaverine, histamine, and tryptamine were close to enterobacteriaceae. It is hypothesized that enterobacteriaceae are primarily responsible for the accumulation of BAs.

IV. CONCLUSION

The results of this study showed that spice extracts (especially cinnamon) had great inhibition effects on BAs in dry sausage. There was a close correlation between microorganisms (enterobacteriaceae and total aerobic bacteria) and BAs. Thus, to avoid excess BAs, the addition of spice extracts (especially cinnamon) is an advisable method for dry sausage production.

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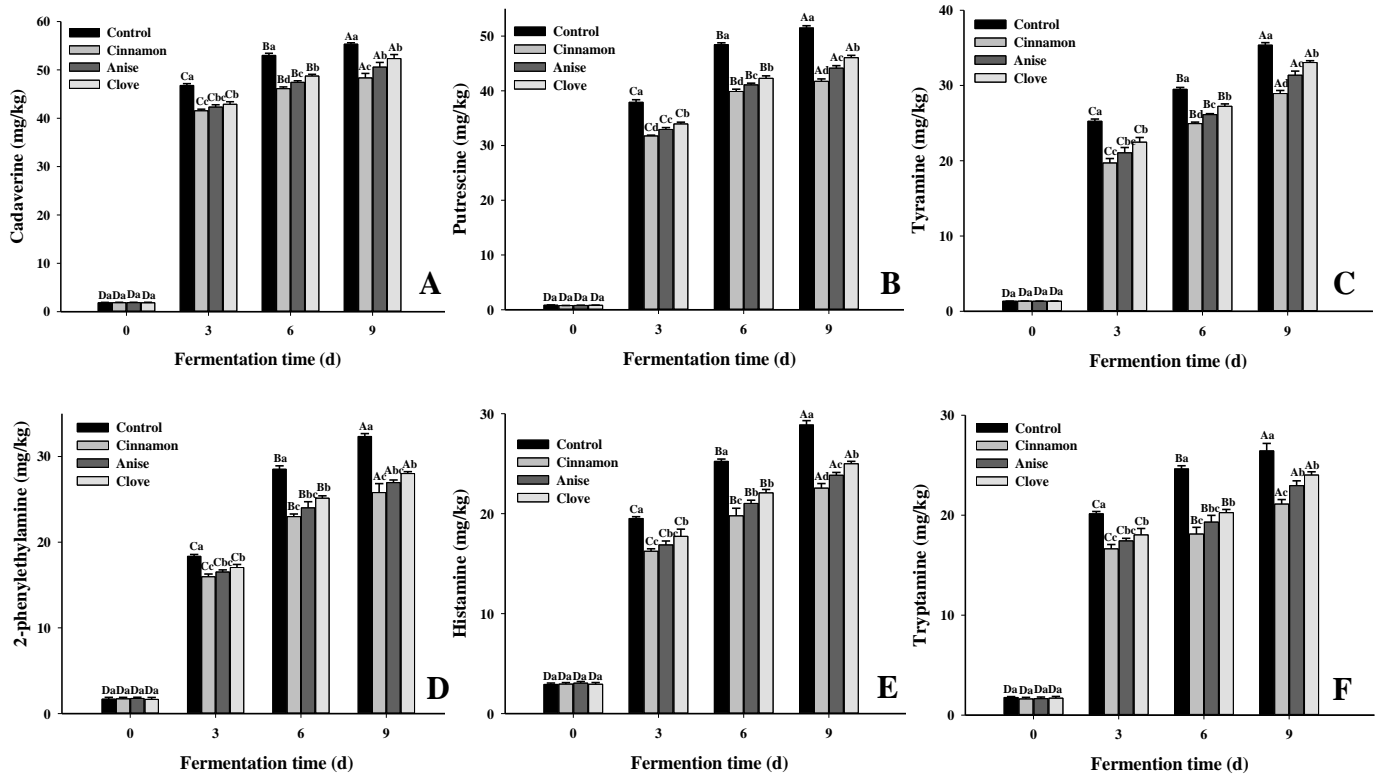


Fig.1 Influence of spice extracts on the biogenic amines of dry sausage during fermentation. Means in the same sausage group with different uppercase letters (A to D) differ significantly ($P < 0.05$); means between sausage groups on the same days with different lowercase letters (a to d) differ significantly ($P < 0.05$).

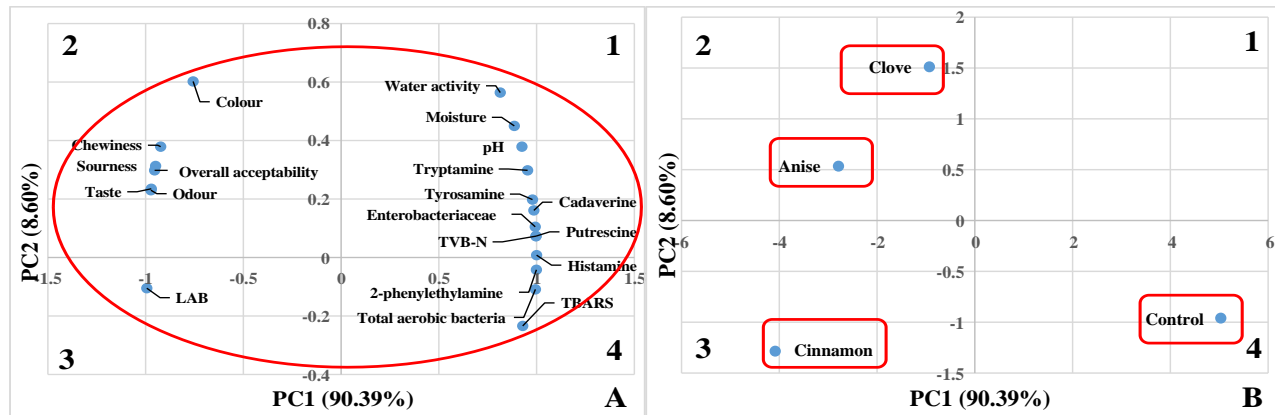


Fig.2 Principal component analysis (PCA) of biogenic amines, physicochemical properties, microorganism, and sensory quality of dry sausages. Weighed PCA bi-plot of scores and loadings for first two principal components.

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