Studies on the simulation of the flavor formation of fried garlic by model reactions

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ABSTRACT

Allium vegetables, including garlic, onion and shallot, contain nonvolatile flavor precursors, i.e. S-alk (en)yl-L-cysteiene sulfoxides in the intact cells. After the cellls are physically break down, these precursors can be transformed into alk (en)yl thiosulfinates, the primary flavor compounds of allium vegetables, and contributing the fresh flavor of allium vegetables. On heating of garlic slice or homogenate, the primary flavor compounds can further transformed into mercaptans, sulfides, disulfides, polysulfides, or thiophenes, the second flavor compounds. When the garlic cloves were blanched to deactivate flavor enzymes, the alk(en)yl sulfoxides can be retained in the cells. These sulfoxides can further be transformed into cysteine, allyl alcohol, acetaldehyde, propanal, and the above sulfur-containing volatile compounds or conducting Maillard reactions with sugars during high temperature thermal processing of garlic cloves. In this thesis, flavor precursors of garlic (alliin, deoxyalliin), primary flavor compounds of garlic (allicin), and secondary flavor compounds of garlic (cysteine, allyl alcohol, allyl mercaptan, propanal, and acetaldehyde) were used to react with glucose in vegetable oil to study the flavor generation of fried garlic and to study the possibility of using these compounds to prepare fried garlic flavor. This thesis includes five major parts. In the first part of this thesis the volatile compounds of fried peeled garlic, fried unpeeled garlic, and fried blanched peeled garlic were isolated and studied. In the second part of this thesis, garlic essential oil was used to react with cysteine and glucose in vegetable oil in a close reactor. The volatile compounds generated were then isolated and fractionated using an acid/base fractionation method. In the third part of this thesis the volatile compound in fried peeled garlic and fried blanched peeled garlic were isolated and fractionated using an acid/base fractionation method. In the fourth part of this thesis, alliin, deoxyalliin, and allicin were synthesized and then react with glucose in vegetable oil in a close reactor. The volatile compounds generated were then isolated and studied. In the fifth part of this thesis, allyl alcohol, allyl mercaptan, propanal, and acetaldehyde were used to react with cysteine, proline, and glucose in vegetable oil in a close reactor. The volatile compounds generated were then isolated and studied. The followings were some major findings in the thesis: 1.Using initial oil temperature 180 C and final temperature 145 C can prepare more favorite fried garlic slices. 2 Allyl mercaptan was found to have antioxidant properties and inhibit maillard type reaction. 3.Alliin, deoxyalliin, and allicin were synthesized and confirmed with high purity using FTIR and TLC in this thesis. 4.Volatile compounds identified in the thermal reaction or degradation solution of alliin, deoxyalliin, or allicin with or without glucose can be classified into those mainly degraded from the themselves, those mainly degraded from lipid, those mainly generated from Maillard reactions. 5.Blanching treatment can deactivate flavor enzymes and retained most of the nonvolatile flavor precursors to generate more volatile compounds in fried blanched garlic slices. 6.In the flavor study of the model reaction system of allyl alcohol, glucose, proline, and cysteine, allyl mercatan was found to affect the oil degradation differently. 7.More furn-type compounds, thiazoles, and thiophenes were found in the model reaction system of allyl mercaptan + cysteine + proline + glucose + propanal + acetaldehyde. These furan-type compounds were proposed to generate from the condensation of propanal and acetaldehyde. Thiazoles and thiophenes were proposed to generate from the condensation of aldehydes and mercaptans. 8.Most of volatile compounds generated from alliin or deoxyalliin model reaction system was mainly acyclic sulfur- containing compounds. Addition of glucose significantly affect the flavor composition of the model reaction systems.

Keywords : simulation ; model reaction

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