

An aroma product comprising flavoring compounds.

5 The present invention concerns an aroma product comprising flavoring compounds and the use of said aroma product.

10 The Maillard reaction is well known in the food area as being a non enzymatic browning. This type of reaction is of primary importance in food industry since it is one of the most important routes to production of flavour, taste and color in cooked food. This type of reaction occurs in a mixture where amino acids together with reducing sugars are heated and react together to give a very broad range of compounds : this range can be as large as comprising near
15 to 200 different compounds. In the food technology, it is already known to induce a Maillard reaction for the production of a certain range of aroma compounds. The US Patent No. 4'466'986 for example concerns a process for the production of a flavoring agent resembling in taste meat,
20 fish or mushrooms, wherein a liquid protein hydrolysate is reacted with at least one monosaccharide by heating. The reaction is carried out in water. The problem with this type of reaction in purely aqueous medium is that firstly the yield of the reaction is not very high and secondly it
25 is not possible to obtain a very broad range of aroma compounds.

Furthermore, it is possible to obtain through thermal degradation of aroma precursors flavor compounds. The
30 problem with this type of reaction is the same as for the Maillard reaction, that is, firstly the yield of the thermal reaction is not very high and secondly it is not possible to obtain a very broad range of aroma compounds.

35 According to prior art, surfactants self-associate when dissolved into aqueous solutions and form a variety of

structures ranging from micelles to mesomorphic structures (also called mesophases) such as lamellar, hexagonal, cubic or β -crystalline phases. Such phases are mainly used so far in foodstuffs as structuring or fat replacing agents (WO 5 92/09209, WO 94/07377, WO 95/35035). The molecular arrangement of the surfactant molecules with the aqueous phase is used to give the product its viscosity and consistency. In order to get rid of the off-taste, which especially is apparent if the edible surfactant is a 10 monoglyceride and present in a mesomorphic phase, low levels of sweetening agents can be added (WO 94/07377). Other applications of monoglycerides in Food Systems are summerized in E. Boyle : "Monoglycerides in Food Systems : Current and Future Uses" FOOD TECHNOLOGY, vol 51, No. 8- 15 1997, pages 52-59. However, the use of mesomorphic structure to generate food flavours was not mentioned so far.

On the contrary, the EP Patent No. 486'822 concerns the 20 generation of food flavours. But this patent concerns a process for preparing flavourant which comprises heating at an elevated temperature an aqueous mixture of a phospholipid, amino acid source and a reducing sugar. However, the flavour generation is not related to the 25 presence of the mesomorphic structures formed due to the presence of the edible surfactant.

The invention concerns the use of self-aggregated structures made out of edible surfactants, as a boosting 30 agent for flavour generation in Maillard reactions or thermal degradation reactions. The incorporation of flavour precursor molecules into the microstructures aims at increasing the reaction yield, extending the obtained reaction compounds and in stabilizing relatively unstable 35 reaction compounds after their generation.

The invention concerns an aroma product comprising flavoring compounds , obtainable through a process comprising :

- 5 - dissolving in water amino acids, peptides or hydrolyzed proteins and reducing sugars or dissolving in water aroma precursors,
- introducing in said solution an edible surfactant taken in the group consisting of a monoglyceride and a phospholipid,
- 10 - heating the obtained mixture to have a mesomorphic phase structure or a microemulsion,
- maintaining said heating to develop flavoring compounds
- and cooling said mixture.

15 In the case of a mixture of amino acids, peptides or hydrolyzed proteins and reducing sugars, it is the Maillard reaction which takes place. In the case of aroma precursors, it is a thermal degradation which takes place.

20 The mesomorphic phase which is obtained can be a microemulsion, a lamellar liquid, a hexagonal or a cubic phase, preferably a cubic phase.

It is known that cubic phase can be used to solubilize
25 large amount of hydrophilic, hydrophobic and amphiphilic molecules without significantly changing the main rheological properties. Moreover, their inherent high viscosity, as well as a three-dimensional structure with well-defined water channels, makes cubic phases attractive
30 as potential delivery system to provide sustained release of volatile compounds in air.

Instead of using the cubic phase to solubilize guest molecules, it has been found according to the present
35 invention that flavoring compounds are directly generated in the mesophase. Thus, the cubic phases play the role of

an active matrix where the aroma is created at a defined time in the final product by heating and then released in a controlled way. The cubic phases are an innovative tool to manage flavour generation pathways since this particular structure is able to compartmentalize and concentrate the potential precursors and final flavoring compounds.

It is important to use according to the invention an edible surfactant. This surfactant can be a monoglyceride, which is substantially saturated and with a carbon chain between 16 and 18. The monoglyceride used is normally a 100 % saturated C16 compound or a 100 % saturated C18 compound or a mixture of both. It is also possible to work with a saturated monoglyceride comprising molecules outside this chain length, but in this case the amount of non-C16 or C18 compounds must not exceed 20 %. It is furthermore possible to have a certain amount of unsaturated compounds. As above mentioned, in this case the amount of unsaturated compounds must not exceed 20 %. According to the second embodiment, the surfactant can be a phospholipid, like a lecithin. It is also possible to have as surfactant a mixture of a monoglyceride and another edible surfactant, like a phospholipid. All the percentages given in the present specification are in weight.

In the technique, it is known that a Maillard reaction takes place at a temperature comprised between 60 to 180 °C. By considering a phase diagram with different monoglycerides, it has been stated that the use of an unsaturated monoglyceride decreases the cubic to hexagonal phase transition temperature, which drops below 100 °C : so that it is not possible at such a temperature to induce a real efficient Maillard reaction. This is the reason why we use according to the present invention substantially saturated monoglyceride in C16 and/or C18. In this case, the phase diagram increases the cubic to hexagonal phase

transition temperature to a range where an efficient Maillard reaction is induced. The cubic phase region occurs from about 80 to 120 °C.

- 5 In the case of a thermal degradation, the aroma precursors used are normally thiamine.

The used monoglycerides are normally solid at room temperature. It is therefore necessary to dissolve said
10 monoglycerides at a temperature around 60 °C in the solution of both types of the reaction compounds precursors.

One possible mechanism which leads to the remarkable rate
15 enhancement is compartmentalization of the reactants (amino acids, peptides or hydrolyzed proteins and reducing sugars or aroma precursors) at the monoglyceride-water interface or close to it, thus inducing a concentration gradient. Therefore, due to locally high concentration of amino
20 acids, peptides or hydrolyzed proteins and reducing sugars or aroma precursors, the chemical reactions are strongly accelerated leading to higher yields of key odorant molecules or even new volatile compounds which are normally not detected in bulk water.

25 The amino acids are taken in the group consisting of cysteine, methionine, glycine, glutathione and and mono-sodium glutamate, the proteins in the group consisting of milk proteins, soy proteins, cereal proteins, vegetable
30 proteins and meat proteins, such as wheat gluten, wheat germ, corn gluten, linseed protein. The peptides are taken from the same group as the proteins or synthesized peptides.

The reducing sugars are taken in the group consisting of mono-, di- and oligosaccharides such as ribose, xylose, glucose, fructose, rhamnose and galacturonic acid.

- 5 By considering the phase diagram with the monoglyceride, which is the better for the high yield of flavoring compounds, it is preferred to have in the reaction mixture an amount of monoglyceride comprised between 60 and 80 %, an amount of amino acids, proteins, peptides and reducing
- 10 sugars comprised between 0.1 and 10 % and an amount of aroma precursors comprised between 0.1 and 10 %, the remaining being water. The amount of water in the mixture is preferably around 20 %.
- 15 According to the invention, the heating of the mixture is carried out at a temperature comprised between 60 and 180 °C during 1 to 8 hours. Systems of the Maillard reaction are often studied at higher temperature (around 140-180 °C) and shorter time (10-20 minutes). It is preferred to carry
- 20 out the heating at a temperature around 100 °C during 4 hours, because of the necessity to stay in the cubic phase region and to avoid the use of pressurizable reaction vessels.
- 25 During the Maillard reaction, the presence of the monoglyceride in the cubic phase allows the Maillard reaction compounds to be then encapsulated, in such a manner that said compounds have a controlled release.
- 30 It has been found that according to the invention, it is possible to obtain ten times more certain Maillard compounds.

For the thermal reaction of the aroma precursors, the

35 heating is carried out at the same temperature range as for

the Maillard reaction, that is between 60 and 180 °C during 1 to 8 hours.

The cooling can be carried out at room temperature.

- 5 Although the cooling step introduces a phase change from, for instance, cubic phase to liquid lamellar and then to lamellar crystalline (β -crystals and aqueous phase), the reaction products are thought to stay complexed inside the mesomorphic structure.

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The present invention concerns further the use of the aroma product comprising flavoring compounds, wherein 0.1 to 5 % of the aroma product is mixed with a food taken in the group consisting of bouillons, soup sauces, gravies, pet food, snacks and canned food, casserole dishes, frozen human foods, meat spreads and dips, bakery products, replacement for beef, chicken, pork, fish and seafood, and the like.

- 20 The mixing of the aroma product can be carried out by different ways. It is possible to add directly the aroma product in the food. It is also possible to prepare a dispersion in an aqueous medium and then make the mixing. Finally, it is possible to make a drying, by way of spray drying or freeze-drying and then add a powder to the food.
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The following of the specification is now made in relation with the example.

30 **Example**

- 2 mmol of cysteine and 2 mmol of ribose were dissolved in 10 ml of phosphate buffer (0.5 mol/l) at pH 5.0. The cubic phase was prepared by introducing 1 g of this solution and 4 g of melted (60°C) monoglyceride (product of the Company Danisco sold under the trade mark Dimodan PV) into a Pyrex
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tube. After vigorous stirring, the tube was placed in an oil bath at 140 °C for 1 minute and stirred again to form an homogeneous cubic phase. Finally, the cubic phase was thermally treated for 4 hours at 100 °C.

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This thermally treated sample is then compared with a reference comprising the same amount of the reactant, but without the monoglyceride : this reference is called aqueous system in the following of the specification.

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The sensory properties of the reaction flavour of the aqueous system with that of the cubic phase were compared by an untrained technical sensory panel. The reaction carried out in the cubic phase was found to have an overall more intense flavour with a strong rubber, eggy, roast chicken-like aroma. The aroma of the aqueous reaction was evaluated after transforming the solution into a cubic phase system in order to have similar volatile-matrix interactions. This mixture was then described as weak in an aroma reminiscent of meat and lard with some burnt character.

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The volatiles formed in the cubic phase compared to those in water were monitored by gas chromatography.

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The following table gives the amount of products generated from the ribose and cysteine solubilized in the cubic phase and in the water system.

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Component	Cubic phase (µg)	Water (µg)
2-Methyl-3-furanthiol (MFT)	18.4	n.d.
2-Methyl-3 (2H) -furanone	36.7	13.1

Furfural	874.3	351.0
Furfurylthiol	12.0	trace
3-Mercapto-2-pentanone	trace	n.d.
Norfuraneol	698.1	291.1

The present table shows drastic differences between the two samples indicating a much higher generation of sulfur compounds in the cubic system. The results show a significant increase in the concentration of furfurylthiol in the cubic phase compared to the water system in which only trace amounts were detected. At the same time, the potent odorant 2-methyl-3-furanthiol was only detected in the cubic phase system.

Besides MFT also its potential precursors furfural and norfuraneol were favored in the cubic phase, being formed 2.5 fold higher amounts.

**Claims.**

1) An aroma product comprising flavoring compounds ,
obtainable through a process comprising :

- dissolving in water amino acids, peptides or hydrolyzed
proteins and reducing sugars or dissolving in water aroma
precursors,
- introducing in said solution an edible surfactant taken
in the group consisting of a monoglyceride and a
phospholipid,
- heating the obtained mixture to have a mesomorphic phase
structure or a microemulsion,
- maintaining said heating to develop flavoring compounds
- and cooling said mixture.

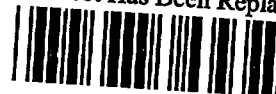
2) An aroma product according to claim 1, wherein the
mesomorphic phase is a cubic phase.

3) An aroma product according to claims 1 or 2, wherein
the amino acids are taken in the group consisting of
cystein, methionine, glycine, glutathione and and mono-
sodium glutamate, the proteins in the group consisting of
milk proteins, soy proteins, cereal proteins, or other
vegetable proteins and meat proteins.

4) An aroma product according to any of claims 1 to 3,
wherein the sugars are taken in the group consisting of
mono-, di- and oligosaccharides, such as ribose, xylose,
glucose, fructose, rhamnose and galacturonic acid.

5) An aroma product according to any of claims 1 to 4,
wherein the monoglyceride is present in an amount comprised
between 60 and 80 %, the amino acids, the proteins, the
peptides and the sugars in an amount comprised between 0.1
and 10 % and the aroma precursors in an amount comprised
between 0.1 and 10 %, the remaining being water.

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6) An aroma product according to any of claims 1 to 5,
wherein the heating of the mixture is carried out at a
temperature comprised between 60 and 180 °C during 1 to 8
5 hours.

7) An aroma product according to claim 6, wherein the
heating of the mixture is carried out at a temperature of
100 °C during 4 hours.

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8) The use of the aroma product according to any of claims
1 to 7, wherein 0.1 to 5 % of the aroma product is mixed
with a food taken in the group consisting of bouillons,
soup, sauces, gravies, petfood, snacks and canned food,
15 casserole dishes, frozen human foods, meat spreads and
dips, bakery products, replacement for beef, chicken, pork,
fish and seafood and the like.