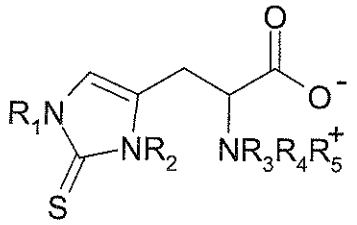
which makes it possible to obtain, at the industrial scale, the product with a good yield and a low cost.

In aiming to develop an environmentally friendly method, at one and the same time using low toxicity reagents, minimising the number of steps and carrying out reactions in aqueous medium, the Applicant has decided to opt for a "reversed" synthesis strategy, which consists in introducing the sulphur into an intermediate already possessing the betaine group. This approach, completely original, may be considered bio-mimetic in so far as the biosynthesis by enzymatic route of L-ergothioneine in fungi proceeds in the same way (Askari, A. and Melville, D.B., 1962, J. Biol. Chem., 237, 1615-1618).

Summary

The object of the present patent application is thus a method for synthesizing a derivative of following formula (I):



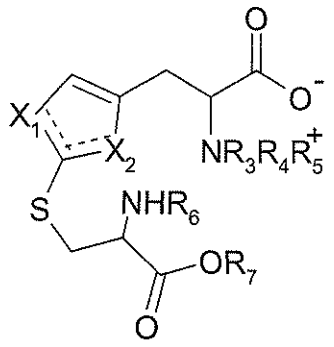
(I),

or a physiologically acceptable salt thereof, a tautomer, a stereoisomer or a mixture of stereoisomers in all proportions, in particular a mixture of enantiomers, and especially a racemic mixture thereof,

for which:

- R_1 and R_2 represent, independently of each other, a hydrogen atom or a (C_1-C_4) alkyl group such as methyl, at least one of the R_1 and R_2 groups representing a hydrogen atom, and advantageously each representing a hydrogen atom, and

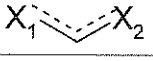
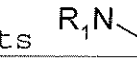
In another aspect, there is provided a compound of betaine type of following formula (II):

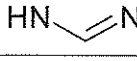
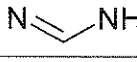


(II),

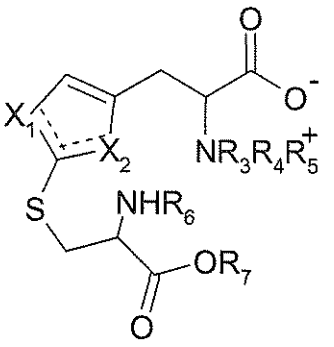
or a physiologically acceptable salt, a tautomer, a stereoisomer or a mixture of stereoisomers in all proportions, in particular a mixture of enantiomers, and especially a racemic mixture thereof,

for which:

-  represents  or , and
- R_1, R_2, R_3, R_4, R_5, R_6 and R_7 are as defined above,

with the exclusion of the compound for which  represents  or , R_3, R_4 and R_5 each represent a methyl group and R_6 and R_7 each represent a hydrogen atom.

In yet another aspect, there is provided a method for preparing a compound of betaine type of following formula (II):

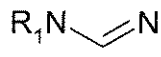
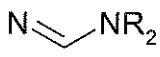


(II),

or a physiologically acceptable salt, a tautomer, a stereoisomer or a mixture of stereoisomers in all proportions,

in particular a mixture of enantiomers, and especially a racemic mixture thereof,

for which:

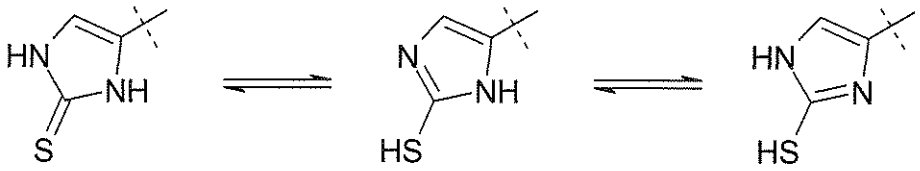
–  represents  or , and

– R_1, R_2, R_3, R_4, R_5, R_6 and R_7 are as defined above,

by reaction of an acid addition salt, with the exclusion of the salt of hydriodic acid, of a compound of betaine type of formula (III) as defined above, with dibromine, then with a cysteine derivative of formula (IV) as defined above, and in particular with cysteine and especially L-cysteine.

"Tautomer" is taken to mean, according to the present invention, a constitutional isomer of the compound obtained by prototropy, in other words by migration of a hydrogen atom and change of location of a double bond. The different tautomers of a compound are generally interconvertible and present in equilibrium, in solution, in proportions that can vary according to the solvent used, the temperature or even the pH.

Within the framework of compounds of the invention, the 2-thioimidazole cycle may be present in the following different tautomer forms:



In the present invention, "physiologically acceptable" is taken to designate what is generally safe, non toxic and neither biologically nor otherwise undesirable and which is acceptable for pharmaceutical, cosmetic or food (human or animal) use, in particular food.

"Physiologically acceptable salts" of a compound is taken to designate salts that are physiologically acceptable, as defined above, and which have the desired activity (pharmacological, cosmetic or food) of the parent compound. Such salts comprise:

(1) hydrates and solvates,

(2) acid addition salts formed with inorganic acids such as hydrochloric acid, hydrobromic acid, sulphuric acid, nitric acid, phosphoric acid and similar; or formed with organic acids such as acetic acid, benzenesulphonic acid, benzoic acid, camphresulphonic acid, citric acid,