column. The latter must satisfy characteristics of number of plates, overflow height, space between plates, diameter of the column compared to the overflow length and of ratio of the cross-section of the column to the gas flow surface, which have been determined very precisely, having the advantage of minimizing the formation of by-products such as methionine dipeptides.

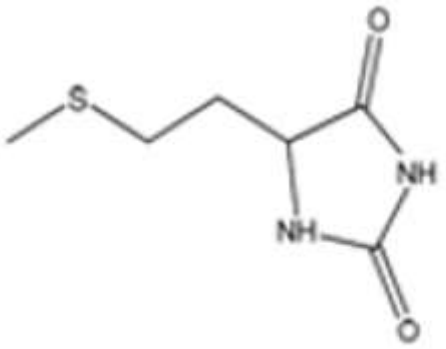
An aqueous solution of hydantoin is introduced at the level of the upper plate of the column and an alkaline solution based on alkali metal carbonate is fed at the level of a plate under the upper plate of the column. The heat required for the reaction is provided by a water vapor stream supplied to the bottom of the column.

The alkaline hydrolysis of methionine hydantoin leads to the formation of ammonia gas and carbon dioxide. It is a very fast process and one of the problems encountered by reactive rectification technology lies in untimely gas production which must be controlled by any means. On the one hand, it is necessary to control the speed of the hydrolysis reaction and on the other hand, it is necessary to provide for an evacuation of the formed gases and in particular of carbon dioxide, as they are released; indeed, the carbon dioxide in the reaction medium will produce carbonic acid causing a decrease in the pH of the medium and a drop in the selectivity for methionine.

The present disclosure provides a method for alkaline hydrolysis of methionine hydantoin using a reactive stripping technology to overcome these obstacles. For this purpose, the reaction is carried out, completely or partially, in a reactive stripping packed column.

The disclosure concerns a method for alkaline hydrolysis of 5-(2-methylmercaptoethyl)hydantoin of formula (1)

[Chem 1]



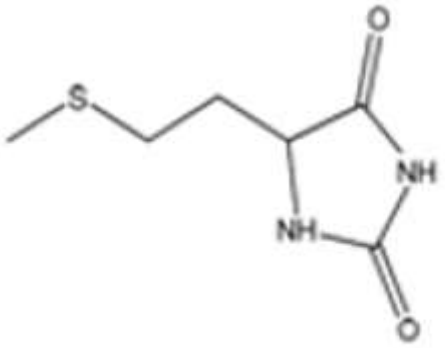
(1)

or of its seleniated equivalent, 5-(2-methylselenoethyl)hydantoin, into a methionine salt or a selenomethionine salt, respectively,

said method being conducted in a basic aqueous medium, in a reactive stripping packed column.

The disclosure, in one aspect, concerns a method for alkaline hydrolysis of 5-(2-methylmercaptoethyl)hydantoin of formula (1)

[Chem 1]



(1)

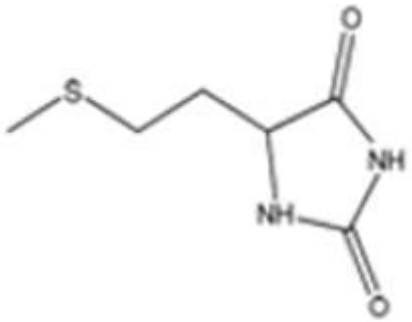
or of its seleniated equivalent, 5-(2-methylselenoethyl)hydantoin, into a methionine salt or a selenomethionine salt, respectively,

characterized in that it is carried out in a basic aqueous medium, first in a reactive stripping packed column, then in at least one reactor selected from the reactive stripping plate columns.

According to a variant of the disclosure, the aforementioned alkaline hydrolysis method is conducted in a basic aqueous medium, first in a reactive stripping packed column, then in at least one reactor, identical to or different from said reactive stripping packed column.

The disclosure, in another aspect, concerns a method for producing methionine from 5-(2-methylmercaptoethyl)hydantoin of formula (1)

[Chem 1]



(1)

or selenomethionine from 5-(2-methylselenoethyl)hydantoin, characterized in that it comprises the method for hydrolysis of 5-(2-methylmercaptoethyl)hydantoin or 5-(2-methylselenoethyl)hydantoin as defined herein.

Before exposing the disclosure in more detail, the definition of some terms used in this text is given hereinafter.

The 5-(2-methylmercaptoethyl)hydantoin, or methionine hydantoin, corresponding to the aforementioned formula (1) may be in the form of a salt. It may be in a pure or a mixed state. A mixture may comprise one or several precursor(s) for the production of methionine, which will generally be the case when the invention falls in the scope of a method for the production of methionine on an industrial scale; methionine or a methionine salt, in particular when the hydrolysis of methionine hydantoin has already started; secondary products; as well as impurities. Of course, this definition applies identically to 5-(2-methylselenoethyl)hydantoin, as well as the entire description of this text.

By reactive stripping, or reactive distillation, or reactive rectification, it should be understood within the scope of the invention, the progress of the reaction, namely the alkaline hydrolysis of hydantoin into methionine salt (or selenomethionine salt) in the liquid phase and the separation from this phase of at least part of the produced gases, within the same column, called a reactive stripping, or reactive distillation, or reactive rectification column, which is a well-documented technology belonging to the general knowledge of a person skilled in the art.

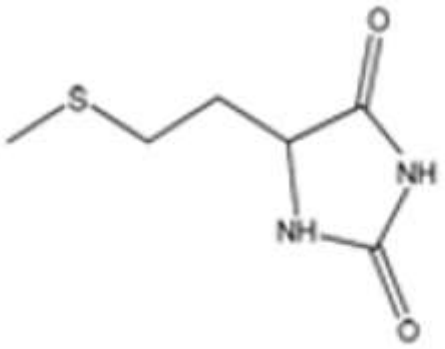
The expressions “first in a reactive stripping packed column” and “then in at least one reactor” mentioned in a variant of a method of the invention, refer to a notion of order in the method, the hydantoin being according to the invention first treated in the reactive stripping packed column, then the resulting stream

being afterwards treated in one reactor or several successive reactors. They do not, however, impart any limitation in the arrangement of the packed column and the reactor or reactors. Thus said packed column and the reactor may be in series, optionally separated by an enclosure for example. According to this variant of the invention, by reactive stripping, or reaction distillation, or reactive

CLAIMS

1. A method for alkaline hydrolysis of 5-(2-methylmercaptoethyl)hydantoin of formula (1)

[Chem 1]



(1)

or of its seleniated equivalent, 5-(2-methylselenoethyl)hydantoin, into a methionine salt or a selenomethionine salt, respectively,

characterized in that it is carried out in a basic aqueous medium, first in a reactive stripping packed column, then in at least one reactor selected from the reactive stripping plate columns.

2. The method according to claim 1, characterized in that the reactive stripping packed column comprises one or more packings selected from structured and random packings.

3. The method according to claim 1 or 2, characterized in that the packing(s) of the reactive stripping packed column are made of one or several material(s) selected from metals and stainless and corrosion-resistant metal alloys such as zirconium, tantalum, titanium, stainless steels, Hastelloy® alloys; plastics such as; fluoropolymers like polytetrafluoroethylenes (PTFE), perfluoroalkoxy (PFA); the ceramics.

4. The method according to any one of claims 1 to 3, characterized in that it is further carried out in one or several reactor(s).

5. The method according to claim 4, characterized in that said reactor or said reactors is/are selected from reactive stripping columns.

6. The method according to claim 5, characterized in that the reactor(s) is/are selected from reactive stripping packed columns, reactive stripping plate columns and reactive stripping bubble columns.

7. The method according to claim 4, characterized in that the reactor(s) is/are selected from Continuous Stirred Tank Reactors (CSTR) and Plug Flow Reactors (PFR).

8. The method according to any one of claims 1 to 7, characterized in that the basic aqueous medium comprises an alkaline hydrolysis reagent selected from alkali metal carbonates, alkali metal hydroxides and any mixture of said carbonates and hydroxides.

9. The method according to claim 8, characterized in that the alkaline hydrolysis reagent is selected from potassium carbonate, potassium hydrogen carbonate, sodium hydroxide, potassium hydroxide and mixtures thereof.

10. The method according to any one of claims 1 to 9, characterized in that 5-(2-methylmercaptoethyl)hydantoin is supplied in the form of a stream further comprising one or several compound(s) selected from the precursors of 5 -(2-methylmercaptoethyl)hydantoin, methionine, salts and peptides, especially dipeptides, of methionine and derivatives, such as hydantoate salts of methionine, 2-amino-4-(methylthio)-butyramide, 4-(methylthio)-2-ureido-butyramide, formate salts, 2-hydroxy-4-(methylthio)-butyrate salts, and impurities.

11. The method according to any one of claims 1 to 10, characterized in that it is carried out at a temperature from 160 to 200°C, preferably from 170 to 190°C.

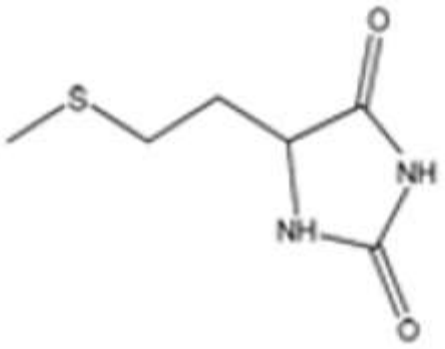
12. The method according to any one of claims 1 to 11, characterized in that it is carried out at a pressure from 7 to 15 bars, preferably from 8 to 12 bars.

13. The method according to any one of claims 1 to 12, characterized in that the residence time of the liquid reaction stream in the reactive stripping packed column is at least 1 minute, preferably from 1 to 3 minutes.

14. The method according to any one of claims 1 to 13, characterized in that the residence time of the liquid reaction stream in the whole assembly of the reactive stripping packed column and the reactor(s) varies from 6 to 10 minutes.

15. The method for producing methionine from 5-(2-methylmercaptoethyl)hydantoin of formula (1)

[Chem 1]



(1)

or selenomethionine from 5-(2-methylselenoethyl)hydantoin, characterized in that it comprises the method for hydrolysis of 5-(2-methylmercaptoethyl)hydantoin or 5-(2-methylselenoethyl)hydantoin as defined in any one of the preceding claims.

16. The method according to claim 15, characterized in that it comprises neutralizing the methionine salt into methionine or the selenomethionine salt into selenomethionine.

17. The method according to claim 16, characterized in that the neutralization of the methionine salt or of the selenomethionine salt is performed in the presence of CO_2.