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(54) METHOD OF MANUFACTURING ANIMAL FEEDSTUFF CONTAINING ENZYMES

(71) We, HENKEL KORMAN-DITGESELLSCHAFT AUF APTIEN, a German Company of 67 Henkelstrasse, 4000 Duesseldorf-Holthausen, Federal Republic of Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

The present invention relates to a method of manufacturing animal feedstuff containing enzymes. The method permits the incorporation of heat- and moisture-sensitive enzymes without loss of activity and stabilizes the enzymes even over a long period of storage.

Enzymes, such as are used as additives for animal feedstuff, are usually unstable substances which are destroyed under the influence of heat and/or moisture. Thus, they can only be used with a considerable loss of activity, for example in the conventional, i.e. steam-tempered pelletizing of animal feedstuff.

According to the present invention there is provided a method of manufacturing animal feedstuff containing an enzyme, in which an enzyme or a product containing an enzyme is sprayed onto the feedstuff in the form of a suspension in a liquid or molten edible fat, the suspension being free from water.

The method is primarily used in the production of feedstuff having a content of heat- and moisture-sensitive proteases. Proteases of this type can have particularly interesting activity maxima in specific pH ranges such as correspond to the stomach pH or intestinal pH of the relevant species of animal. They may be obtained in a known manner from strains of bacteria or fungi, for example from *bacillus licheniformis*, *bacillus subtilis*, *bacillus natta* or *rhizopus rhizopodiformis*, and are effective in an acid and/or an alkaline environment.

Other enzymes for which the method is

suitable are, for example, amylases, cellulases, lipases, lab and pancrease enzymes, and enzymes from vegetable seeds, which are sensitive to heat and/or moisture under normal pelletizing conditions.

The enzyme does not have to be present in a pure form, but may be used also in the form of raw product containing enzyme, such as is directly separated from the liquid in which the micro-organism has been cultivated, or combined with a diluent e.g. sodium sulphate.

Suitable edible fats are animal and vegetable fats and oils and, if necessary, waste fats, which are unsuitable for human consumption. In order to increase the energy content, such fats are normally added to the feedstuff in quantities of 0.1 to 10 percent by weight. Oils which are liquid at normal temperature are preferred, although solid fats, which are sprayed onto the feedstuff in a molten state, are also suitable.

The enzyme is suspended in the liquid or molten fat by intensive agitation, so that it is finely distributed as uniformly as possible. The amount of enzyme is such that there is 0.01 to 1 percent by weight of enzyme in the finished feedstuff given to the animals. In order to avoid precipitation of the enzyme, the suspension is agitated until it is sprayed at 40 to 60°C. A more stable distribution can be obtained by the joint use of suitable auxiliary substances and emulsifiers e.g. fatty acid mono- and diglycerides and polyglycol ethers. Furthermore, further conventional feedstuff additives and auxiliary substances, such as antibiotics, can be added to the suspension of enzyme and fat.

The liquid suspension of fat and enzyme is sprayed onto the feedstuffs at normal room temperature or, preferably, at temperatures of 40 to 90°C at which the fat is adequately fluid. The apparatus used by feedstuff manufacturers can be used for this purpose without modification. Improved penetration is

obtained if the suspension of fat and enzyme has a temperature in the range of from 60 to 90°C but this temperature should be used for only a short period of time immediately before the spraying operation because of the sensitivity of the enzyme to elevated temperature. Since the fat protects the enzymes against water and atmospheric moisture, there is no risk of loss of activity even at elevated temperatures. Even during storage of the feedstuff, the coating of fat contributes to the protection of the enzymes against inactivation by the influence of moisture or active substances contained in the feedstuff.

The feedstuffs usually exist in the form of mixed feedstuffs comprising products which contain starch and albumen and to which are added conventional additives e.g. mineral substances, vitamins and amino acids. In particular, the composition depends upon the species of animal for which the feedstuff is intended. Mixtures of feedstuffs containing enzymes are preferred for the rearing of young animals such as piglets, calves, chickens and for the rearing of trout. The feedstuffs can be present in the form of meal or granulated material although, in general, they are nowadays preferably in the form of pellets. Since the pelletizing operation is effected under pressure at elevated temperatures and in the presence of moisture, sensitive enzymes cannot be added directly during the pelletizing operation without a considerable loss of activity.

The present invention will now be further illustrated by way of the following Example:

Example:

30g of a finely powdered and dried protease obtained from *bacillus subtilis* were homogeneously suspended in 5 kg of liquid fat (soya oil) under agitation. After heating to 70°C for a short period of time, the suspension was uniformly sprayed onto 95 kg of pelletized food for fattening chickens. The anticipated activity of the enzyme was fully retained immediately after spraying and also after storage for a period of 6 weeks.

A comparison test was carried out in a conventional manner, the enzyme being mixed with the feedstuff before pelletizing. Only a residual activity of approximately 20% was detected immediately after pelletization even under relatively careful pelletizing without steam-tempering.

WHAT WE CLAIM IS:

1. A method of producing animal feedstuff containing an enzyme, in which an enzyme or a product containing an enzyme is sprayed onto the feedstuff in the form of a suspension in a liquid or molten edible fat, the suspension being free from water.

2. A method as claimed in Claim 1 in which the enzyme is a protease.

3. A method as claimed in either Claim 1 or Claim 2 in which the suspension is sprayed

on at 40 to 90°C.

4. A method as claimed in any one of Claims 1 to 3, in which there is 0.01 to 1 percent by weight of enzyme in the finished feedstuff.

5. A method as claimed in any one of Claims 1 to 4, in which the feedstuff is present in a pelletized form.

6. A method as claimed in any one of Claims 1 to 5, in which the liquid or molten edible fat is added to the feedstuff in an amount of 0.1 to 10 percent by weight.

7. A method of producing animal feedstuff containing enzyme substantially as hereinbefore described and with reference to the Example.

8. Animal feedstuff whenever prepared by a method as claimed in any one of Claims 1 to 7.

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