METHOD FOR SUPPLYING FOODSTUFF SAMPLES FOR MICROBIOLOGICAL TESTING

The invention relates to a method for supplying foodstuff samples for the microbiological testing.

To date, microbiological examinations were carried out exclusively by hand. This is justifiable, when few samples are concerned. However, in the foodstuffs industry, samples have to be examined frequently and in large numbers with regard to the bacillus factor. A further complication is that in microbiological examinations, work must be carried out under sterile conditions, and too great a time must not elapse from the delivery of the samples up to installation in the incubator, because otherwise owing to the multiplication of the bacilli even at room temperature, the result of the examination would be falsified.

The invention is based on the problem of developing the testing method of the type indicated in the introduction such that it can run automatically after preparation of the samples up to installation of the injected nutrient media into the incubator.

This problem is solved according to the invention.

An essential feature of the method according to the invention is the use of a laboratory robot system with a handling robot and a programmable control unit. Such a system is indeed already known as a universal system to carry out various laboratory operations (laboratory robot system of the firm Zymark Corporation, Hopkinton, MA USA). However, this has never until now been installed and used to carry out the relatively complex microbiological examinations. The result which is aimed for according to the invention is only achieved in that the laboratory robot system is used in combination with two further quite specific items of laboratory apparatus which are likewise already known per se, namely the so-called stomacher and the so-called spiral-plater. The stomacher allows the comminution and homogenization of samples, which are contained in plastic bags, with the plastic bag closed. Through this it becomes possible to leave the samples, which are to be examined, in plastic bags during the entire examination. This, in turn, is a prerequisite for the fact that the samples can be handled individually by the laboratory robot, without the samples or residues of samples hereby coming into contact with each other, whereby the result of the examination would be falsified. The microbiological examination further requires that sample liquid with differing concentration is injected out from each sample onto the nutrient medium. The spiral-plater, with which the sample liquid is injected onto the rotating nutrient medium through a nozzle which is moved in radial direction, i.e. in a spiral shape and hence in one working step in differing concentration, creates the prerequisite for the fact that this process can also be handled by the laboratory robot system, which would scarcely be possible with a multiple-stage injecting out, e.g. with sample liquids of different concentrations, owing to the too high complexity of such a process and owing to too great an expenditure of time. In all, it is achieved by the method according to the invention that in particular samples of foodstuffs can be examined fully automatically in large numbers. It is merely necessary to place the samples, which have been removed for example in the foodstuffs factory, in the plastic bag in readiness. They are then treated fully automatically, according to the method of the invention, up to installation of the ready injected nutrient media, in petri dishes, into the incubator.

In one embodiment of the new method according to the invention, the accurate dosing of the samples, hitherto performed, which would only be able to be carried out by the robot with difficulty, is not necessary. The samples which have only been estimated approximately as regards their weight, can be treated just as they arrive after removal. The desired precise weight ratio between the sample and the physiological nutrient solution is produced through corresponding dosing of the nutrient solution, which is preferably able to be carried out easily automatically as a time-dependent, but also volumetric dosing. Here, the control unit takes charge of the evaluation of the weighing of the sample and the calculation of the necessary quantity of nutrient solution.

The another embodiment, the new method makes possible the further acceleration thereof through the "nesting" of sections of the process, whereby the stomacher is very soon freed for a new sample. In addition, the clean removal of the plastic bags of which the contents have been evaluated, is ensured by simply dropping into the waste opening.

A further embodiment acts in the same direction. The mechanical screen surrounding the pipette acts as a filter, through which only sample liquid can pass. Of course, the pipette must be cleaned and carefully sterilised after each removal process. Through the activation of the disinfection and cleaning bath by ultrasonics, at the same time a mechanical cleaning in particular of the screen of the pipette is achieved, whereby one is saved from exchanging a filter after each removal process. To save time, the suction pipette can be allowed to drain, whilst the stomacher is in operation.

The spiral-plater, known per se, has a built-in dosing pump. In the conventional use within examinations which are carried out by hand, the sample liquid which is to be injected out is sucked in by means of the backwardly-running dosing pump through the injection nozzle of the spiral-plater. Normally, two nutrient media are injected in a spiral shape with the sample liquid from one sample. Until now, this meant two suction processes. In one embodiment of the new method, sample liquid for the spiral-plater is only sucked in once, and the injection of several nutrient media is nevertheless possible, which further complies with the automatic carrying out of the method.

The method may include a step for the reliable mutual separation of the samples. It is likewise carried out automatically, controlled by the control unit.

An essential prerequisite for the automatic running of the examination is a reliable handling of the filled plastic bags by the laboratory robot. This is ensured particularly well when the laboratory robot for the handling of the plastic bags uses a hand in. On transportation, the plastic bag is clamped between the clamping jaws. To open the bag, the openings in the clamping jaws are acted upon with negative pressure and the clamping jaws are moved apart. The openings can also remain acted upon with negative pressure with the clamping jaws in closed state. Then the plastic bags are secured particularly reliably.

In the course of an examination, each plastic bag has to be transported several times and in so doing has to be deposited so as to be accurately positioned at its destination, e.g. on the scales or in the stomacher or in the holding device. In order that this is successful with