such fixed conversion coefficient is highly likely to cause large error.

[0014]

Because of many error factors and uncertainties as mentioned above, there have been problems that: it is difficult to set the control reference values for microorganisms appropriately; and it is impossible to know what range the control accuracy falls within.

[0015]

~~An object~~ Embodiments of the present invention ~~is~~seek to: set control reference values more accurately than ever in a system for measuring microorganisms in products, materials and their manufacturing environments using a rapid microbiological method, such as the ATP method, which uses measurement units different from those used in the conventional culture method; make the control accuracy fall within a desired range; and achieve microbiological control using the same.

Solution to Problem

[0016]

To solve the above problems, a microorganism measuring system according to claim 1 includes luminous reaction means for making ATP in cells of microorganisms in a sample cause luminous reaction by supplying a predetermined reagent to the microorganisms; optical measurement means for measuring luminescence intensities of the microorganisms causing the luminous reaction; arithmetic control means for converting measurement values of the luminescence intensities measured using the optical measurement means into ATP contents, storing the conversion results, and performing a statistical process. The arithmetic control means executes the steps of: inputting results of CFU countings repeatedly performed using a surface plate culture method in a normal condition; inputting results of ATP measurements repeatedly performed using the luminous reaction

means and the optical measurement means at the same time as the CFU countings are repeatedly performed; based on the results of the repeated CFU countings, determining a coefficient of a probability density function of CFU counts in the sample; based on the results of the repeated ATP measurements, determining coefficients of a probability density function of ATP contents per CFU; using the determined coefficients of the two probability density functions, determining a probability density function of ATP measured values in the normal condition; performing a statistical test on appropriateness of the determined probability density function; determining a probability density function of ATP measured values in a contaminated condition corresponding to CFU counts in the contaminated condition set in advance; using the determined probability density function of the ATP measured values in the normal condition, calculating a alert reference value at which a probability of false positives is equal to or less than a probability set in advance; using the determined probability density function of the ATP measured values in the contaminated condition, calculating ~~a warning~~an action reference value at which a probability of false negatives is equal to or less than a probability set in advance; and each time the ATP measurement is performed, testing whether or not the ATP measured value satisfies any of the alert reference value and the ~~warning~~action reference value.

[0017]

In addition, a microorganism measuring system according to claim 2 includes the microorganism measuring system according to claim 1, in which a plurality of types of the probability density function of the ATP measured values are prepared, and the arithmetic control means further executes the step of, based on the results of the repeated CFU countings, selecting one from the plurality of types of the probability

needed to analyze the results of the ATP measurements using the printing means.

[0026]

In addition, a microorganism measuring system according to claim 11 includes the microorganism measuring system according to claim 1, in which the arithmetic control means further executes the step of creating information needed to analyze the results of the ATP measurements, both in a protected format which disables the information from being tampered and in an unprotected format which enables the information to be analyzed.

[0026a]

According to a second aspect of the present invention, there is provided a microorganism measuring method for a microorganism measuring system, the microorganism measuring system comprising: luminous reaction means for making ATP in cells of microorganisms in a sample cause luminous reaction by supplying a predetermined reagent to the microorganisms; optical measurement means for measuring luminescence intensities of the microorganisms causing the luminous reaction; arithmetic control means for converting measurement values of the luminescence intensities measured using the optical measurement means into ATP contents, storing the conversion results, and performing a statistical process, wherein the arithmetic control means executes the steps of: inputting results of CFU countings repeatedly performed using a surface plate culture method in a normal condition; inputting results of ATP measurements repeatedly performed using the luminous reaction means and the optical measurement means at the same time as the CFU countings are repeatedly performed; based on the results of the repeated CFU countings, determining a coefficient of a probability density function of CFU counts in the sample; based on the results of the repeated ATP measurements, determining coefficients of a probability density function of ATP contents per CFU; using the determined coefficients of the two probability density functions, determining a probability density function of ATP measured values in the normal condition; performing a statistical test

on appropriateness of the determined probability density function; determining a probability density function of ATP measured values in a contaminated condition corresponding to CFU counts in the contaminated condition set in advance; using the determined probability density function of the ATP measured values in the normal condition, calculating a alert reference value at which a probability of false positives is equal to or less than a probability set in advance; using the determined probability density function of the ATP measured values in the contaminated condition, calculating an action reference value at which a probability of false negatives is equal to or less than a probability set in advance; and each time the ATP measurement is performed, testing whether or not the ATP measured value satisfies any of the alert reference value and the action reference value.

Advantageous Effects of Invention

[0027]

According to embodiments of the present invention, the microorganism measuring system for measuring microorganisms in products, materials, their production environments using a rapid microbiological method, such as an ATP method, whose measurement units are different from those of a conventional culture method ~~is~~may be capable of: setting control reference values with higher accuracy than ever, and making their control accuracy fall within a desired range; and accordingly achieving microbiological control using them. Its details are as follows.

[0028]

According to aspects of the invention as recited in claim 1 and 12, based on the results of the repeated CFU countings and the results of the repeated ATP measurements, the probability density function of the ATP measured values in the normal condition is obtained; the alert reference value at which the desired probability of false positives is equal to or less than the probability, and the action reference value at which the desired probability of false negatives is equal to or less than the probability are determined; and the ATP measured values