[0005] Another way of inspecting packages containing a substance subject to spoiling is by destructive testing in which the package must be opened or otherwise rendered unusable such as pH analysis and culturing. Each method of destructive testing has its individual disadvantages such as not detecting early stage spoilage or not being sensitive to certain bacteria or contaminants. More importantly, however, destructive testing requires opening the package to sample the substance. The act of opening the package to sample the substance reintroduces the potential for contamination and spoilage. Thus, any test on the substance may not be valid for a given package going forward. Therefore, any packages tested are taken to be representative of a production lot and the sampled packages themselves are culled. This results in incomplete testing of a lot, excess product waste, and a significant expenditure of time which reduces flexibility in responding to changes in product demand.

SUMMARY OF THE DISCLOSURE

[0005a] An aspect of the present invention provides an apparatus for inspecting a case having a plurality of packages and determining whether a substance in each of the packages is spoiled, said apparatus comprising: an inspection system comprising: an electromagnetic source for generating an electromagnetic signal; a plurality of electromagnetic scan systems, each electromagnetic scan system corresponding to a package of the plurality of packages, said electromagnetic scan system for receiving the generated electromagnetic signal, directing the received signal at a corresponding package, and receiving an attenuated electromagnetic signal from the corresponding package; a processor for determining whether each package contains spoiled substance as a function of the attenuated electromagnetic signal received from the package; and a sampler for sampling the received attenuated signal and generating a set of data points representative of an amplitude of the received attenuated signal over a predetermined period of time; and a labeling system for marking a case having at least one package containing spoiled substance; wherein the processor analyzes each set of data points, and wherein the processor: detects a peak within the set of data points, shifts the data points with respect to time based on the detected peak in order to align the detected peak with a predetermined time, and compares the set of shifted data points to at least one mathematical model to determine whether the package contains spoiled substance.

[0005b] Another aspect of the present invention provides a method for inspecting a case having a plurality of packages and determining whether a substance in each of the packages is spoiled, said method comprising: selecting a case having a plurality of packages, wherein a substance is aseptically packaged into the package, the substance is a biological fluid, and the package is substantially transparent with respect to a frequency of an electromagnetic signal; generating an electromagnetic signal; scanning the case, said scanning comprising: receiving the generated electromagnetic signal on of a plurality of electromagnetic scan systems, each electromagnetic scan system corresponding to one of the plurality of packages in the case, directing the received signal at the corresponding package, and receiving an attenuated electromagnetic signal from the corresponding package at the corresponding electromagnetic scan system; sampling each received attenuated signal; generating a plurality of sets of data points, each set of data points representative of an amplitude of a corresponding received attenuated signal over a predetermined period of time; analyzing each set of data points, said analyzing comprising: detecting a peak within the generated set of data points, shifting the data points with respect to time based on the detected peak, comparing the set of shifted data points to at least one mathematical model, and determining whether the package contains spoiled substance as a function of said comparing; and marking a case having at least one package containing spoiled substance.

[0006] In one embodiment, an apparatus inspects a case of packages containing a substance subject to spoilage. The system includes an inspection system, a processor, and a labeling system. The inspection system includes an electromagnetic source, a plurality of electromagnetic scan systems, and a sampler. Each of the packages in the case has a corresponding electromagnetic scan system. The electromagnetic source generates an electromagnetic signal, and each of the plurality of electromagnetic scan systems directs the generated electromagnetic signal to a corresponding package in the case of packages. Each of the plurality of scan systems receives an attenuated electromagnetic signal from the corresponding package, and the sampler samples each of the received attenuated signals to generate a set of data points representative of an amplitude of the received attenuated signal over a predetermined period of time. The processor analyzes each set of data points by detecting a peak within the set of data points, shifting the data points with respect to time based on the detected peak, and determining whether the shifted data points

correspond to a package containing a non-spoiled substance without generating an image from the set of data points. The labeling system marks any case having a package containing spoiled substance. Optionally, the apparatus includes robots for removing cases of packages from pallets for inspection and returning non-spoiled cases to a pallet after inspection. The apparatus may also include a culling system for removing packages