

DuPont Qualicon RiboPrinter® System

APPLICATION PROFILE

Product quality's hidden opponents might be easier to beat than ever before

When problems crop up in food and pharmaceutical ingredients, it is vital to be able to know what the culprit is and where it originated. When spoilage organisms are to blame, a genetic fingerprint of the offender can be used to track down the source of contamination.

The leading producer of a food and pharmaceutical dry powder was experiencing serious quality control problems due to an unknown contaminant at its aging dockside plant. Particle size was crucial in the food-grade product. Unless the powder was processed to the proper granular consistency, a batch was useless to customers. Occasionally, the factory turned out a lot that was slimy and unusable.

Routine biochemical-based tests established the presence of a *Bacillus* in the finished product. The spoilage organism was the chief suspect of the problem; however, the *Bacillus* had an alibi—it could be found in good batches as well as bad. Why, quality control managers wondered, did some batches with the *Bacillus* fail while others with the organism had no problems?

Bacillus Survives Processing

Plant managers suspected that the factory's antiquated design and the variety of bulk materials it handled were the source of the contaminant, yet they had no way of identifying the sporeformer, or tracking its path. It was also clear that this robust *Bacillus* was capable of surviving and even thriving in the powder's processing regimen of fermentation, drying, milling and sieving. The sporeformer's adaptability and survival techniques made it elusive and resistant to cleaning and sanitation.

For nearly a year, the company had kept records from a program of daily sampling. Biochemical profiles of the organism produced abundant information that was of little use because it produced no conclusions. Having exhausted conventional methods of analysis, the company provided Qualicon, Inc. with culture samples from this program to see if RiboPrint® patterns of the *Bacillus* could be differentiated.

The RiboPrinter® system produced RiboPrint® patterns—genetic fingerprints—of each sample that showed there were a number of strains of *Bacillus* present. However, one particular pattern was associated with each of the spoiled batches. This definitive DNA-based information was based on the essence of the organism, the “genetic” core that did not change despite its environment or activity.



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RiboPrinter® Patterns Track Contaminant

The company had finally fingerprinted its culprit, but still didn't know its source. They next used RiboPrinter® system characterization of the strain in comparison with RiboPrint® patterns from cultured samples of the plant environment and the powder's ingredients (Figure 1). They discovered that ruined product could be tracked to an inert ingredient, a common mineral mined from soil containing the sporeformer.

The supplier of the mineral was a reputable broker of materials from around the world. Batches of this common mineral from the broker's varied sources were further sampled as they arrived on ships at the dockside. It was determined that only the supply from a particular West African nation contained the *Bacillus* that generated the RiboPrint® pattern linked to the spoilage.

Solutions

To avoid the slimy product in the future, the plant stipulated to the broker that they would need to be supplied from another source. This move dramatically reduced, but didn't entirely eliminate, the spoiled product nor its attendant, expensive problems of storage, disposal and interruption of supply to customers. Further investigation showed that the offending organism had established itself in the plant environment. The company began a long-term regimen of targeted dry cleaning directed by RiboPrint® patterns that revealed contaminated areas.

The industry trend away from harsh decontamination of ingredients and the global scope of suppliers now used in industry posed a number of problems for the manufacturer that could only be resolved by having detailed and accurate microbial information. The fact that this *Bacillus* could grow quickly and spread just as fast showed the company the value of continuing to monitor their process. Regular, detailed surveillance gave the company the information it needed to avoid problems and eliminate the costly, complicated process of cleaning up after them.

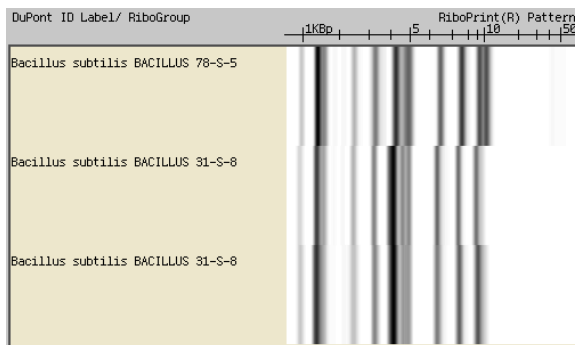


Figure 1. RiboPrint® patterns for several *Bacillus subtilis* types found in the powdered product. The genetically distinct "fingerprint" for the pattern at the top of the figure shows how easily the RiboPrinter® system can characterize a sample below the species level and use it to track down the source of contamination.

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