

Probiotic Viability Quantification: From Traditional Enumeration Methods to More Advanced Tools

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Abstract

Accurate enumeration of probiotic cells is essential to ensure that dietary supplements and functional foods meet their label claim throughout shelf life. Traditional plate counting (CFU) remains the industry standard but is time-consuming and limited in detecting viable but non-culturable (VBNC) cells, leading to an possible underestimation of viable probiotics. Emerging culture-independent methods such as flow cytometry (FCM) and viability droplet digital PCR (v-ddPCR) offer faster, more sensitive and precise alternatives. FCM enables rapid quantification of live cells, including VBNC populations, while v-ddPCR provides strain-specific enumeration with high accuracy. However, those techniques face challenges in scalability, cost and equipment requirements. In practice, for culturable probiotics, both methods show strong correlation with CFU. For VBNC, an integrated quantification approach can be considered to combine both culture-dependent and culture-independent data to improve the detection accuracy.

Additionally, formulation strategies—such as selecting stable strains, optimizing excipients, and controlling moisture and temperature—are critical to maintaining viable counts throughout shelf life. This presentation will explore enumeration technologies and formulation best practices to support robust, science-based probiotic product development.

Keywords: *Plate counting (PC), Flow cytometry(FCM), viability droplet digital PCR (v-ddPCR), viable but non-culturable cells (VBNC), formulation.*