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# On-Site Sequential Signal Generator of Dead and Living Yeast for Brewery Industry

Living and dead yeast cells of all species have the same characteristics which cannot be distinguished by observation through a microscope, even if the species Saccharomyces cerevisiae has a prolate spheroid, clear yellowish and semi-major axe of 3-5 microns. In brewery industry living yeast cells during the early stages of "lag phase" growth through "exponential phase" were preferred and needed for start-up the fermentative process. The "static phase" of yeast cells possesses the highest cell density which is the optimized stage for the process. The final destination of yeast cells is mortality (death phase) which their growth rate has the minimum. There will be dead cells mixed with living cells according to cell cycle. In the past, the traditional method to check living and dead yeast cells is staining cells with "methylene blue" (or cystal violet). However the method must be done by a laboratory specialist, take time to determine cell densities through a microscope using manual cell counting devices (hemocytometer). The present project had been fully supported from Singha Beverage Company to overcome the problem and to invent the equipment that can determine dead and living cells with real time analysis and automatic report. We employed the principle of cell polarizations in AC non-uniform electric fieldS with theoretical calculation of the lower critical frequency to separate dead and living yeast cells. The invention was achieved by combination of a sequential signal generator (SSG) (to be patent) equipped with tablet computer (touch screen) for on-site operation in the brewery industry. Dead and living yeast cells were separated by tuning the unique sinusoidal electric fields (to be patent) and their percentages were analyzed through image processing with numerical report. The phase difference addressing on the opposite electrodes fixed as Pi-radian which their phase sequences can automatically be altered and circulated. This is the first equipment in the world to report success in the processing portion of living and dead yeast cells with the rapid-time analysis of 15-20 minutes per sample. The invention can be applicable to another biological cells which have the same structure comprising the plasma membrane (cell membrane) of a phospholipid lipid bilayer with or without single-multiple cell walls. Now this invention have been employed as a prototype for routine work at Singha Beverage Company.

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