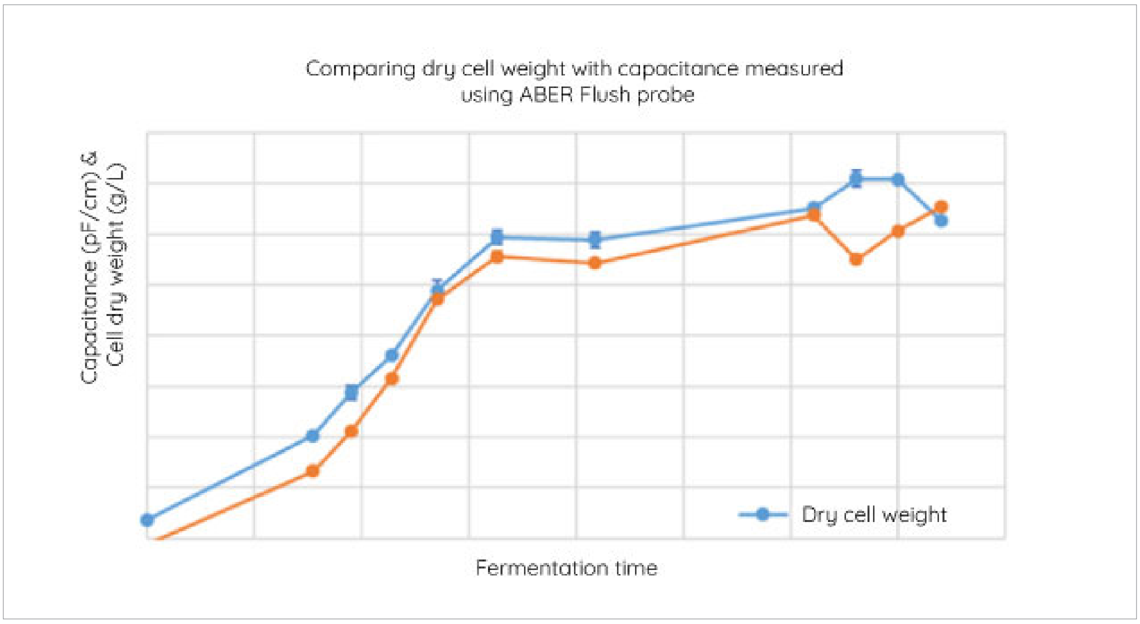
Biomass Fermentation - Filamentous Fungi

The productivity of a biological process is primarily defined by the amount of biomass generated during fermentation. Biomass measurements coupled with growth rate are critical for maintaining a steady state during a continuous process. Commonly, optical density (OD @600nm) is used for biomass measurement which depends on the uniform scattering of light for the prediction of the number of cells in a suspension. However, uniform light scattering is not possible if cells occur in clumps/chains such as in case of fungi, where the cells morphology is filamentous in its nature.

As such, physical methods have been employed to determine the fungal biomass, which relies on sample harvesting and off line dry cell weight measurements. This has various limitations which can affect biomass measurement/calculation and can take between 45 min to 4 hours, depending on the equipment used. The physical method also fails to discriminate between biomass and necromass. Therefore, there is a requirement for the accurate measurement and control of biomass within the fermenter, at both laboratory and industrial scale.

For more reliable real-time online measurements, this study was designed to evaluate Aber capacitance technology for measuring filamentous fungal biomass. Capacitance (pF/cm) measured online was therefore compared with the physically measured cell dry weight. The primary aim of the investigation was to evaluate the accuracy of using an ABER probe to measure biomass online between capacitance and biomass.

Data obtained using Aber Flush Probe



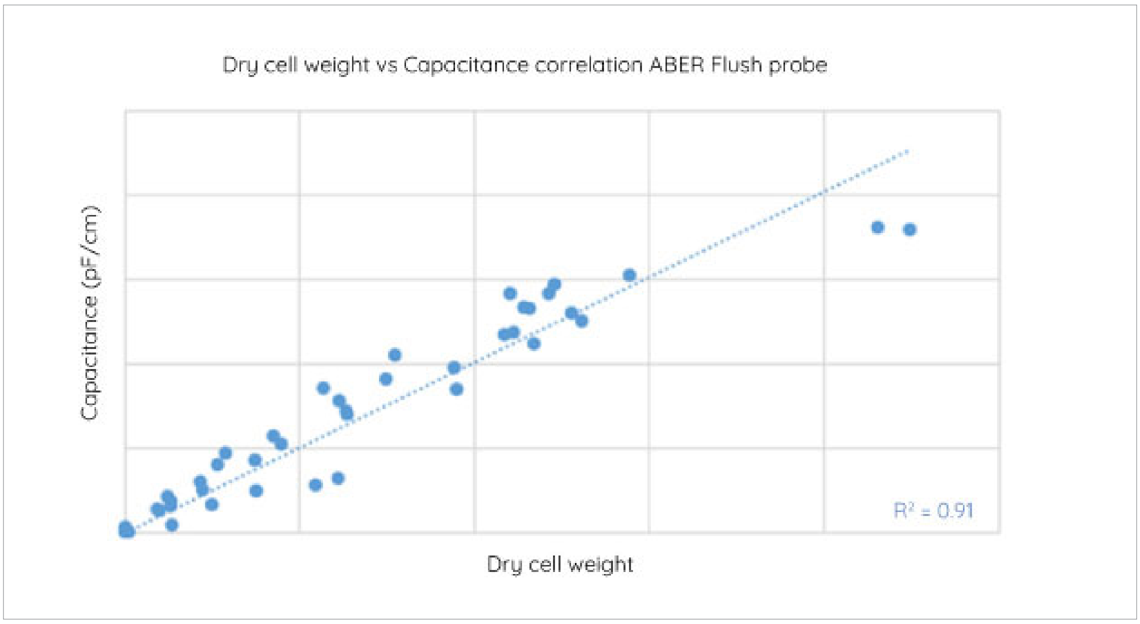
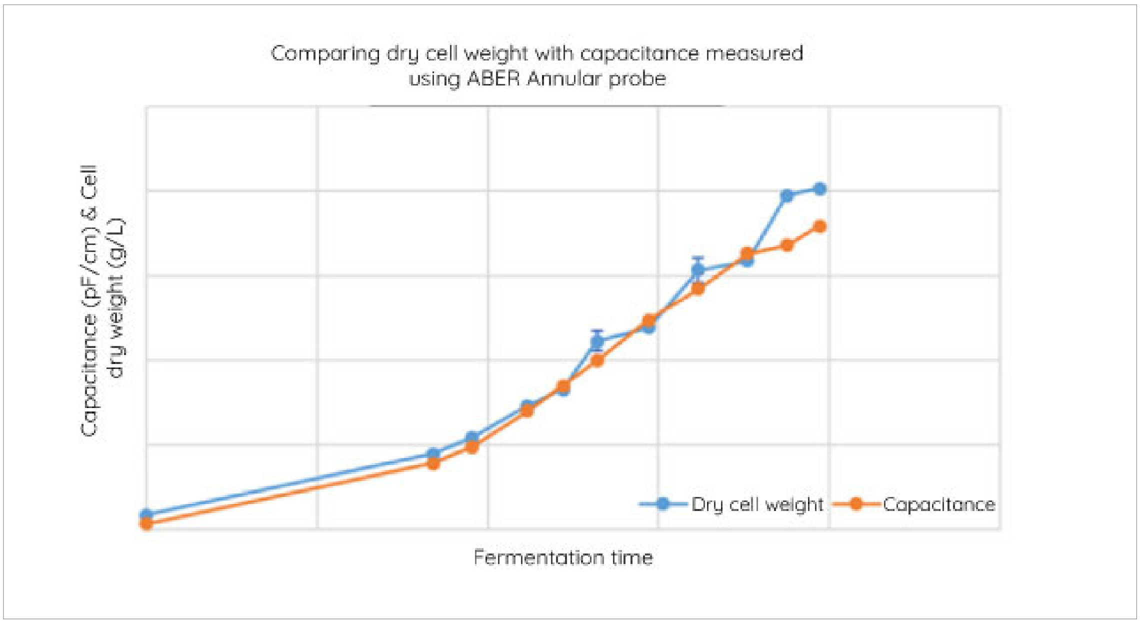


Figure 1: Comparison between Aber capacitance measured using the flush probe and dry cell weight of fungal biomass (Data courtesy of customer)

Data obtained using Aber Annular Probe



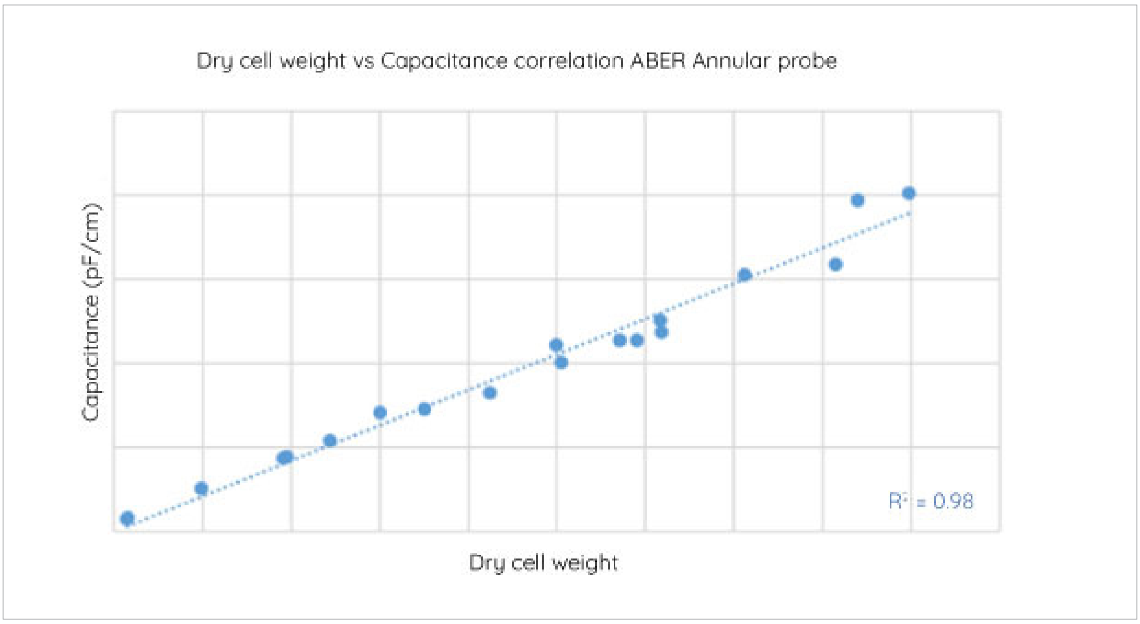


Figure 2: Comparison between Aber capacitance measured using the annular probe and dry cell weight of fungal biomass (Data courtesy of customer)

Note: The graphs illustrate the capability of the ABER flush/annular probe to monitor fungal biomass.

This company (name of company withheld) has shown that for a range of filamentous fungal biomass, online capacitance measurements have generated robust, accurate and comparable data for cell mass. Correlations between measured biomass and capacitance were shown to generate R2 values > 0.9 for both Flush and Annular probes (> 0.98 for the latter). As such the use of Aber's capacitance technology can be used as an immediate, on-line measurement which gives a direct relationship to cell biomass in a fermentation where other online measurements (such as optical density) cannot be employed.

Summary of the benefits:

- Monitor challenging fungal processes using capacitance.
- Allows for continuous in-line monitoring of fungal growth.
- Excellent correlation between inline capacitance and offline cell dry weight.
- Obtain a real time fingerprint of the process.
- Real time profile can be used to optimize nutrient feed, troubleshooting, and controlling critical events during the process.

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