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COMPARATIVE STUDIES OF FLUID DYNAMIC GAUGING AND A MICROMANIPULATION PROBE TO STRENGTH MEASUREMENTS

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ABSTRACT

Deposit strength is a measurement that is difficult to quantify, as it is a function of the deposit age. Despite this, deposit strength is known to be a key parameter in cleaning and removal processes and thus the capability to obtain a quantitative measure of adhesion strength suitable for use in industrial cleaning models is necessary for the further understanding and design of cleaning-in-place systems.

This paper describes work carried out in parallel by the groups at Birmingham and Cambridge to determine adhesion strength of food layers in situ, immersed in liquid, and in real time, using complementary techniques.

The Birmingham group uses a micromanipulation technique for adhesion strength measurements. A T-shaped probe is pulled across a circular plate, removing the deposit. The force required to move the arm is measured and converted into adhesion strength (work required to remove the deposit per unit area of the surface to which it is attached).

The Cambridge group uses fluid dynamic gauging (FDG) coupled with computational fluid dynamics to yield an alternative indicator of adhesion strength, namely the stress field required to disrupt a deposit.

Experiments have been performed on a baked tomato purée deposit using both FDG and micromanipulation, and the respective measures of adhesion and cohesion strength correlated. Both baking time and the length of time the deposit was hydrated for before experimentation was varied to ascertain adhesion and cohesion trends. The data show a good correlation, with each approach yielding information which complements the other set of observations.