EXPERIMENTAL STUDIES OF FOOD FAT FOULING USING A NOVEL SPINNING DISC APPARATUS

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ABSTRACT

Fouling phenomena analogous to wax deposition in crude oil transport are experienced in the food sector with liquid and semi-crystallised mixtures of fats used in baking and biscuit manufacture. Food fats are a major food component and are usually mixtures of triglycerides and smaller quantities of diglycerides. Like waxes, fats can solidify when subjected to temperatures below their cloud point, causing freezing fouling deposits to build up on relatively cold pipe walls. This coring phenomenon occurs via crystallisation, and yields a viscous gel which can harden over time to give a solid deposit.

Here, the design and operation of a novel spinning disc apparatus (SDA) featuring cooled, removable heat transfer surfaces is reported. Surface temperature and heat transfer rates are key parameters in freezing fouling so these are measured *in situ* using surface sensors. The SDA device is employed to study freezing fouling of a model solution of tripalmitin (PPP) in a non-crystallising paraffin oil, similar to that employed by Fitzgerald *et al*. (2004), augmenting the results obtained therein with a larger flow loop system. A series of experiments were undertaken to study the effects of bulk concentration, coolant temperature and disc rotation speed on the deposition process and the properties of formed deposits were further analyzed.

Independent characterization tests were performed to establish the cloud point and thermodynamic behaviour of the model solutions. Rheometry was performed on model solutions over the mushy zone (at and below their cloud point) using controlled stress devices, to determine the nature of the gels formed by these model solutions. These results were then compared with tests on deposits recovered from fouling experiments.

Fitzgerald, A.M., Barnes, J., Smart, I. and Wilson, D.I. (2004). *Food Bioprod. Proc.*, **82**, 207-212.