

SUPPORTING INFORMATION PARAGRAPH

Case 1: mimicking a NO-DRAIN process

The inlet ports (aqueous phase and organic phase) of the μ -device were connected with the Pullulan 7 w/w% and Sunflower oil + 4 w/w% admul wol fluid lines, respectively

The aqueous phase drain port of the μ -device platform was opened and the drain channel filled with Pullulan 7 w/w% solution while excess fluid flowed through the drain port. At this point the drain port was closed.

The oil phase drain port of the μ -device platform was opened and the drainage channel filled with Sunflower oil + 4 w/w% admul wol while excess fluid flowed through the drain port. At this point the drain port was closed

The device was operated at the following pressure for 30 minutes: Pullulan 7 w/w% = 41.3 kPa (6 psi), Sunflower oil + 4 w/w% admul wol = 82.7 kPa (12 psi). Droplets of Pullulan in Sunflower oil were formed from all the $\tilde{\mu}$ -channels ($\sim 20\ \mu\text{m}$ Dia.).

The drain port (oil phase) of the μ -device platform was opened and the drain channel filled with Pullulan 7 w/w% solution while excess fluid flowed through the drain port. At this point the drain port was closed.

The pressure of Pullulan was increased to 344.7 kPa (50 psi) and maintained for 2:30 minutes. Within this time all the oil $\tilde{\mu}$ -channels were filled with Pullulan.

Oil inlet port of the μ -device platform was connected back to the Sunflower oil + 4 w/w% fluid line and the aqueous phase inlet port with the Pullulan 7 w/w% fluid line.

The μ -device platform was started again at the operating condition pressures: Pullulan 7 w/w% = 41.3 kPa (6 psi) , Sunflower oil + 4 w/w% admul wol = 82.7 kPa (12 psi)

Case 2: effect of DRAIN

All the steps from a) to g) were repeated but before starting the μ -device platform at the operating condition pressures, the oil drain channel (filled with Pullulan 7 w/w%) was “cleaned” with Sunflower oil + 4 w/w% admul wol through the drain port. After this operation, Pullulan 7 w/w% was left only in the oil μ -channels but not in the drain channel.

Water Phase Fouling

Fouling Protocol

In order to mimic a potential mix up of the two phases during process conditions and to evaluate the ability of the system to recover to normal operating conditions, the following fouling protocol was adopted. We started this protocol using a new μ -device platform

Case 1: mimicking a NO-DRAIN process

The inlet ports (aqueous phase and organic phase) of the μ -device were connected with the Pullulan 7 w/w% and Sunflower oil + 4 w/w% admul wol fluid lines, respectively

The aqueous phase drain port of the μ -device platform was opened and the drain channel filled with Pullulan 7 w/w% solution while excess fluid flowed through the drain port. At this point the drain port was closed.

The oil phase drain port of the μ -device platform was opened and the drainage channel filled with Sunflower oil + 4 w/w% admul wol while excess fluid flowed through the drain port. At this point the drain port was closed

The device was operated at the following pressure for 30 minutes: Pullulan 7 w/w% = 41.3 kPa (6 psi) , Sunflower oil + 4 w/w% admul wol = 82.7 kPa (12 psi). Droplets of Pullulan in Sunflower oil were formed from all the μ -channels ($\sim 20 \mu\text{m}$ Dia.).

The drain port (water phase) of the μ -device platform was opened and the drain channel filled with Sunflower oil + 4 w/w% admul wol solution while excess fluid flowed through the drain port. At this point the drain port was closed.

The pressure of Sunflower oil + 4 w/w% admul wol was increased to 344.7 kPa (50 psi) and maintained for 2:30 minutes. Within this time all the water μ -channels were filled with Sunflower oil + 4 w/w% admul wol.

Water inlet port of the μ -device platform was connected back to the Pullulan 7 w/w% fluid line and the oil phase inlet port with the Sunflower oil + 4 w/w% admul wol fluid line.

The μ -device platform was started again at the operating condition pressures: Pullulan 7 w/w% = 41.3 kPa (6 psi) , Sunflower oil + 4 w/w% admul wol = 82.7 kPa (12 psi)

Case 2: effect of DRAIN

All the steps from a) to g) were repeated but before starting the μ -device platform at the operating condition pressures, the water drain channel (filled with Sunflower oil + 4 w/w% admul wol) was “cleaned” with Pullulan 7 w/w% through the drain port. After this operation, Sunflower oil + 4 w/w%

admuls were left only in the water μ -channels but not in the drain channel. Operating conditions were:: Pullulan 7w/w% = 41.3 kPa (6 psi) , Sunflower oil + 4 w/w% admuls = 82.7 kPa (12 psi)