

# The SINTEF Oil drop generator

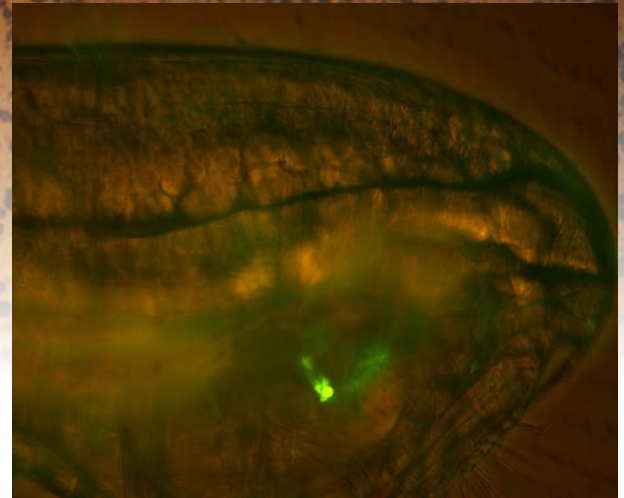
March 2015

## Generation of controlled oil-in-water dispersions for toxicity testing

### Background

Preparation of oil water dispersions (OWDs) as exposure media for aquatic toxicity testing is usually accomplished by subjecting mixtures of oil and water to a defined amount of energy such as controlled agitation in an aspirator bottle or mixing by agitating the water with pumps or propellers. Most of these systems are static and the resulting oil concentration and droplet size distribution is highly dependent on the oil properties and also the geometry and operational conditions of the generator system (e.g. mix energy, temperature). As an alternative to these methods a system for generating defined OWDs in flow systems was developed.

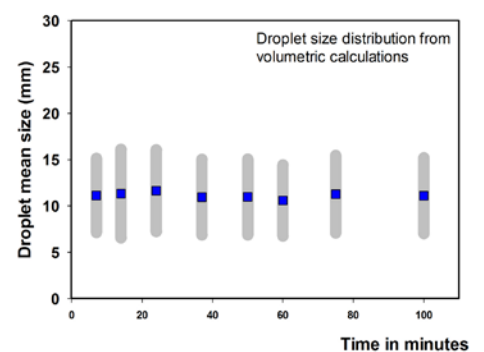
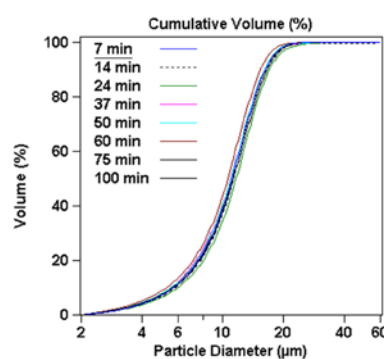
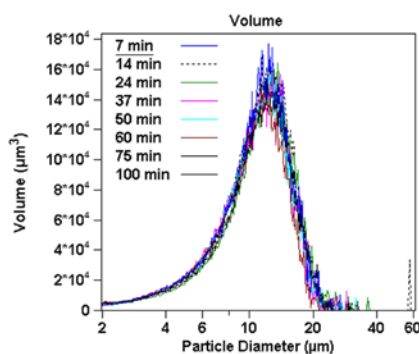
A recent report on a pressurized fluid injection (PFI) droplet generator (Nordtug et al, 2011) introduced a simple design to systematically deliver oil into a turbulent but controlled water stream. The method is based on continuous generation of oil dispersions with defined oil droplet size distribution and oil concentrations that could be adjusted by changing the oil:water ratio and the energy of the saltwater input (turbulence).

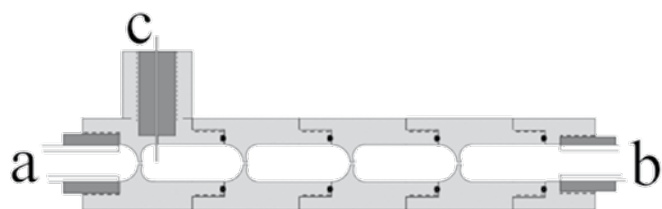


### Design of the pfi and exposure system

The following design criteria were defined for the experimental set-up:

1. Capacity to provide continuous production of dispersed oil droplets with defined size distribution of oils with different physio-chemical characteristics (e.g. viscosity, weathering degrees).
2. Ability to maintain stable and reproducible concentrations of dissolved and dispersed fractions for extended time periods (several days - weeks).
3. Avoidance of surfacing of oil droplets by establishing a balance between turbulence and droplet size distribution in exposure vessels.
4. Minimized adhesion of oil droplets to wetted surfaces by choice of materials and reducing volume/surface ratios.
5. Controlled light and temperature conditions
6. Easy access for sampling and maintenance.





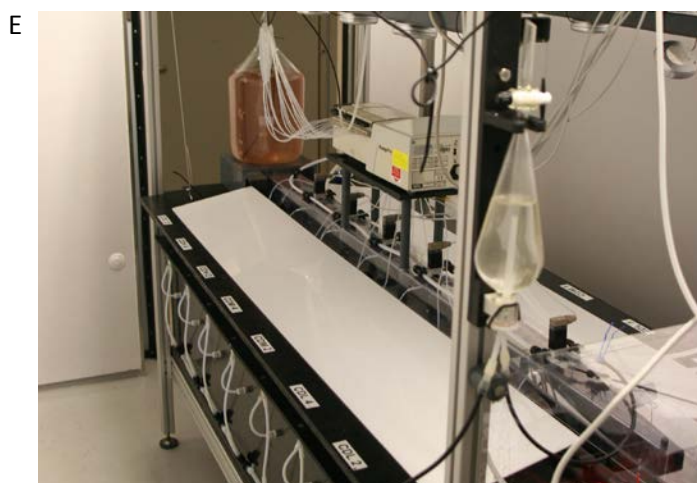
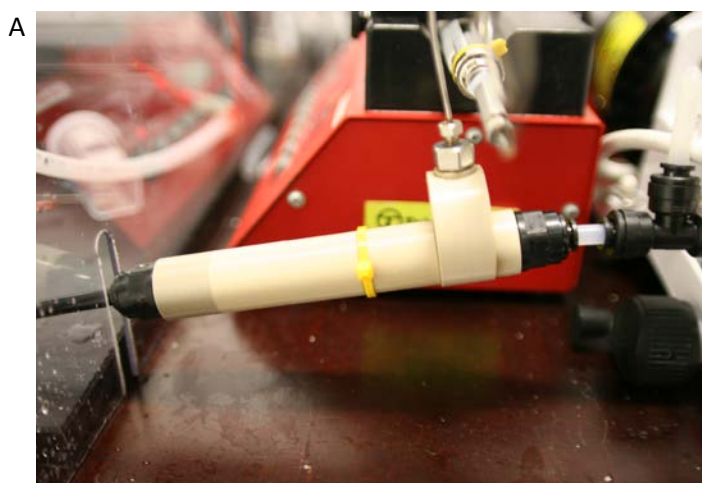
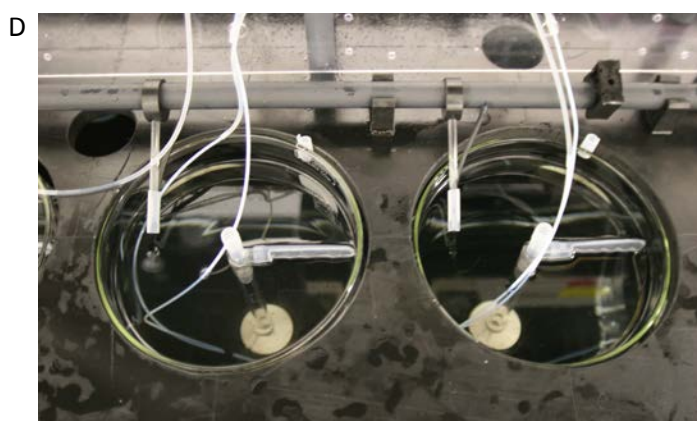
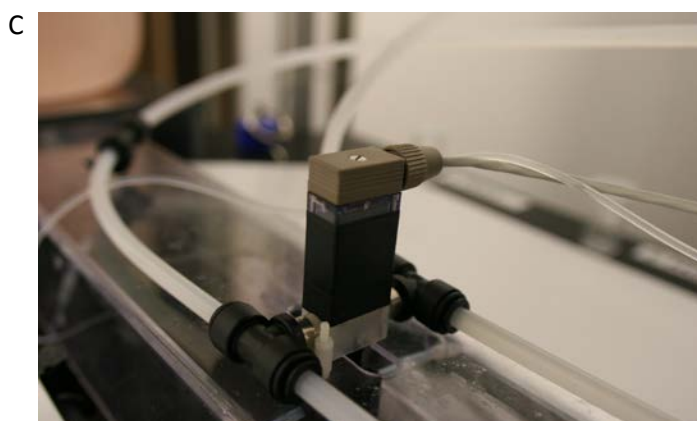
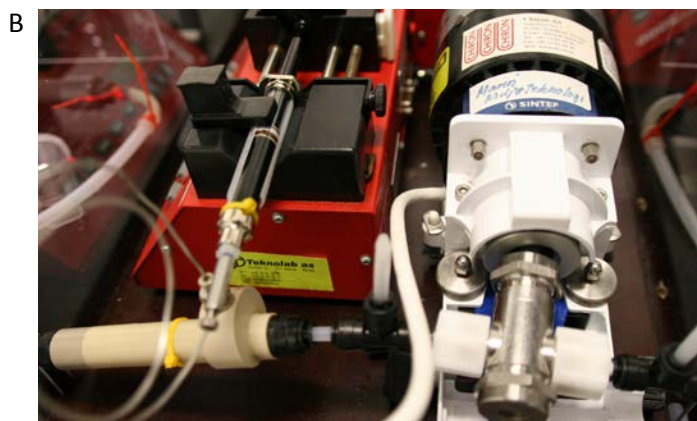
Left: Transect of the dispersion generator. a; Seawater inlet, b; Dispersion outlet, c; Inlet capillary for oil. The diameter of the inner chambers was 8 mm and the nozzle diameter was 0.5 mm.

The PFI system (A and B) containing the generator, a water pump and a syringe pump (for oil). Solenoid valves (C) controlled through a computer are used to make controlled dispersion concentrations. The dispersions are delivered to exposure chambers (D) which are lowered into a water bath (E) for optimal temperature control.

### Application of the system

The PFI in combination with a custom-made exposure system have been previously applied to address the following:

- Evaluation of the differences in effects between naturally and chemically dispersed oil (Hansen et al., 2012; Hansen et al., 2015)
- Evaluation of the contribution of oil droplets to toxicity (Nordtug et al., 2011B, Olsvik et al., 2011)
- Evaluation of the potential use of PFI-generated OWDs and WSFs for static-renewal toxicity studies



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