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Subsea Dispersant Injection: How to Assess Oil Droplets Behavior in the Water Column from Pilot-Scale Experiments

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Every aspects of a hydrocarbon release in deep waters are accompanied by uncertainties. These releases can occur from leaking wrecks, pipeline ruptures, or even blowouts. As the most catastrophic event, the blowout (subsequent to the total loss of control of the well head) lead to a massive release of hydrocarbons in the water column which can drastically impact the ecosystem for a long time frame. When this event happens in deep sea, such as in DeepWater Horizon in 2010, subsea application of dispersant can be employed to reduce the surfacing amount of oil. This technics have several benefits as it limits the risks incurred by workers above the well by reducing the volatile organic component concentrations. In addition, dispersant volumes can be lessen by a factor 5 and the application of dispersant can be carried out 24/7 even under harsh conditions. With the addition of dispersant, the oil behavior in the water column is notably modified and many questions remain concerning the fate of the dispersed oil.

Acquiring data in deep waters is very challenging. In order to better understand the action of dispersant on oil we used the CEC (Cedre Experimental Column), an original tool developed at Cedre to study the behavior of substances in the water column. In this study, pilot-scale experiments were carried on using different ratios of oil/dispersant. Thanks to shadowgraph imaging method, set up with the use of two high speed cameras at different heights in the water column, processing the data acquired on the shape and sizes of oil droplets allow to assess how the droplets evolve after their formation.

The results obtained show substantial differences in term of behavior between the different ratios of oil/dispersant tested. The tip-streaming phenomenon, known to take place in fluids with a low interfacial tension and a sufficiently high viscosity, was clearly identified. In addition, for each oil/dispersant ratio we were able to assess some characteristics of the plume and its evolution in the water column. Data collected from these experiments can be compared to field data and then, could be integrated to the validation process of modeling softwares.