Mixing Behavior of 45° Inclined Dense Jets in Currents

Mingtao Jiang, Adrian Wing-Keung Law, Shuai Zhang

PII: S1570-6443(16)30237-4
DOI: https://doi.org/10.1016/j.jher.2017.10.008
Reference: JHER 415

To appear in: *Journal of Hydro-environment Research*

Received Date: 19 August 2016
Revised Date: 27 August 2017
Accepted Date: 30 October 2017

Please cite this article as: M. Jiang, A.W-K. Law, S. Zhang, Mixing Behavior of 45° Inclined Dense Jets in Currents, *Journal of Hydro-environment Research* (2017), doi: https://doi.org/10.1016/j.jher.2017.10.008

Mixing Behavior of 45º Inclined Dense Jets in Currents

Mingtao Jiang[a,b], Adrian Wing-Keung Law[b,c], Shuai Zhang[b,c]

[a]*Interdisciplinary Graduate School, Nanyang Technological University, 50 Nanyang Avenue, Singapore 639798*

[b]*Environmental Process Modelling Centre (EPMC), Nanyang Environment and Water Research Institute (NEWRI), Nanyang Technological University, 1 Cleantechloop, Singapore 637141*

[c]*School of Civil and Environmental Engineering, Nanyang Technological University, 50 Nanyang Avenue, Singapore 639798*

[*]Email address for correspondence: cwklaw@ntu.edu.sg Tel: +65-6790-5296

Abstract:

In the present study, we experimentally investigated the mixing behavior of 45º inclined dense jets in unbounded co-flowing and counter-flowing currents using the Planar Laser Induced Fluorescence (PLIF) approach. The experiments were conducted in a towing flume, and the test conditions included a wide range of Densimetric Froude number (*Fr*) and Nominal Densimetric Froude number (*NFr* > 0 for co-flowing and < 0 for counter-flowing currents). The results showed that the mixing behavior can be categorized into dense-jet-dominated and current-dominated regimes. Within $|NFr| < 1.0$, the dense jet trajectories mainly depended on the source discharge characteristics, and the ambient currents had little effects. The dimensionless coefficients, including the centerline peak height z_m/FrD and dilution S_m/Fr at the centerline peak, were all nearly independent of *NFr*. Outside this range, however, the mixing became dominated by the currents, and the characteristics mainly depended on the value of *NFr* instead. The influence of currents on the jet spreading and concentration decay along the jet trajectories were quantified in details based on the experimental results. In particular, in counter-flows, the non-dimensional centerline penetration depth x_{cp}/FrD and the dilution at the centerline penetration depth S_{cp}/Fr were found to be strongly correlated with *NFr*.

Keywords: Inclined dense jets; Co-/Counter-flowing currents; Jet trajectory; Dilution.