

Accepted Manuscript

Ascent modes of jets and plumes in a stationary fluid of contrasting viscosity

Urmi Dutta, Shamik Sarkar, Amiya Baruah, Nibir Mandal

PII: S0301-9322(14)00042-1

DOI: <http://dx.doi.org/10.1016/j.ijmultiphaseflow.2014.02.007>

Reference: IJMF 2012

To appear in: *International Journal of Multiphase Flow*

Received Date: 9 August 2013

Revised Date: 19 December 2013

Accepted Date: 17 February 2014



Please cite this article as: Dutta, U., Sarkar, S., Baruah, A., Mandal, N., Ascent modes of jets and plumes in a stationary fluid of contrasting viscosity, *International Journal of Multiphase Flow* (2014), doi: <http://dx.doi.org/10.1016/j.ijmultiphaseflow.2014.02.007>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Ascent modes of jets and plumes in a stationary fluid of contrasting viscosity

Urmi Dutta, Shamik Sarkar, Amiya Baruah, Nibir Mandal*

High Pressure and Temperature Laboratory

Faculty of Science, Jadavpur University

Kolkata 700032, India

Abstract

Using multi-phase numerical experiments based on the Volume of fluid (VOF) methods we show the ascent behaviour of a fluid injected into another immiscible fluid with higher viscosity. Our VOF models reveal that the injected fluid forms jets characterized by a large head trailing to a slender tail, which do not break up, but ascend in two principal modes, *Mode 1: continuous* and *Mode 2: pulsating*. In Mode 1, their heads grow continuously either by volume expansion, forming balloon-shaped geometry (*Mode 1a*) or by curling, forming mushroom-shaped geometry (*Mode 1b*). In contrast, Mode 2 jets ascend in pulses, forming multiple heads, leading to pinched-off geometry. In this study we show the viscosity ratio (R) between the injecting and the ambient fluids as a crucial parameter in controlling the ascent modes, and provide an estimate of critical R for the Mode 1 to 2 transition under varying fluid injection rates (non-dimensionalized as Reynolds number, Re). From the entrainment velocity field we explain that the transition of continuous to pulsating process results from the flow convergence at several locations along the upwelling direction. We have also discussed the effects of buoyancy on the ascent modes in case of plumes.

Keywords: Jet shapes, fluid model, viscosity contrast, Reynolds number, flow perturbations, entrainment.

*Corresponding author (E-mail: nibirmandal@yahoo.co.in)

Phone: 91-33-24146666 (Extension: 2364); Fax: 91-33-24137121

Download English Version:

<https://daneshyari.com/en/article/667639>

Download Persian Version:

<https://daneshyari.com/article/667639>

[Daneshyari.com](https://daneshyari.com)