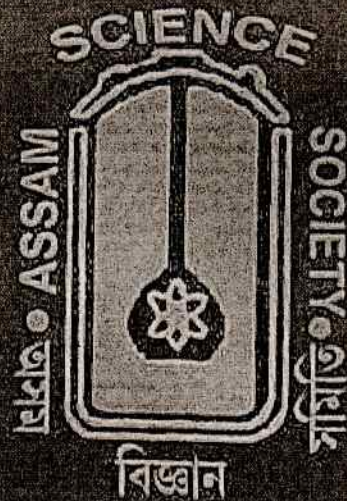


# RECENT TRENDS OF RESEARCH IN SCIENCE AND TECHNOLOGY

Proceedings of 59th Annual Technical  
Session of Assam Science Society

VOLUME 15, 2014



ASSAM SCIENCE SOCIETY  
Jawahar Nagar, Khanapara, Guwahati

Published by **Dr Dhireswar Kalita**, General Secretary, on behalf of the Assam Science Society, Jawahar Nagar, Khanapara, Guwahati, with the financial assistance of NEIST, Jorhat, Assam.  
Phone No: 9864026155; E-mail: gsass2014@gmail.com

ISBN : 13-978-81930041-2-8

**EDITORS :**

**P. K. Baruah**

Department of Botany  
Cotton College, Guwahati -1.

**S. R. Patgiri**

Department of Botany  
Cotton College, Guwahati -1.

**P. Sharma**

Department of Geogarphy  
Cotton College, Guwahati -1.

**D. Borah**

Department of Botany  
Cotton College, Guwahati -1.

**A M P Hussain**

Department of Physies  
Cotton College, Guwahati -1.

Copyright © 2014, Assam Science Society

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without prior written permission of the publisher.

## Studies of Near surfaceatmospheric Aerosols During the Diwali Festival Over Dibrugarh, North-East India

Jhuma Biswas<sup>1\*</sup>, Binita Pathak<sup>2</sup> and Pradip Kumar Bhuyan<sup>2</sup>

### Abstract

Intensive fire work activities release huge amount of anthropogenic aerosols during the Diwali festival in India in October-November every year. During the festival days, widespread burning of firecrackers takes place over the study region in the late afternoon hours which constitutes a major source of near surface pollutants such as aerosols, Black Carbon (BC), organics, trace gases etc. Concentration of air pollutants such as Particulate Matter (PM), PM<sub>10</sub>, PM<sub>2.5</sub> and BC were monitored for the period 2009-2010 during Diwali festival, post-Diwali and normal days over Dibrugarh, North-East India. The pollutant concentrations as recorded on Diwali days were found to be several times higher (5.33 and 2.76 times for PM<sub>10</sub>, 5.74 and 2.75 times for PM<sub>2.5</sub>, 1.21 and 1.66 times for Black Carbon for the year 2009 and 2010 respectively) compared to normal day average value at the peak hours of fire work activity. The diurnal variations on Diwali days showed maximum concentrations of PM (~175 µg/m<sup>3</sup>) and Black Carbon (~47 µg/m<sup>3</sup>) at late evening hours between 17:30 h to 19:30 h and 17:00 h to 23:00 h respectively over Dibrugarh. The above results indicates the massive contribution of widespread use of fireworks on the pollutant levels and thus significant increases in air pollutants throughout Diwali festival over Dibrugarh which can be associated with serious health impacts.

**Key words:** Diwali Festival, Black Carbon, Particulate Matter, fireworks

### Correspondance

1. Department of Physics, Birjhora Mahavidyalaya, Bongaigaon - 783380, Assam, India
2. Centre for Atmospheric Studies, Dibrugarh University, Dibrugarh-786004, Assam, India  
jhumabiswasdu@gmail.com, pathak.binita8@gmail.com, pkbhuyan@gmail.com

**Introduction:**

Diwali is one of the main holy festivals of lights and is celebrated in autumn every year all over India. The festival arrangements typically extend over a few day periods of late October or early November month with burning of large amount of firecrackers and sparklers. Massive amounts of crackers and sparklers are burned mainly on the Diwali day and also on the day before the Diwali (pre-Diwali) and after the Diwali (post-Diwali). Fireworks have a large number of chemicals for example potassium nitrates, potassium chlorate, potassium perchlorate, charcoal, sulfur, manganese, sodium oxalate, aluminum and iron dust powder, strontium nitrate, and barium nitrate, etc<sup>9,11</sup>. The poisonous substances used in the firecrackers when burnt can release significant amount of suspended particulate matter (PM), black carbon (BC), toxic gases and metals that are harmful to the health of all living beings. Burning of firecrackers and sparkles increased human health effects especially in the infants, women and elderly people<sup>3</sup>. Besides the air pollution the high level noise generated by the numerous firecrackers make sound pollution which effects badly to the birds and animals. Several studies have been performed associated with Diwali fireworks over different places in India<sup>1,2,4,8,10</sup>. Air quality degradation resulting from intense firework activities during Diwali festival and its impact on human health has been noted by Limaye and Salvi<sup>5</sup>. Ravindra *et al.*<sup>9</sup> reported that fireworks lead to short term variation in air quality and observed 2-3 times enhancement in concentrations of PM and PM10 in Hisar city during Diwali festival. The effect of fireworks on short-term variation in air quality at the same study location Dibrugarh was earlier reported by Pathak *et al.*<sup>8</sup> which shows that there was a significant increase in concentrations of O<sub>3</sub>, NO<sub>x</sub>, SO<sub>2</sub>, CO and BC during the peak hours of firework activity of the Diwali festival for the year 2012.

In the year 2009 and 2010 Diwali festival was celebrated all over India on 17th October and 5th November respectively. The PM and BC aerosol mass concentrations were closely monitored to examine the effect of short period firework events on their concentration over Dibrugarh (27.3° N, 94.6° E) during the Diwali festival period for the two consecutive years 2009-2010.

**Instrumentation and methods:**

A Quartz Crystal Microbalance (QCM) Impactor (model PC-2, California Measurements Inc., USA), have been used for measurement of near surface particulate matter (PM) concentration. Size segregated aerosols are made to impact on quartz crystals stacked one below the other and by monitoring the change in frequency difference between the reference crystal and the sensing crystal, the mass concentration of aerosols deposited in each stage is obtained in real time. Hence the QCM provides mass concentration of the particles collected in each stage as a function of particle diameter