ISSN: 0973-4929, Vol. 15, No. (3) 2020, Pg. 377-379

Current World Environment

www.cwejournal.org

Biochar Application in Agricultural Fields may be Fatal for Solar Energy Mission and Climate Change Targets

UMESH CHANDRA KULSHRESTHA
Editor-in-chief

School of Environmental Sciences, Jawaharlal Nehru University, New Delhi 110 067 India.

Article History

Published on: 18 December 2020

Dear Readers

I hope you are safe and doing well during COVID-19 pandemic. In spite of challenges, the authors have very enthusiastically contributed highly relevant papers as included in this issue of Current World Environment. I thank all the contributors for their sincere efforts made to enable its timely publication. In this issue, we have papers on environmental pollution, pollution remediation, water purification, COVID-19 impacts, post COVID-19 scenario of environmental education, monsoon, climate and application of activated carbon and ash.

The presence of elemental carbon and soot in ambient air is a matter of serious concern for human health and climate change[1]. The black carbon (BC) has the tendency to absorb solar radiation causing positive radiative forcing[2-3]. BC is also responsible for dimming of the atmosphere when the intensity of incoming solar light is reduced by the atmospheric fine carbon particles[4-5]. According to a report the carbonaceous aerosols contribute ~6 W/m^2 dimming per decade over India[6]. Further, the reports indicate that the solar dimming is increasing in Indian region due to increased fossil fuel combustion.

The solar energy conversion efficiency depends on the intensity of the incident sunlight and the temperature of the solar cell. Dimming inhibits the intensity of solar light so the target for solar cell temperature achievement is also adversely affected. Therefore, dimming cools the Earth's surface. The growing effect of dimming will also impact the temperature of solar cell. However, the carbon deposition alone will be reducing the reflected

CONTACT Umesh Chandra Kulshrestha umeshkulshrestha@gmail.com Director, Trans-Disciplinary Research Cluster, School of Environmental Sciences, Jawaharlal Nehru University, New Delhi 110 067 India.

Doi: http://dx.doi.org/10.12944/CWE.15.3.01

fraction due to its absorbing properties. But the soil dust-carbon mixed material will not be helping so much in absorption. This has a scope of further investigation. Generally, more than 30% of the incidental light is reflected by the untreated silicon of the cell[7]. This is minimized by coating an anti-reflection layer. Reflection is also checked by using textured surfaces of the cells.

The black carbon is also reported in dustfall[8]. Generally, coarser particles are removed through dustfall which is known as sedimentation process of removal of particles from the atmosphere. Sharma *et al.,*[9] have reported 310 mg/m^2/d or 1131 kg/ha/y fluxes of dustfall at Delhi which had particles ranging from1.5 μm to 151.5 μm. The dustfall includes suspended soil dust, construction dust and road dust. Soil dust is abundant in the Indian atmospheric environment. The soils from agriculture fields also contribute to suspended dust into the atmosphere during prevailing dry weather conditions especially through high-speed winds.

According to Mishra and Kulshrestha[8], dustfall is significantly enriched with carbon. The EC content was around 9 times higher in the atmospheric dust than its corresponding soils. Around 1 mg/m^2/d BC is deposited onto the surface in Delhi which is translated as 10 g BC/ha per day which comes to 3.6 kg C/ha per year. This amount of BC dust is very huge which is mainly contributed by resuspension of carbon-dust mixed particles in which carbon is mostly emitted from transport and industrial sectors in Delhi. The aerosol BC deposition will further add to these estimates of BC deposition on the surfaces. Imagine, if the agriculture sector which covers huge area, starts adding the resuspended dust which is often transported to far places through trans-boundary and long range transport, the carbon rich dustfall fluxes will be much higher posing a serious challenge of clean air, bright sunrays, high visibility and solar energy exchange by the solar cells.

Problem of efficiency will be worsen during winters when solar flux is reaching the Earth's surface is lower than the summers. Due to lower wind speed and temperature during winters, relatively stable atmosphere further becomes conducive to add carbon rich suspended dust from all sector including an extra input from agricultural field due to biochar application. Application of biochar in agriculture fields at mass levels for few years will increase carbon particles in air which in turn will increase atmospheric haze reducing solar light intensity. A few year application of biochar in the fields may become long-term dimming problem and may hamper the climate change targets too.

Mistakes out of innocence are expected but should not be repeated. With growing understanding about the issue, we cannot take immature decisions. For example the ignorance due to innocence of harmfulness of SO_2 while using coal for energy resulted in acid rain problem in the temperate regions. Later, the scientific evidences helped and forced to go for SO_2 reduction policies. Such examples of environmental disasters suggest that there is a need to have foresightedness about such mass scale applications as per the contemporary scientific understanding. The short time profit may be a temporary gain but in long term it may turn devastating, very similar to the cancers from pesticides, dried wells due to eucalyptus plantation, choked drains due to plastic or the congestion due to BRT Corridor of Delhi.

If the solar energy dependency is the mission, there is need to prevent and minimize dimming effect in order to receive adequate intensity of sunlight. In this aspect, the efforts of Environmental Pollution Control Authority (EPCA) for banning plastic burning and pyrolysis oil (tyre oil) units helped reducing BC in the NCR Delhi which contributed to increased visibility and light intensity[10]. This has also affected ozone levels in urban areas[11]. The crop residue burning also a source of BC and contributes towards hazy atmosphere, poor visibility and dimming of sunlight. The crop residue burning (CRB) problem can be solved by opting non-burning methods and practices. Bio-refinery is one such effective option which can control CRB and carbon emissions. The approach of use of happy seeder technology (HST) must be appreciated. The HST is a machine which is used for direct sowing the new wheat crop without any tillage even when the rice straw residue is in soil. In a nutshell, a holistic approach is needed to avoid emissions and resuspension of carbon in the air which may be helpful for solar energy mission as well as for coping with climate change.

References

1. IPCC (2007), Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment, Report of the Intergovernmental Panel on Climate Change, 996 pp., Cambridge University Press, Cambridge, United Kingdom, and New York, NY, USA.
2. Badarinath, K.V.S., Latha, K.V., 2005. Seasonal variations of black carbon aerosols and total aerosol mass concentrations over urban environment in India. *Atmos. Environ.* 39, 4129-4141.
3. Chen, L.W.A., Doddridge, B.G., Dickerson, R.R., *et al.,* 2001. Seasonal variations in elemental carbon aerosols, carbon monoxide and sulfur dioxide: Implications for sources. *Geophysical Research Letters* 28, 1711e1714.
4. Bond T.S, Doherty, S. J., Fahey D. W. et al., 2013. Bounding the role of black carbon in the climate system: A scientific assessment. JGR, 118 (11), 5380-5552. https://doi.org/10.1002/jgrd.50171.
5. Satheesh, S. K. and Ramanathan, V. (2000). Large differences in tropical aerosol forcing at the top of the atmosphere and earth's surface. *Nature* Vol. 405, Issue 6782, pages 60-63.
6. Kumari B. P. and Goswami B. n., 2010. seminal role of clouds on solar dimming over the Indian monsoon region, *Geophysical Research Letters*, 37, L06703, 5 PP., doi:10.1029/2009GL042133.
7. SPE, 2020. Solar Performance and Efficiency. https://www.energy.gov/eere/solar/solar-performance-and-efficiency, retrieved on December 16, 2020.
8. Mishra M. and Kulshrestha U. 2016.Chemical Characteristics and Deposition Fluxes of Dust-Carbon Mixed Coarse Aerosols at Three Sites of Delhi, NCR. *J Atmospheric Chemistry*, http://link.springer.com/article/10.1007/s10874-016-9349-1.
9. Sharma A., Singh S. and Kulshrestha U.C. 2017. Determination of Urban Dust Signatures through Chemical and Mineralogical Characterization of Atmospheric Dustfall in East Delhi (India). *J Indian Geophysical Union*, 21, 140-147
10. Kulshrestha, U. 2020. NCR Air Pollution issue. Editorial, Special Issue of JNU ENVIS RP Newsletter 24 (4).
11. Kulshrestha, U. 2020. Reason for High Levels of Ozone in Delhi during COVID-19 Lockdown. NCR Air Pollution, JNU ENVIS RP Newsletter 24 (4), 3-4.