

## Document Information

### Manuscript Title

TestAssignment--10

### Manuscript Id

RGS00010

### Review Type

Double Blind

### Review Due Date

15 September, 2025

### Recommendation



Accept

## Regional Anesthesia & Pain Medicine

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### **Assessment of Dew Harvesting as a Sustainable Water Source and Air Quality Indicator: A Case Study of Dhanbad, Jharkhand, India**

Journal:	<i>Regional Anesthesia &amp; Pain Medicine</i>
Manuscript ID	Draft
Article Type:	Review
Date Submitted by the Author:	n/a
Complete List of Authors:	sarode, shruti; Sant Gadge Baba Amravati University,
Keywords:	Acute Pain, Aged, Analgesics, Opioid

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Manuscripts

To

The Editor-in-Chief

*International Journal of Environmental Sustainability & Water Resources*

123 Green Research Avenue

New Delhi – 110001, India

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**Subject:** Submission of Manuscript – *Assessment of Dew Harvesting as a Sustainable Water Source and Air Quality Indicator: A Case Study of Dhanbad, Jharkhand, India*

Dear Editor,

On behalf of my co-authors, I am pleased to submit our manuscript titled “**Assessment of Dew Harvesting as a Sustainable Water Source and Air Quality Indicator: A Case Study of Dhanbad, Jharkhand, India**” for consideration for publication in the *International Journal of Environmental Sustainability & Water Resources*.

This study investigates the feasibility of dew harvesting as a sustainable water source in a resource-constrained region and examines its potential as an indicator of air quality. The findings provide valuable insights into sustainable water management practices and environmental monitoring, which align with the scope and readership of your esteemed journal.

We confirm that this manuscript is original, has not been published previously, and is not under consideration by any other journal. All authors have read and approved the manuscript and have contributed significantly to the research work.

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We kindly request you to consider this manuscript for publication, and we look forward to your positive response.

Thank you for your time and consideration.

Sincerely,

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**Keywords:** Dew; regional air pollution; chemical composition; dry deposition; atmospheric water

## 1. Introduction

Water scarcity is a global issue, and India is not spared from this global problem. Water scarcity is a scenario where demand exceeds availability and is a key determinant of water security and directly affects the health and wellbeing of humans. Owing to growing populations, burgeoning industries, resource centric lifestyles, changing agricultural patterns, and global warming, water has become a limited resource, although renewable one. Increasing population leads to extraction of more of water resources through its domestic usage and increasing industries and agricultural coverage to fulfill its demands. In contrast climate change affects the spatial distribution and timing of water availability (Greve et al., 2018). As per the report of IPCC, climate change will make the drought situation even worse, so the water scarcity issue in the arid and semi-arid regions draws highest of attention. This requires very intricate level water management, knowing the fact that freshwater resources are already imbalanced, and the situation will worsen further.

Globally, water is extracted from ground water sources (spring, well, handpump, and surface water sources (river, lake, canal, pond). Reducing freshwater resources have led to look out for alternative water sources. Desalination is the prevalently used technique for converting the saltwater of the Earth's oceans to potable ones. Global oceans covering 70% of the Earth's surface, the water reservoir for desalination is abundant, and could be a promising way to fulfill the water needs of humans. However, desalination is a costly measure. This again necessitates looking for alternative water source. The atmosphere around the Earth contains more than  $12.9 \times 10^{12}$  m<sup>3</sup> of renewable water (Shafeian et al., 2022). Therefore, local water production through utilizing this atmospheric water vapor will be a logical solution to the water scarcity

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3 51 problem. This atmospheric water vapor is abundantly available everywhere and is not exploited  
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5 52 much. Arid and semi-arid regions (either naturally or due to climate change impacts) can  
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7 53 consider harnessing this potential water resource from the air for freshwater production (Salehi  
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9 54 et al., 2020; Jarimi et al., 2020; *Raveesh et al., 2021*). Active air cooling, desiccant-based water  
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11 55 harvesting, fog collection, and dew water harvesting are the main atmospheric water generation  
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13 56 techniques (Tu et al., 2018; Peeters et al., 2020). Active air cooling involves cooling the air  
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15 57 below the dew point to provoke condensation. In this case, energy is required for cooling the  
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17 58 air and to supply sufficient amount of air to the cold surface (Peeters et al., 2021). Desiccant  
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19 59 based water harvesting involves a good desiccant material to capture air moisture even at low  
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21 60 relative humidity (Kim et al., 2017), where desiccant surface facilitates adsorption of water  
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23 61 vapor on a hydrophilic porous adsorbent, or absorption in a hygroscopic medium, or a  
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25 62 combination of both (*Xu et al., 2020*, Kim et al., 2018). In contrast to active air cooling and  
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27 63 desiccant-based water harvesting, fog and dew harvest rely on passive air cooling. Dew and  
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29 64 fog are naturally occurring process although the climatic conditions suitable for using these  
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31 65 concepts are few and are not much explored. Dew harvesting is best at higher humidity  
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33 66 (RH>40%), and fog harvesting is optimal during the super-saturated conditions (when super-  
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35 67 saturated conditions exist (Rao et al., 2022). Dew is formed when atmospheric water vapor is  
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37 68 condensed on a surface at a temperature below its dew point temperature (Khalil et al., 2016;  
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39 69 Beysens et al, 2007).  
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47 70 Dew is a unique natural process that has gained attention for a long time, as an important source  
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49 71 of water in arid and semi-arid regions. Under low wind condition and clear sky, when relative  
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51 72 humidity is high (> 70%), surfaces cool below dew point temperature, and dew formation  
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53 73 occurs. For the dew formation, relative humidity of ambient air should have a typical value of  
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55 74 more than 70%. Under this condition of RH, radiative cooling can allow the substrate to fall  
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57 75 below the dew point temperature and counterbalance the latent heat of condensation (Beysens  
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et al., 2010). Hence, sufficient moisture content in air and intensive radiative cooling are the main requirements for dew formation. Additionally, clear skies and light winds are favourable for dew formation (Baier et al., 1966). While clear skies allow for faster loss of radiation to the outer space and therefore accelerate radiative cooling, light winds brings extra moisture to the surfaces (Newton and Riley 1964).

Making changes in quality, type and orientation of the condensing surface, dew yield is maximized to meet the ever-growing water demand (Sharan et al., 2011). Dew water can be harvested using i) a passive cooling condenser, ii) solar-regenerated desiccant, and iii) water harvesting from air using active cooling condensation technology (Jarimi et al., 2020).

As dew involves ambient air surrounding the condensing surface along with the co-occurrence of dry deposition, it represents well the characteristics of regional air of the concerned site. Dew is one of the means of wet deposition. Wet and dry deposition are the processes by which gases and particles are ultimately removed from the atmosphere. While wet deposition relies on rain/dew/frost/snow etc, dry deposition is a continuous process. Wet scavenging occurs either through wet atmospheric precipitation or through occult precipitation (Kurzyca & Frankowski, 2019). Wet atmospheric precipitation involves rain and snow. Occult precipitation involves dew, fog, and frost. Scavenging of atmospheric particles and gases happens in huge quantity through rain (including both in-cloud scavenging and below cloud scavenging), but it is season specific. In contrast, the occurrence, frequency and duration of dew events are higher than those of rain (Romps, 2017), snow, fog or frost. Therefore, dew can be considered as a continuous means of wet deposition that happens during the night time. Besides removing the pollutants, dew is an important source of water, and also provides nutrients for vegetation, owing to the availability of trace elements in dew (Tian et al., 2023).



99 Particle scavenging through wet deposition can happen either through in-cloud scavenging or  
100 below-cloud scavenging. Scavenging of different size of particles via rain or dew or frost or  
101 snow is a part of below cloud scavenging. Scavenging ratio or washout ratio of particle gives  
102 an idea about the fraction of total atmospheric particles removed by a specific wet deposition  
103 component. The ability of particle to be scavenged by wet deposition depends on nature of  
104 particle, size of particle, and the transformations that may involve during the scavenging of  
105 particles. Besides, seasonal variation has been observed by some studies in the particle  
106 scavenging (Sakata and Asakura 2009; Chan et al., 1986). Gas scavenging through wet  
107 deposition can occur under below cloud scavenging. Depending on whether the gas is soluble  
108 in water or not, scavenging of a specific gas takes place. Even for water soluble gases, some  
109 gases are reversibly soluble, and others are irreversibly soluble. These parameters differentiate  
110 the type of scavenging of gas.

111 The present work aims to address the importance of dew in two different ways: i) for water  
112 harvesting, and ii) for ambient air quality analysis. This study will involve dew collection on a  
113 surface with the passive cooling process and characterizing the dew water for its physico-  
114 chemical properties. While the former will provide a feasibility identification of dew as a  
115 potential fresh water source, the latter will give a chance to assess the ambient air quality in an  
116 indirect manner.

## 117 2. Experimental Procedure

### 118 2.1 Study area

119 The study has been carried out in Dhanbad district of Jharkhand state in India. Dhanbad is one  
120 of the major districts in Jharkhand and covers an area of 2861 km<sup>2</sup>. As this state is known for  
121 its coal mines, Dhanbad is popularly known as “Coal Capital of India”. As the area is actively  
122 associated with coal mining for more than a century, the air in this region is prevalently

contaminated with particulate matter and gaseous pollutants. As per the report of Ministry of Coal, Government of India, Jharkhand has the highest measured coal and lignite resources in India (53,245.02 million tonnes). Due to prevalent active and abandoned coal mines, vehicular activities in and around the city, coal washeries, coke oven distillation units and power plants, the air in Dhanbad remains contaminated with huge load of particulate matter and gaseous pollutants. Owing to this, Dhanbad was one categorized as one of the 131 non-attainment cities in India by MoEFCC during launch of NCAO programme in 2019. Dhanbad has a hot tropical climate, with three distinct seasons, viz-summer, monsoon, and winter. The summer season is hot and dry from March–June, with maximum temperature ranging from 46 to 48 °C. Rainy season continues from July to October with the average annual rainfall recorded to be 1280 mm. The south-west monsoon lasts from July to October and this monsoon season gets N85% of the annual rainfall. The monsoon season is followed by cool and dry winter season from November to February, with lowest recorded temperature in the range of 5–7 °C.

## 2.2 Experimental Set-Up

The dew collection experiment was carried out in the Indian School of Mines (ISM), Dhanbad (now IIT-ISM Dhanbad) in the winter months (November to February) in the year 2014. ISM campus is situated along National Highway 32, Dhanbad, in the state of Jharkhand. The terrace selected for dew collection set-up installation was part of the Environmental Science and Engineering (ESE) department and faced the open sky. This set up involved a 1×1 metal frame, with the top sloping 30° from horizontal, which held a plywood for backing. The condensing surface made up of thermocol, covered with polythene film was fixed on the plywood. Collection accessories (gutter and hose) were also supported on the frame, as shown in Fig. 1. The dew collection set up was made free from interfering particles deposited on them by washing with distilled water every day before exposure for collection. The set up was placed at the site facing open sky at 8.00 pm and was removed at 6.00 am before sunrise.

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3 148 **2.3 Analytical Techniques**  
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6 149 The accumulated dew water samples were carefully collected and analyzed for quantitative as  
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8 150 well as qualitative parameters. Quantitative parameter involved the yield of dew from the  
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10 151 collection set up. The dew collection method involved collecting the dew from the hose and  
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12 152 scraping out the rest on the slanting collection surface. After measuring the total yield of  
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14 153 collected dew, the sample was transferred into a beaker to measure pH, electrical conductivity  
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16 154 (EC), and total dissolved solids (TDS). The measurement of these preliminary qualitative  
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18 155 parameters was done on site only. After filtration, the samples were used for ion analysis. Four  
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20 156 major cations  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  and three major anions  $\text{SO}_4^{2-}$ ,  $\text{NO}_3^-$  and  $\text{Cl}^-$  were  
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22 157 analyzed based on the standard methods mentioned in APHA (2005) (the utilized methods are  
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24 158 mentioned in Table 1).  
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30 159 **2.4 Dew Yield Estimation and ambient air quality assessment**  
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33 160 Dew formation involves phase change of water vapor to liquid water. As, this is a surface  
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35 161 phenomenon, it also involves scavenging of gases as well as particles in the ambient  
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37 162 atmosphere. Dew formation in this study was facilitated by radiative cooling, and therefore did  
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39 163 not involve any alternate cooling arrangements. Therefore, limitations of radiative cooling  
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41 164 limited the dew yield as well. The scavenged gases and particles in the dew water were  
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43 165 representative of the ambient air, and therefore provided a good opportunity for understanding  
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45 166 the ambient air quality of the region as well.  
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49 167 **2.5 Neutralization factor**  
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52 168 The acidic components ( $\text{SO}_4^{2-}$  and  $\text{NO}_3^-$ ) present in dew and rain, which react with basic  
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54 169 components ( $\text{K}^+$ ,  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$ ). The function performed by cations in neutralizing the  
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56 170 acidifying components are based on the abundance or scarcity of basic components, that is  
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58 171 estimated by calculating neutralization factor (Das et al., 2005):  
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$$NF_X = X/[NO_3^- + SO_4^{2-}] \quad (1)$$

Where X is the cation species responsible for neutralization.

## 2.6 Sea contribution

The non-sea salt fraction is calculated to assess the ion contributions from sources other than the sea (anthropogenic and geogenic). The  $Na^+$  totality considered of sea origin is both primary basis (Keene et al., 1986) and ionic concentration of sea water of this calculation. Percentage sea salt fraction (%SSF) and %NSSF are given by equations:

$$\%(SSF_X) = 100 \times \frac{(Na) \times (X_{sea}/Na_{sea})}{X} \quad (2)$$

$$\%(NSSF_X) = 100 - \%(SSF_X) \quad (3)$$

Where X denotes the ion concentration as measured in dew and rain,  $X_{sea}$  denote the ion concentration in bulk seawater, and  $Na_{sea}$  specify the Na reference ion concentration in bulk seawater.

## 3. Results and discussion

### 3.1 Dew Yield

A total of 30 dew samples were collected from the self-fabricated surface. Over the three months of winter, only 30 samples were collected, as sometimes dew samples were less to be considered as sample, or was interfered by the high time rain. The average dew amount collected was  $0.13 \text{ L/m}^2$ . Dew yield is primarily limited by the availability of cooling energy, which does not exceed  $100 \text{ W/m}^2$ , and this limits the theoretical maximum yield of dew in the order of  $0.8 \text{ L/m}^2$  per night. As per research of Clus et al. (2009), in practical situation, this theoretical maximum is again reduced to  $0.6 \text{ L/m}^2$  due to heat losses with wind, cloud coverage and limited air humidity. Even though the yield obtained in this experiment is lower than the

practical theoretical maximum, this simple experiment suggests that dew water harvest can be a potential water source, with good condensing materials, and can be beneficial for arid and semi-arid regions. This kind of simple experiment can form the preliminary examination of dew yield identification in such regions. Advancement of material science and technology have now come up with new condensing surface which can maximize the yield significantly. The best example can be Black Silicon, which has a remarkable optical emissivity in the infrared region of the atmospheric window waveband (Sarkar et al., 2019). Liu et al. (2021) estimate that a yield of more than 1L/m<sup>2</sup>/night can be obtained with passive cooling. This yield is a considerable amount for drinking or irrigation purposes, specifically in the scarce water regions or regions where water pollution is prevalent in the conventional surface water and ground water sources.

**3.2 Physico-chemical analysis**

Dew samples collected from the self-fabricated dew collection setup were analysed for its physico-chemical parameters and the statistical summary is mentioned in Table 2. The obtained values are compared against the drinking water quality standards in India. As evident from the values shown in Table 2, the collected dew water has an ionic content well within the permissible limits. This confirms that qualitatively dew water can certainly be utilized for drinking purposes. Atmospheric water is one of the purest forms of water, as it is formed by condensation of water vapor, and the ionic content measured for dew samples collected in this study validates this. In current times, when ground water and surface water resources are shrinking due to huge water demand, atmospheric water is a silver lining which can be harnessed by various means, and one of them is through dew collection. Similar kind of study done by Nath and Yadav (2018) in New Delhi, reported higher ionic content in dew water for all the ions except potassium and sulphate. Fig. 2 (a) and (b) shows the cation and anion distribution of dew for the entire sampling period. The trend of ionic contribution for dew

samples showed high values of  $\text{Ca}^{2+}$  and  $\text{SO}_4^{2-}$ . Higher values of  $\text{Ca}^{2+}$  would have come from geogenic sources. Lowest  $\text{NO}_3^-$  concentration can be accounted for the negligible vehicular activities during night, which mainly release nitrogen oxides for nitrate formation. So, the splitting of  $\text{SO}_2$  in alkaline medium could be the reason behind higher values of  $\text{SO}_4^{2-}$  in samples, subsequent continuous dissolution of  $\text{SO}_2$  (Singh et al., 2006; Nath et al., 2018). Also, under the high RH condition when dew is formed, heterogeneous oxidation of  $\text{SO}_2$  takes place with alkaline particles like Ca and Mg (Khemani et al., 1989). Besides, Hunt et al. (2015), stated that the tropospheric ozone correspondingly provides a pathway for oxidation of  $\text{SO}_2$  under aqueous environments.

Dew and rain samples collected in the months of January and February, 2014 were compared for ionic composition and are shown in Fig. 3. It was found that  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{SO}_4^{2-}$ ,  $\text{NO}_3^-$  and  $\text{Cl}^-$  contents were around 14, 27, 5, 2, 7, 8 and 15 times greater in dew in comparison in rain, respectively. Scavenging of airborne particles or gases in dew happens over the night, so more of ambient pollutants are concentrated in dew. In contrast, same scavenging by rain is a very short-term process, so less of pollutants get trapped in rain. Higher values of soluble ions in dew when compared with rain is also reported by Muselli et al. (2021); and Xu et al. (2015), and Yadav and Kumar (2014).

### 3.3 pH and electrical conductivity

Dew pH values on a daily basis and their frequency distribution are depicted in Fig. 4(a) and 4(b), respectively. The pH of dew reached between 7 to 8.7, with a mean value of 7.66. For rain, mean value of pH was 6.19 with maximum of 7.13 and minimum of 4.9. For comparison of dew and rain, only samples of dew and rain collected during same months were considered. This comparison found the mean pH of rain about 1.5 pH units more acidic than dew pH. Higher pH values of dew in comparison to those of rain is attributed to particles and gaseous composition at different altitudes (Jiries, 2001) at which rain and dew are formed, along with

the difference in contact time of water with the pollutants present in atmosphere in each case (Beysens et al., 2006). It has been observed that the higher pH of dew in comparison to rain validates the previously published data (Singh et al., 2006; Yadav and Kumar, 2018).

In other hand, the EC values of dew samples for the entire sampling duration were in the range of 109.1-650  $\mu\text{S}/\text{cm}$  with a mean value of 323.29  $\mu\text{S}/\text{cm}$ . Fig. 5(a) shows plot of EC against dew volume. From this graph it is evident that higher EC was found for lower volumes. As dew formation is a surface phenomenon, dew is diluted with longer dew duration time or higher dew volumes. This is supported by the reason accounted for by Beysens et al. (2006) that on the condenser surface dissolution of deposited gas and solid particles takes place. Similar result was seen in the plot [shown in Fig. 5(b)] of total dissolved ions (TDIs) versus dew yield.

### 3.4 Neutralization and Sea contribution

Neutralization factor determines the alkalinity or acidity of dew and rain. The high concentration of  $\text{Ca}^{2+}$  in both dew and rain indicates that it is the most prevalent neutralizing cation. NF values for  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$  and  $\text{K}^{+}$  are 1.86, 0.61 and 0.40 for dew and 1.27, 0.45 and 0.07 for rain, respectively. The higher NFs values for dew than those for rain are probably due to the simultaneous taking place of dry deposition when dew is formed. For calculation of SSF and NSSF contribution, the ionic concentrations are expressed in meq/L. The corresponding results are presented in Table 3, which show that NSSF value for dew is higher than rain only for  $\text{K}^{+}$ . In this study dew samples showed high SSF values for  $\text{Mg}^{2+}$  and  $\text{Cl}^{-}$ . For rain also high SSF is observed for  $\text{Cl}^{-}$ . Study carried out in New Delhi (Kumar and Yadav, 2014) has also reported high value of SSF for  $\text{Cl}^{-}$ , and low for  $\text{K}^{+}$ ,  $\text{Ca}^{2+}$ ,  $\text{SO}_4^{2-}$ , and  $\text{NO}_3^{-}$  for both dew and rain.



## 267 **Conclusions**

268 This study involved dew collection from a self-fabricated setup for estimating the dew yield,  
269 and to consider dew as an indirect method of air pollution study. As the setup involved simplest  
270 of condensing material, the yield obtained was 0.13 L/m<sup>2</sup>, which is much lower than the  
271 theoretical maximum value. Certainly, this simple experiment suggests that dew water can be  
272 regarded as a significant source of freshwater in water scarce regions. Also, with utilizing the  
273 advanced condensing materials, this yield can be maximized.

274 Dew water collection is less geographically dependent (Meng et al., 2022), rather, collection  
275 efficiency depends on radiative cooling. Any of the process by which this cooling can be  
276 maximized, as in case of radiative condenser or fuel powered active condensers, the dew  
277 collection efficiency can be maximized. A radiative condenser is made of materials having high  
278 emittance in the infrared region, so it cools faster than other surfaces at nighttime. In case of  
279 active dew condensers, cooling condensation or regenerative desiccation is used to cool trapped  
280 air to the dew-point temperature to condense the water vapor for collection, and thus requires  
281 energy input (Khalil et al., 2016; Jarimi et al., 2020).

282 Besides water scarcity, environmental pollution is another major global challenge now-a-days.  
283 Among all environmental pollution, air pollution is considered the most dynamic one, owing  
284 to role of atmospheric processes in it and the transboundary nature of air pollution. Even  
285 though, air pollution is a global issue, the pollutants emitted at the local level, are more crucial  
286 to understanding the air pollution problem. In this study, dew composition was determined in  
287 terms of water-soluble components of solid dry deposition, SO<sub>2</sub> and NO<sub>2</sub>. Dew pH and ionic  
288 composition was found to be always higher when compared with those of rainwater. The high  
289 TDS in dew represented the high level of dust load in surrounding air. Although rainwater is  
290 assessed worldwide for pollutants in air, it is representative of air pollution at a large scale,



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involving ambient as well as upper atmosphere. Contrary to this, dew considers local ambient air in major. So, it can be a better method for the study of air pollution at regional level. Further studies can be done for incorporation of gaseous sources other than SO<sub>2</sub> and NO<sub>2</sub> in dew and role of dew as complementary potable water source. The limitations of this study involve lack of simultaneous measurement of ambient pollutant concentration and meteorological conditions. Further studies can include these measurements to come up with the values of scavenging ratio, and thus help in understanding the efficiency of dew in carrying out wet deposition.

**Acknowledgement**

All authors express their gratitude to Mr. G. Sharan for his invaluable contributions in designing the dew collection setup.

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### 399 List of Table with Captions

400 **Table 1.** List of methods incorporated to measure the physico-chemical properties of dew and  
 401 rain

402 **Table 2.** Statistical summary of physico-chemical analysis of dew samples collected across  
 403 the entire sampling duration

404 **Table 3.** SSF and NSSF for dew and rainwater

405 **Table 1.** List of methods incorporated to measure the physico-chemical properties of dew and  
 406 rain

S. No.	Parameter	Involved technique
1.	pH	pH Meter
2.	EC	Conductivity meter
3.	TDS	
4.	Na <sup>+</sup>	Flame Photometer
5.	K <sup>+</sup>	Flame Photometer
6.	Ca <sup>2+</sup>	Complexometric titration
7.	Mg <sup>2+</sup>	Complexometric titration
8.	SO <sub>4</sub> <sup>2-</sup>	Nephelometer
9.	NO <sub>3</sub> <sup>-</sup>	UV-Visible Spectrophotometer
10.	Cl <sup>-</sup>	Argentometric Titration

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**Table 2.** Statistical summary of physico-chemical analysis of dew samples collected across the entire sampling duration

Parameter	Min.	Mean±SD	Max.	Indian Standard	Drinking Water Quality Standards in India (IS 10500:2012)
pH	7	7.66±0.39	8.7	6.5-9.5	6.5-9.5
EC	109.1 μS/cm	323.29±146.03 μS/cm	650 μS/cm	-	-
TDS	77.5 mg/L	231.27±106.65 mg/L	492 mg/L	500 mg/L	500 mg/L
Na <sup>+</sup>	0.27 meq/L	0.37±0.04 meq/L	0.44 meq/L	180 ppm	7.83 meq/L
K <sup>+</sup>	0.03 meq/L	0.10±0.07 meq/L	0.34 meq/L	-	-
Ca <sup>2+</sup>	0.26 meq/L	0.43±0.23 meq/L	1.05 meq/L	-	-
Mg <sup>2+</sup>	0.07 meq/L	0.13±0.04 meq/L	0.2 meq/L	30 ppm	2.46 meq/L
SO <sub>4</sub> <sup>2-</sup>	0.42 meq/L	0.55±0.15 meq/L	1.08 meq/L	200 ppm	4 meq/L
NO <sub>3</sub> <sup>-</sup>	0.02 meq/L	0.03±0.01 meq/L	0.07 meq/L	45 ppm	0.72 meq/L
Cl <sup>-</sup>	0.39 meq/L	0.46±0.03 meq/L	0.51 meq/L	250 ppm	7 meq/L

**Table 3.** SSF and NSSF for dew and rainwater

	Sea water	Dew	Rain	Dew	Dew	Rain	Rain
Ions	ratio	ratio	ratio	%SSF	%NSSF	%SSF	%NSSF
K <sup>+</sup>	0.021	0.32	0.16	9.23	90.77	12.75	87.25
Ca <sup>2+</sup>	0.044	1.68	4.78	2.95	97.05	0.92	99.08
Mg <sup>2+</sup>	0.23	0.42	2.5	55.51	44.49	9.2	90.8
SO <sub>4</sub> <sup>2-</sup>	0.125	1.58	2.92	8.63	91.37	4.27	95.73
NO <sub>3</sub> <sup>-</sup>	0.00002	0.11	0.17	0.02	99.98	0.01	99.99
Cl <sup>-</sup>	1.166	1.2	0.32	97.45	2.25	98.95	1.05

### List of Figures with Captions

**Fig. 1.** Self-fabricated dew collection set up

**Fig. 2** Composition of (a) Cations and (b) anions of dew

**Fig. 3.** Distribution of cations and anions in dew and rain samples

**Fig. 4.** (a) Daily pH of dew samples (b) percentage frequency distribution of pH of dew

**Fig. 5.** Plot of (a) electrical conductivity variation with dew volume and (b) Total dissolved ions variation with dew volume





Fig. 1. Self-fabricated dew collection set up

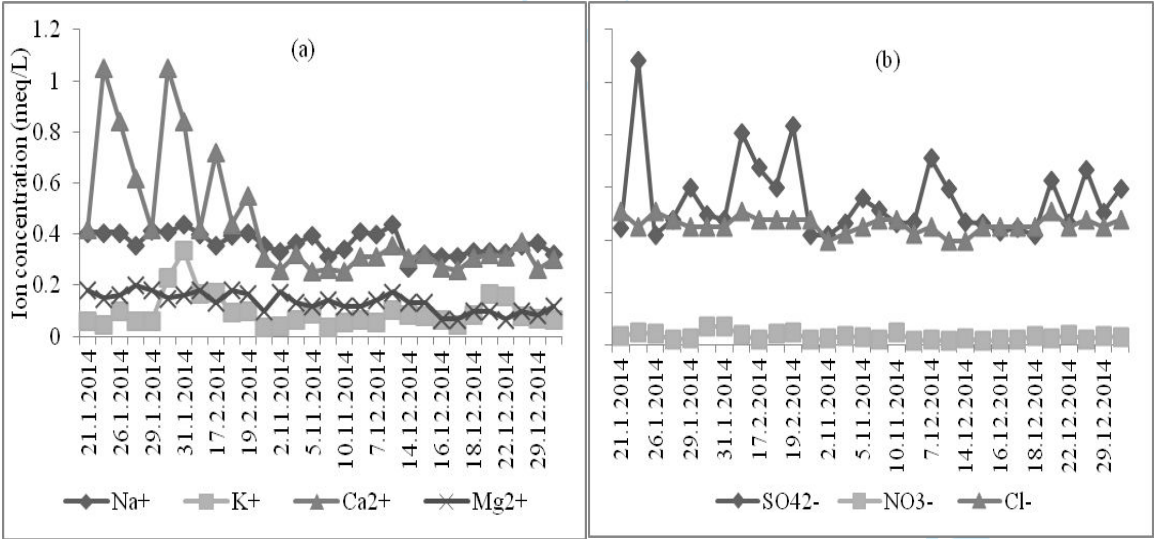
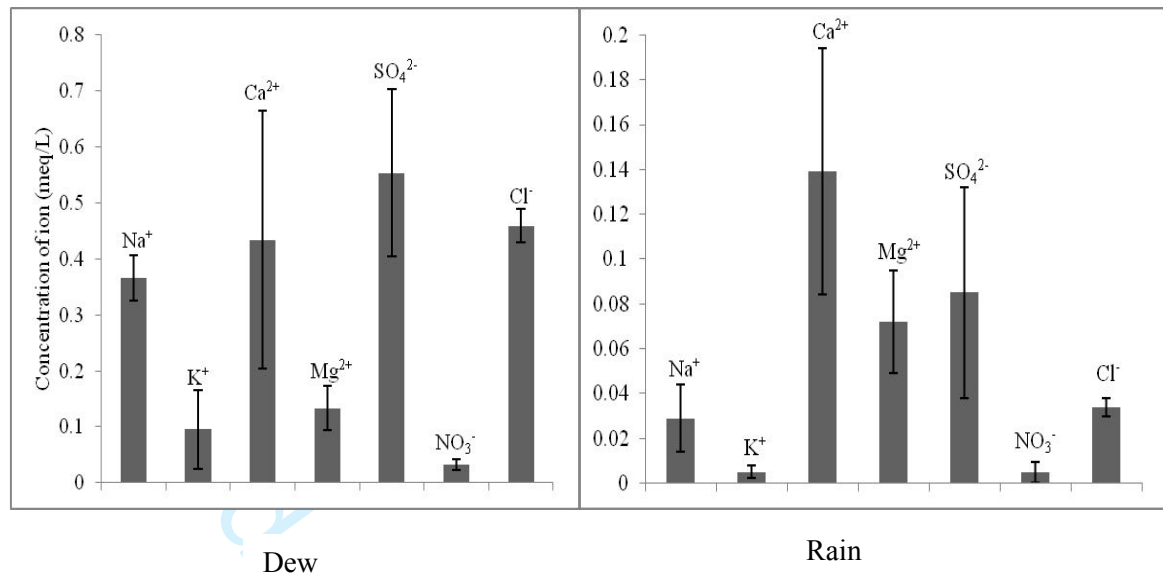
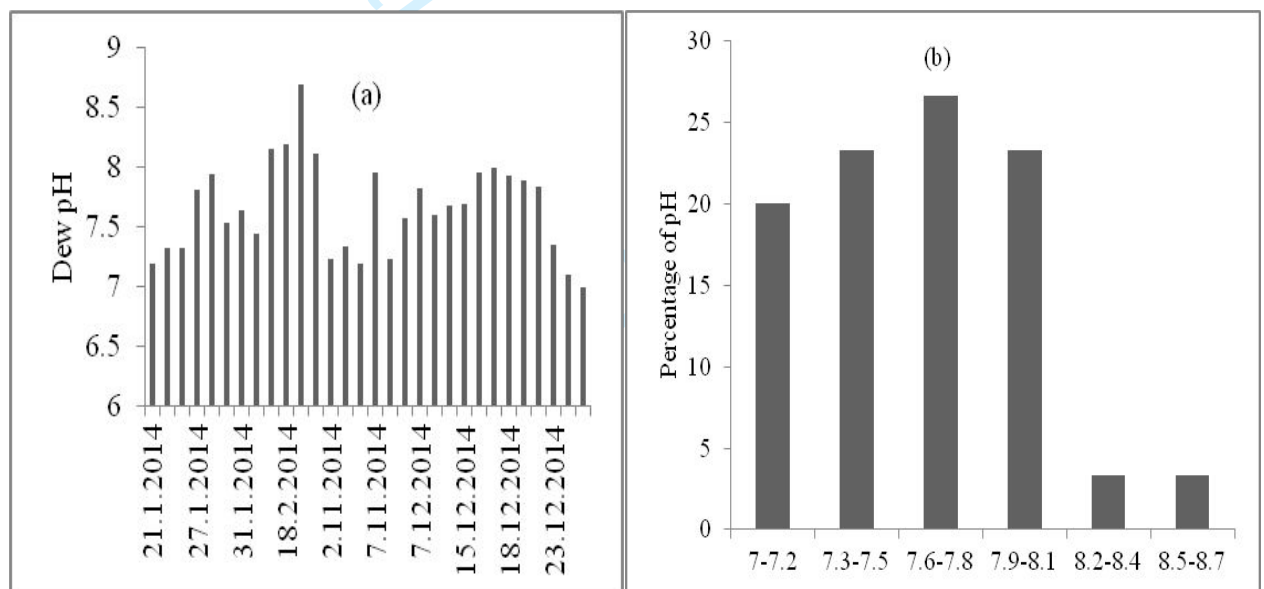


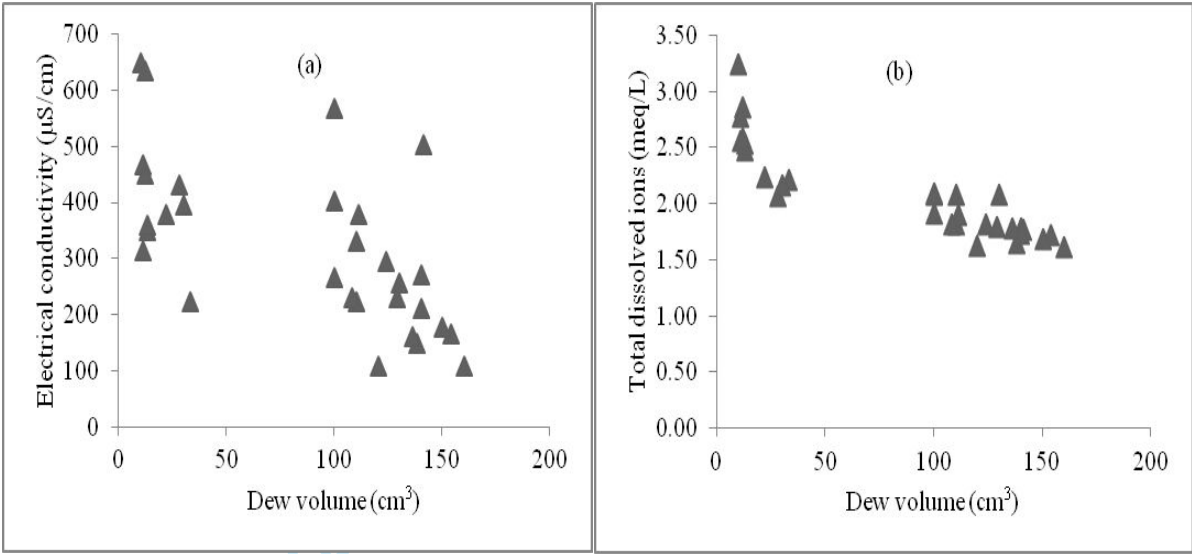
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Review Checklist

Title/Heading

☒ Does it clearly indicate response/commentary?

Content

☐ Is the letter concise, focused, and well-argued?  
☐ Are arguments supported with evidence?

☐ Does it refer accurately to the article or issue being discussed?

Tone & Clarity

☐ Is the tone professional, constructive, and respectful?

References

☐ Are cited works relevant and accurate?

Responses to Editor Comments

Editor Comment : test editor's note

Reviewer Reply 1 :test editor's comment

Review Decision & Feedback

 Accept

Originality of the work	<div><div>★</div><div>★</div><div>★</div><div>★</div><div>★</div></div>	(3.0)
Methodological soundness	<div><div>★</div><div>★</div><div>★</div><div>★</div><div>★</div></div>	(4.0)
Clarity of presentation	<div><div>★</div><div>★</div><div>★</div><div>★</div><div>★</div></div>	(3.0)
Significance of findings	<div><div>★</div><div>★</div><div>★</div><div>★</div><div>★</div></div>	(4.0)
Relevance to journal's scope	<div><div>★</div><div>★</div><div>★</div><div>★</div><div>★</div></div>	(3.0)

Ethical Considerations

Is there evidence of appropriate ethics approval and/or consent?

notApplicable

Figures and Tables

Are figures/tables clear and necessary?

No

Would you like to review a revision of this manuscript?

No

Overall Comments