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# Analysis of Atmospheric Scavenging Processes in Polluted Areas of India

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**ABSTRACT:** The practice of manual scavenging has accursed Indian society since time immemorial. The efforts to abolish this custom have garnered momentum within the state machinery, advocacy groups and academia the last three decades, particularly since the constitution of the Safai Karamchari Andolan (SKA) in 1994. Safaimitra Suraksha Challenge, launched last year, aims to completely mechanise all septic and sewage tank cleaning operations in 243 cities across India, by April 30, 2021. Officially, the number of manual scavengers dropped to 42,303 in 2018 from 770,338 in 2008. Notwithstanding the said developments, the drastic reduction in the official count in the recent past can be construed as indicative of gross underassessment rather than being reflective of their actual numbers in India.

**KEYWORDS:** scavenging, atmospheric, polluted, India, challenge, reduction, Safai Karamchari Andolan

## I. INTRODUCTION

Officially, the number of manual scavengers dropped to 42,303 in 2018 from 770,338 in 2008. Notwithstanding the said developments, the drastic reduction in the official count in the recent past can be construed as indicative of gross underassessment rather than being reflective of their actual numbers in India.

While the Indian government attributes this drop to the strict enforcement of the Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013 and the impact of the Swachh Bharat Abhiyan, it couldn't be farther from the truth. A closer inspection of the problem reveals many shortcomings in the implementation of the said act, Swachh Bharat Abhiyan as well as procedures adopted to arrive at the official figure of manual scavengers. [1,2,3]

The survey and its shortcomings

The survey of manual scavengers in 2018 was conducted by the National Safai Karamcharis Finance and Development Corporation (NSKFDC) at the behest of the Ministry of Social Justice and Empowerment. This survey, which found 87,913 manual scavengers in India, was only conducted in the statutory towns of 14 Indian states.

Of the 87,913 manual scavengers identified by the survey, 42,303 were recognised by the ministry and only 27,268 have been integrated into relevant schemes and have received any form of entitlements or benefits from the ministry.

It is but obviously a grossly underreported survey, given the fact that the Socio-Economic Caste Census of 2011 identified 1,82,505 households with the primary occupation of manual scavenging.

Whereas, the SKA estimated that the numbers of such scavengers were around 12 lakh, which seems more reasonable, given the fact that the Census of 2011 estimates the number of dry latrines in the country at around 26 lakh.

Notwithstanding the efforts of the government, the assumption that the age-old practice of manual scavenging has seen a drop of almost 89 per cent in seven years (based on the estimations done by the SKA in 2011 and the NSKFDC Census, 2018) is irrational.

The fact that this survey was confined to statutory towns in India is reflective of the Central government's attempt to willfully misjudge manual scavenging as an urban problem. [2,3,4]

The act and its implementation

The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013 aims to eliminate insanitary latrines (those not connected to pits/septic tanks/sewage lines) alongside tracking the rehabilitation of manual scavengers in other occupations and conducting periodic surveys.

To eliminate this practice, the act has provisions for stringent penalties, for direct or indirect employment of any person in hazardous cleaning of sewers or septic tanks by any person, local authority or agency. For example, even the first instance of its contravention is punishable with imprisonment up to two years or fine up to Rs 2 lakh or both.

If a worker dies while performing such work, even with safety gear and other precautions, the employer is required to pay compensation of Rs 10 lakh to the family.

Despite such stringent provisions, hardly any action is visible on the ground — not a single FIR was filed in 2014, according to the 57th Standing Committee of Social Justice and Empowerment, 2017-2018.

Two cases under the law were reported from Karnataka in the National Crime Records Bureau report of 2015, where only one went for trial. Karnataka has maintained its lead in its compliance with the law by filing 55 FIRs. This clearly reveals a lack of empathy on part of the state, bureaucracy and even society.

As per the National Commission for Safai Karamcharis (NCSK) database, 608 manual scavengers have died between 2013 and 2017 while cleaning septic tanks. However, many advocacy groups have raised concern over the authenticity of this data, claiming that the actual number would be much more.[3,4,5]

NCSK reported 123 deaths during January-August 2017, whereas, the SKA reported 429 deaths in the same duration in the National Capital Region alone.

While the contemporary official records evidently underestimate the employment and deaths of manual scavengers in India, the implementation of policies pertaining to their welfare have fallen short in terms of reach and coverage.

The Self Employment Scheme for Liberation and Rehabilitation of Scavengers (SRMS) was set up in January 2007 with the objective of rehabilitating them and their dependents with alternative livelihoods. The benefits and entitlements offered under the SRMS are as follows:

An immediate one-time cash assistance of Rs 40,000 to one member of the family of the identified manual scavenger

A concessional loan of up to Rs ten lakh for self-employment projects

A monthly stipend of Rs 3,000 for up to 2 years and access to skill-training programmes for all manual scavengers and the dependents[4,5,6]

A credit-linked back-ended capital subsidy of Rs 3,25,000 against aforementioned loan

As per the reports of the parliamentary standing committee in 2017-18, the support to the manual scavengers have been atrociously inadequate so far. Only 27,268 manual scavengers have been provided with the one-time cash assistance.

#### Swachh Bharat Abhiyan vs manual scavenging

Under the Swachh Bharat Abhiyan, India claims to have constructed approximately 1,000 lakh toilets since 2014, thereby providing approximately 95 per cent households with access to toilets.

The constructed toilets are connected either to twin pit, septic tanks with soak pit, single pits or are connected to sewerage lines. National Annual Rural Sanitation Survey 2017-18 estimates that 13 per cent of the toilets constructed had twin pits, while 38 per cent were equipped with septic tanks with soak pits and 20 per cent had single pits.

While the twin pit variety does not require human handling of faecal matter, the other two varieties require manual or mechanical extraction of faecal matter after a period of time. Given the abundance of septic tank with soak pit and single pit varieties of toilets and the low availability of suction pumps at the village level for mechanical extraction, it is obvious that most of these toilets in rural areas would be cleaned manually.[5,6,7]

Given the present policy climate which has relegated the scourge of manual scavenging to just an urban challenge, it is pertinent that the situation of rural sanitation be highlighted.



While it is irrefutable that the Swachh Bharat Abhiyan has made unprecedented and positive behavioural and infrastructural changes with regard to the usage of toilets, we need more effort and time to substantially reduce manual scavenging. Perhaps, at a policy level, the Swachh Bharat Abhiyan has addressed the issue of access to toilets, ignoring those cleaning them.

#### Judicial intervention and the way forward

Given the gaps in assessment and laxity in implementation, it is unlikely that manual scavenging would end anytime soon. However, the judiciary has taken a proactive role in addressing this issue.

The aforementioned survey in 2018 to estimate the number of manual scavengers in India was conducted at the behest of the judgement passed by the Supreme Court in the matter of Safai Karamchari Andolan and others versus the Union of India and others.

More recently, the Bombay High Court in response to a PIL filed in 2019, sought a response from the Maharashtra Government regarding the number of convictions in cases related to the employment of manual scavengers as well as the disbursement of compensations upon their death, doubting the tendency of underreporting by the government.

The state and society needs to take active interest in the issue and look into all possible options to accurately assess and subsequently eradicate this practice. It also warrants an engagement of all stakeholders for the proper introduction of mechanisation and ensuring that it is made available to all those who are forced to engage in this undignified practice.[6,7,8]

## II. DISCUSSION

Another study focuses upon the understanding of fog water chemistry in Delhi city. Total seventy fog water samples were collected at two different sites in Delhi during December 2014 to March 2015. Selected parameters such as pH, major anions ( $\text{Cl}^-$ ,  $\text{F}^-$ ,  $\text{NO}_3^-$  and  $\text{SO}_4^{2-}$ ) and major cations ( $\text{NH}_4^+$ ,  $\text{K}^+$ ,  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{Na}^+$ ) were determined in the samples. The pH of the fog water collected during the monitoring period at Site I (traffic intersection) varied from 4.68 to 5.58 indicating the acidic nature of fog water while at the site II (green cover area), it ranged from 6.11 to 6.88 having slightly lower acidity. At the Site I, the average concentration of  $\text{Cl}^-$ ,  $\text{Na}^+$ ,  $\text{SO}_4^{2-}$ ,  $\text{NH}_4^+$  was recorded as  $1.5 \times 10^{-2}$ ,  $8 \times 10^{-3}$ ,  $4 \times 10^{-3}$  and  $1 \times 10^{-2}$   $\mu\text{Eq/L}$  respectively. Such values of ionic species may be attributed to the local sources, including factories, motor vehicle emissions and civil construction etc. However, non-local sources such as moderate- and long-range transport of sea salt also had significant influence on ionic content of fog water. In general the  $\text{Na}^+$  ratio values were found to be higher side suggesting the influence of non-marine sources. Extremely high values of  $\text{Cl}^-/\text{Na}^+$  ratios indicated the contribution from combustion of organochlorine compounds. Hence, the higher ratios of inorganic ions and acidic pH revealed that fog is an effective mechanism for the scavenging of various pollutants emitted by different sources in the city. Real-time simultaneous studies on chemical characteristics of rainwater and  $\text{PM}_{10}$  aerosols were carried out to understand the scavenging of major chemical components in Indian region. The concentrations of  $\text{Ca}^{2+}$ ,  $\text{NH}_4^+$ ,  $\text{SO}_4^{2-}$  and  $\text{NO}_3^-$  were observed to be lower in the aerosol samples collected during rain as compared to before and after rain events. The most significant reduction was noticed for  $\text{Ca}^{2+}$  (74%) during rain which showed highest scavenging ratio (SR) and indicated that below-cloud scavenging is an effective removal process for  $\text{Ca}^{2+}$  in Indian region. Among non-sea salt components,  $\text{Ca}^{2+}$  had highest SR at Hyderabad indicating typical characteristics of crustal influence as abundance of calcium carbonate in soil dust has been reported in India. However, the levels of these major chemical components gradually got build-up in due course of time. After rain events, the levels of  $\text{SO}_4^{2-}$  aerosols were noticed to be substantially higher (more than double) within 24 h. In general, scavenging ratios for all components (except  $\text{Ca}^{2+}$ ,  $\text{NH}_4^+$  and  $\text{K}^+$ ) were higher over BOB as compared to Hyderabad.[7,8,9] The maximum fall in aerosol levels (BR minus AR) was observed during continuous and low intensity rain events that did not allow building up of aerosol concentrations.

## III. RESULTS

Another study presents a parametric investigation on the scavenging of atmospheric aerosols by the raindrops between clouds and the ground. A well-established governing mathematical model for scavenging action combined with certain parametric models has been used. The model has been solved to investigate the influence of raindrop-based parameters

(number concentration, diameter, velocity), aerosol-based parameters (particle diameter, aerosol cloud height), and meteorological parameters (temperature, pressure, air viscosity; which in turn depend on the altitude of scavenging) on the scavenging performance. It has been found that in order to maintain the desired scavenging performance despite a decrement in the size of aerosol particles, a higher number concentration or diameter of raindrops is required. For a given rain intensity, smaller raindrops have been found to provide better scavenging performance. Also, a rise in the altitude at which the scavenging takes place and increase in the height of aerosol cloud have been observed to improve the scavenging performance. Though an increase in raindrop diameter also improves the overall scavenging performance, the exact nature of variation depends on the size of aerosol particles and the number concentration of raindrops.

Another study presents the results of one of the first systematic experiments on tritium ((3)H) concentrations in ground level air against that in rainwater near a pressurized heavy water reactor in a tropical region. The samples were collected over the rainy season of three years (2007, 2008 and 2010). For this study, 31 data sets were collected and interpreted based on the theoretical information available in the literature. The specific activity ratio of (3)H between rainwater and air moisture at ground level was calculated for each data set. The average specific activity ratio was found to be  $1.96 \pm 2.72$ . A correlation ( $r = 0.82$ ,  $p < 0.001$ ) was observed between the total rain hours in a day and the rainwater (3)H activity. Higher rain duration with slower rain rate yielded higher (3)H concentrations as more time was available for the scavenging/wash out process to take effect together with lower dilution. The present data also suggested the need to further investigate the influence of raindrop distribution and other local meteorological parameters on the (3)H wash out process. An attempt was also made to predict the (3)H concentration in air moisture samples using a Gaussian plume dispersion model and the values were compared with the measured (3)H activity. The measured values were generally lower than the predictions.[8,9,10]

#### IV. CONCLUSION

Manual scavenging is a caste-based occupation (Shahid, 2015, Social Change, 45(2), 242–255). It involves the manual removal of human excreta from dry latrines and septic tanks (using basic tools such as tin boards, buckets and baskets lined with sacking) and then carrying it on the head or shoulder and disposing it away (Kumar, 2014, Scavenger community at the crossroads: Reflection on state intervention). Broadly, these people work in municipal corporation, railways, households, cleaning of open defecation area, industries and hotels where they deal with human and animal excreta. Dealing in sewerage and manholes, garbage loading and caring and cleaning animal carcass is also included in manual scavenging. Historically, the scavenger community is considered to be untouchable (Singh, 2014, Contemporary Voice of Dalit, 7(1), 81–94), because of lowest caste status and lowest occupational status. Their lowest social status made them to face exclusion in almost all domains in society. They are protected through constitutional rights in documents and are provided with some welfare services for their development. This study aims to understand the current status of social exclusion of scavenger community and usefulness of government inclusion policies on social and occupational status of scavenger community. This is a cross-sectional study, following mixed method research design. The study was conducted in four towns of Haryana: Ladwa, Kurukshetra, Indri and Radwar. The safai karamchari (sanitary workers) of municipalities from these four towns were selected as respondents. Data was collected through semi-structured interview and structured tool was used for assessing social exclusion. Here, the results show that all respondents (safai karamchari) belong to Balmiki caste and all were Hindu by religion. Among them, 62% respondents were illiterate, more than 80% reported that this work was transferred from ancestors or lack of opportunity, and 98% reported no protective gears provided while working. Social exclusion found prevalent in almost all domains, while the face exclusion was in social, cultural, educational, occupational, political domains and accessing social services. The result shows that Indian policies for social inclusion fail in case of scavenger community. Therefore, this is matter of dealing for social work profession.[11]

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