# Collaborates with the Local Community to Preserve Shared Land Ecosystems

The initial phase of our collaborative initiatives involved recognizing the common ecosystems in which both our university and the local community have a significant stake. These ecosystems include parks, green areas, and natural reserves that are essential to the identity of our region. Manipal University Jaipur partners with local environmental organizations and community groups to perform thorough assessments of these ecosystems. Such evaluations enable us to gain insights into the current conditions of these shared environments and pinpoint areas that require attention. Engaging the local community is of utmost importance. We actively seek feedback from residents, organizations, and stakeholders to ensure that our conservation efforts resonate with their values and aspirations. In collaboration with community volunteers, students, and faculty, Manipal University Jaipur participates in habitat restoration initiatives. These projects involve the removal of invasive species, the planting of native plants, and the creation of environments conducive to wildlife. The shared ecosystems often feature walking paths and recreational facilities. Our collaborative endeavors also focus on the upkeep and enhancement of these areas to guarantee safe and enjoyable experiences for everyone. Manipal University Jaipur aims to lead by example through the adoption of sustainable land management practices, which include minimizing pesticide usage, conserving water, and encouraging responsible waste management within shared ecosystems. Additionally, the university provides educational programs that are accessible to community members of all ages, encompassing guided nature walks, workshops, and lectures on topics pertinent to shared ecosystems. Collaborative workshops at Manipal University Jaipur equip community members with the necessary tools and knowledge to actively participate in ecosystem preservation, covering subjects from native plant gardening to the creation of wildlife habitats. We promote active involvement from the public by offering volunteer opportunities, engaging in citizen science projects, and providing regular updates on the advancements of our collaborative initiatives.

The community celebrates milestones and achievements in ecosystem conservation through events and gatherings that enhance the relationship between Manipal University Jaipur and its local residents. The partnership between Manipal University Jaipur and the surrounding community in the stewardship of shared land ecosystems exemplifies our commitment to environmental responsibility and community involvement. Collectively, we are safeguarding the natural beauty of our area and strengthening connections among community members, nurturing a sense of pride in our collective environment, and laying the groundwork for a more sustainable future.

MUJ/DSW/Student Clubs/2023/Coreografia/1stApril2023

# DIRECTORATE OF STUDENTS' WELFARE

# Ecstasy

## Cultural Event

## Coreografia – The Official Dance Society of MUJ

## OFFLINE EVENT

## Venue: Dr. TMA Pai Auditorium

Date of Event (1st and 2nd April 2023)

MANIPAL UNIVERSITY
JAIPUR

# Index

## 1. Introduction of the Event

Dancing is more than just knowing how to move the body; it is an expression of one's deepest thoughts and emotions. We are excited to present the second edition of Ecstasy, a dynamic and vibrant celebration of the art of dance. This in-house event will bring together dancers and dance enthusiasts of all levels and backgrounds, featuring a diverse range of performances by professional and amateur dancers. Attendees will have the opportunity to learn new dance styles, connect with other dance enthusiasts, and experience the joy and excitement of live dance performances. Ecstasy will be held in Manipal University Jaipur campus, on 1st and 2nd April 2023.

## 2. Objectives of the Event

- To help fellow students to grow not only in dance but grow as a professional.
- To help the students in improving self-confidence, adapt to different situations, to improve in teamwork as well as in leadership
- To help the students to learn and improve upon themselves and mainly to help the students nurture their passion and give them opportunities where they can showcase their talent.

## 3. Beneficiaries of the Event

- All students of Manipal University Jaipur

## 4. Brief Description of the event

Coreografia presents Ecstasy, a 2-day event that celebrated dance in its true form. This event comprised of 4 teams that battled it out in a series of dance competitions spread across 2 days, mainly being Solo, Duet and Battle. The 4 team leaders got a fixed number of credits and had to sit through an auction to select their team members. The events were as follows:

Day 1 – Solo

There were two categories to this event, Solo Western and Solo Classical. The event took place in Dr. TMA Pai Auditorium.

Day 1 – Battle

This was a hip hop based 4v4 battle. The battle took place in Campus, in Academic Block-1 Lobby. The battle was judged on musicality, beat sense, flow levels, and other technical aspects.

Day 2 – Duets

This was an all-style Duet competition which took place in Dr. TMA Pai Auditorium.

The winners and the winning team were announced on the last day, during a cultural event, which was the closing event of Ecstasy.

## 5. Photographs


## 6. Brochure or Creative of the Event


## 7. Schedule of the event

| | |
|---|---|
| Desk setup for participation starts | 6th March 2023, 6PM |
| Desk setup for participation ends | 16th March 2023, 9PM |
| Road to Ecstasy | |
| • Auction | 18th March 2023, 6PM |
| • Desk setup and minor activities | 20th March to 26th March 2023 |
| • Flash mob with flex reveal | 27th March 2023, 7:30PM |
| • Inter-club performances | 29th March 2023, 7:30PM |
| Ecstasy Day 1 - Inauguration | 1st April 2023, 11AM |
| Ecstasy Day 1 - Solo Dance Competition | 1st April 2023, 12PM |
| Ecstasy Day 1 - Battle | 1st April 2023, 5:30PM |
| Ecstasy Day 2 - Duet Dance Competition | 2nd April 2023, 12PM |
| Cultural Event | 2nd April 2023, 6:30PM |

**8. Attendance of the event:** Total attendee: 112

| Timestamp | Name | Registration Number | Year |
|---|---|---|---|
| 3/16/2023 16:17:34 | AANYA MITTAL | 229310435 | 1st |
| 3/16/2023 17:12:53 | Charvi Solanki | 221015168 | 1st year |
| 3/16/2023 17:17:15 | Sanchi Mishra | 229303029 | First |
| 3/16/2023 18:13:04 | Manjul Varshney | 219302057 | 2nd |
| 3/16/2023 18:55:57 | Shreya chouhan | 229311258 | 1st |
| 3/16/2023 19:45:50 | Ananya Gupta | 220606008 | 1st Year |
| 3/16/2023 20:57:49 | Bhoomi Gupta | 229301707 | 1st |
| 3/16/2023 22:09:46 | Ishita sharma | 229303237 | First |
| 3/16/2023 22:20:17 | M.yagna | 229303220 | 2nd sem |
| 3/16/2023 22:21:11 | Yash Chowdhary | 229311060 | 1st |
| 3/16/2023 23:06:33 | Shruti dubey | 210606022 | 2nd |
| 3/16/2023 23:24:54 | Navyaa Jain | 219310202 | 2nd |
| 3/16/2023 23:26:47 | Priyasha SINGH | 209302050 | 3 |
| 3/17/2023 2:21:35 | Kanishka Kasana | 229301231 | 1st |
| 3/17/2023 12:11:25 | Kirti Jain | 220803009 | 1 |
| 3/17/2023 13:10:28 | Bhavya sharma | 220606032 | 1 |
| 3/17/2023 13:18:04 | Harvindra Singh | 229302325 | 1st |
| 3/17/2023 14:04:31 | Anant Khemka | 209301508 | 3rd |
| 3/17/2023 14:40:09 | Anisha | 221016049 | 1st year |
| 3/17/2023 18:33:42 | Twinkle Khatwa | 221007050 | First |
| 3/17/2023 18:59:34 | Khushi verma | 211004006 | 2nd |
| 3/17/2023 19:28:39 | Srishti Jaiswal | 229302008 | 1st year |
| 3/18/2023 12:32:50 | Devika Kaimal | 229301514 | 1st |
| 3/18/2023 15:06:19 | Shruti Sunthwal | 229309147 | 1st year |
| 3/18/2023 19:43:20 | Stuti Saxena | 229310263 | 1st |
| 3/18/2023 20:01:52 | Nupur Palav | 209202061 | 3rd |
| 3/18/2023 20:18:26 | Mehma singh | 220801003 | 1 |
| 3/18/2023 20:59:53 | Anvenshi garg | 220901428 | 1st |
| 3/18/2023 22:19:00 | Devyansh Mishra | 229302594 | 1st year |
| 3/18/2023 23:01:26 | Naman sharma | 221305001 | 1 st year |
| 3/19/2023 18:17:33 | Mahi Kulshresth | 229310362 | First year |
| 3/19/2023 18:26:25 | Devyani Ghildiyal | 229301091 | 1 |
| 3/19/2023 20:30:09 | Sandali Singh | 229301803 | 1st |
| 3/19/2023 20:48:19 | Ayonija | 229302173 | 1 |
| 3/19/2023 20:52:26 | Yashni yogeesh poojary | 221305061 | 1 st |
| 3/19/2023 21:05:07 | Swarna Jain | 229301247 | 1st |
| 3/19/2023 21:11:39 | Ushasi Bhattacharya | 221103011 | 1st year |
| 3/19/2023 21:19:58 | AMAN SHARMA | 229303298 | 2026 |
| 3/19/2023 21:37:17 | Harsh Thakur | 229301722 | 1st year |
| 3/19/2023 21:41:47 | Mayank Maheshwari | 229309030 | 1st year |
| 3/19/2023 21:44:00 | Vitika Vora | 219309114 | 2nd |
| 3/19/2023 21:58:27 | Shreya Yogesh shedge | 229310170 | 1 st |
| 3/19/2023 22:05:53 | Himanshi Punjabi | 211007042 | 2nd |
| 3/19/2023 23:13:19 | Vedika Gupta | 221007014 | 1 |
| 3/20/2023 21:07:46 | Satvika Arora | 229310274 | 1st |
| 3/20/2023 22:38:29 | Priyanshu Saini | 209301418 | 3rd |
| 3/21/2023 12:37:11 | Shreja Shekhar | 229302536 | 1st |
| 3/21/2023 12:38:48 | Simran Chhipa | 221015104 | 1st |
| 3/21/2023 16:18:16 | Sakshi anjana | 221101027 | 1st |
| 3/21/2023 16:39:21 | Anushka singh | 229301760 | 1st |
| 3/21/2023 16:45:00 | Tulsi Ghonshette | 221016067 | 1st |
| 3/21/2023 16:48:16 | Tanisha Mishra | 229303442 | 2023 |
| 3/21/2023 16:50:11 | Shristi Krishna | 229301311 | 1st |
| 3/21/2023 16:51:34 | Paridhi Rawat | 221201037 | 1st year |
| 3/21/2023 17:12:53 | Udisha Jaiswal | 229303196 | 1st year |
| 3/21/2023 17:17:15 | Shreya Gupta | 229302230 | 1st year |
| 3/21/2023 18:13:04 | Muskan Gupta | 229302508 | First |
| 3/21/2023 18:55:57 | Saloni singh | 229301405 | 1 |

| | | | |
|---|---|---|---|
| 3/21/2023 19:45:50 | Shivambika Bhati | 201301051 | 2026 |
| 3/21/2023 20:57:49 | Ishika gandhi | 220901355 | 1st year |
| 3/21/2023 22:09:46 | Yuvraj Singh Chouhan | 229102008 | 1 |
| 3/21/2023 22:20:17 | Tanisha yadav | 229303277 | 1st |
| 3/21/2023 22:21:11 | Sarvi Agarwal | 229301372 | 1st |
| 3/21/2023 23:06:33 | Arshia | 229301779 | 1st |
| 3/21/2023 23:24:54 | Tvisha Khanna | 229301606 | 1 |
| 3/21/2023 23:26:47 | Nayani Jindal | 229311253 | 1st |
| 3/22/2023 2:21:35 | Aryan Agrawal | 229302124 | 1st |
| 3/22/2023 12:11:25 | Ananda Chaturvedi | 229302457 | 1st year |
| 3/22/2023 13:10:28 | ISHANK BANSAL | 229302220 | 1st |
| 3/22/2023 13:18:04 | Pratishtha singh | 211002044 | 2nd |
| 3/22/2023 14:04:31 | Shubham Kukreti | 229302422 | 1st |
| 3/22/2023 14:40:09 | Kartik Dubey | 229303040 | 1st |
| 3/22/2023 18:33:42 | Anushka Das | 229310232 | 1 |
| 3/22/2023 18:59:34 | Sushank Choudhary | 229302339 | 1st |
| 3/22/2023 19:28:39 | Sunny Jayaswal | 229301061 | 1st |
| 3/22/2023 12:32:50 | Saksham Arun | 229311032 | 1st |
| 3/22/2023 15:06:19 | Sanskriti Jha | 229301120 | 1st |
| 3/22/2023 19:43:20 | Deepanshu poonia | 229310103 | 1stYear |
| 3/22/2023 20:01:52 | Priyanshi Garg | 229311224 | 1 st |
| 3/22/2023 20:18:26 | Nikita Sharma | 229301413 | First |
| 3/22/2023 20:59:53 | Naman | 229302321 | 1st year |
| 3/22/2023 22:19:00 | Parth | 229301241 | 1st |
| 3/22/2023 23:01:26 | Goutham R Varma | 229309042 | 1st |
| 3/22/2023 23:02:33 | Milind | 219301778 | 2003 |
| 3/22/2023 23:03:25 | Suraj Chaudhary | 229309234 | 1 |
| 3/22/2023 23:04:09 | Isha Gupta | 221103065 | 1st yera |
| 3/22/2023 23:05:19 | Sanidhya Mehta | 229303449 | 1st |
| 3/22/2023 23:06:26 | Ridhi Agrawal | 220901043 | 1 |
| 3/22/2023 23:07:07 | Sujal jain | 229309038 | 1st |
| 3/22/2023 23:11:39 | Shreyas Kumar | 229310403 | 1st Year |
| 3/22/2023 23:19:58 | Aryan singh | 229303356 | 1st |
| 3/22/2023 23:20:17 | Anushka Sharma | 229302020 | 1 |
| 3/22/2023 23:21:47 | Vidit Sood | 229301097 | 1st |
| 3/22/2023 23:22:00 | Shashank Saraswat | 219310301 | 2nd |
| 3/22/2023 23:23:27 | Shashank | 229303430 | 1st |
| 3/22/2023 23:25:53 | Aaron Sequeira | 219302100 | 2023 |
| 3/22/2023 23:26:19 | Hiten Gehlot | 219302018 | 2nd year |
| 3/22/2023 23:27:46 | Harsh Upadhyay | 229302547 | 1st |
| 3/22/2023 23:28:29 | Aryan Sharma | 219309105 | 2nd |
| 3/22/2023 23:29:11 | Tiya Gandhi | 220606025 | 1year |
| 3/22/2023 23:30:48 | Shikha wadhwani | 221103035 | 1 |
| 3/22/2023 23:31:16 | Eishana B | 229311199 | 1st |
| 3/22/2023 23:32:21 | Yashika khattri | 229302074 | 1st |
| 3/22/2023 23:33:00 | Yash Sharma | 229309194 | 1st year |
| 3/22/2023 23:34:16 | Bhavya sharma | 220606032 | 1 |
| 3/22/2023 23:35:11 | Lipika | 229301292 | 1 |
| 3/22/2023 23:35:48 | Shreyasi ray | 229302125 | 1 |
| 3/22/2023 23:36:16 | Ishika sazena | 229302183 | 1 |
| 3/22/2023 23:33:21 | maahin khan | 229302496 | 1 |
| 3/22/2023 23:34:00 | arvind nair | 229301393 | 1 |
| 3/22/2023 23:34:16 | shagun verma | 229303024 | 1 |
| 3/22/2023 23:50:11 | saksham chanana | 229301116 | 1 |

**9. Post event link: NA**

MANIPAL UNIVERSITY
JAIPUR

Raghav Handoo

General Secretary, Coreografia, MUJ

**Signature of the Student Coordinator**

Mr. Hemant Kumar

Department of Mechatronics

**Signature of the Faculty Coordinator**

MANIPAL UNIVERSITY
JAIPUR

# FACULTY OF ENGINEERING

## DEPARTMENT OF CIVIL ENGINEERING
AND
## DEPARTMENT OF ARTIFICIAL INTELLIGENCE MACHINE LEARNING

Prepared a Report

On an event

**"Basic Life Support"**
20 October, 2023

**Venue: Smt. Sharada Pai Auditorium**

**Organized By:**

**Dr. Meena Sharma**
**Dr. Puneet Mittal**

## Table of Contents

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## 1. Introduction of the Event

Basic Life Support (BLS) is a critical set of skills and actions that can be performed by bystanders or healthcare providers to sustain or revive a person's life in the event of a cardiac arrest or other life-threatening emergencies. BLS techniques primarily focus on maintaining an open airway, providing effective chest compressions, and ensuring proper ventilation, with the goal of oxygenating the brain and vital organs until more advanced medical care can be administered. The primary purpose of this training was to empower participants with the ability to recognize and respond effectively to life-threatening emergencies, particularly cardiac arrests. Participants learnt how to provide immediate care until professional medical assistance arrives, and in some cases, actions alone could be the difference between life and death.

In a world that urgently requires sustainable solutions, this training directly addresses the Sustainable Development Goal (SDG) set by the United Nations, particularly:

**SDG 3 (Good Health and Well Being):** To Ensure healthy lives and promote well-being for all at all ages.

## 2. Objective of the Event

- Understand the importance of early recognition and activation of the emergency response system.
- Develop proficiency in providing high-quality chest compressions.
- Acquire the knowledge to assess and respond to various emergency scenarios, including choking and sudden cardiac arrest.

## 3. Beneficiaries of the Event

Faculty Members of Manipal University Jaipur.

## 4. Details of the Guest

Dr. Ravi Prakash Chaudhary is the Associate Director and HOD of Emergency Medicine at Manipal Hospital Jaipur. He treats and devises diagnosis plans for patients from all walks of life and of all ages. He is very compassionate and empathetic for his patients. He has done MBBS from JLN medical College, Ajmer and Masters in Emergency Medicine from GWU-USA. He is having experience of 10 years in the field of emergency medicine.

## 5. Brief Description of the event

**Introduction to BLS:** The training commenced with an overview of the importance of BLS and its role in saving lives during cardiac and respiratory emergencies.

**CPR:** Dr. Prakash provided detailed instruction on performing cardiopulmonary resuscitation (CPR) on adults. He emphasized the importance of chest compressions, rescue breaths, and the correct compression-to-ventilation ratio. The training included hands-only CPR techniques, focusing on uninterrupted chest compressions to maximize the chances of survival.

**Practical Demonstrations:** Dr. Prakash conducted practical demonstrations, allowing participants to practice BLS skills on manikins and receive feedback on their technique.

**Choking Relief:** Dr. Prakash demonstrated techniques for relieving choking in conscious and unconscious adults, children, and infants.

**Recognition of Heart Attacks and Strokes:** Participants learned to recognize the signs and symptoms of heart attacks and strokes, along with the appropriate steps to take in these emergencies.

**Chain of Survival:** Dr. Prakash discussed the concept of the "Chain of Survival" and how each link in the chain is crucial for improving survival rates in cardiac emergencies.

**Q&A and Scenario-Based Learning:** The session encouraged active participation through interactive discussions, question-and-answer sessions, and scenario-based learning to simulate real-life situations.

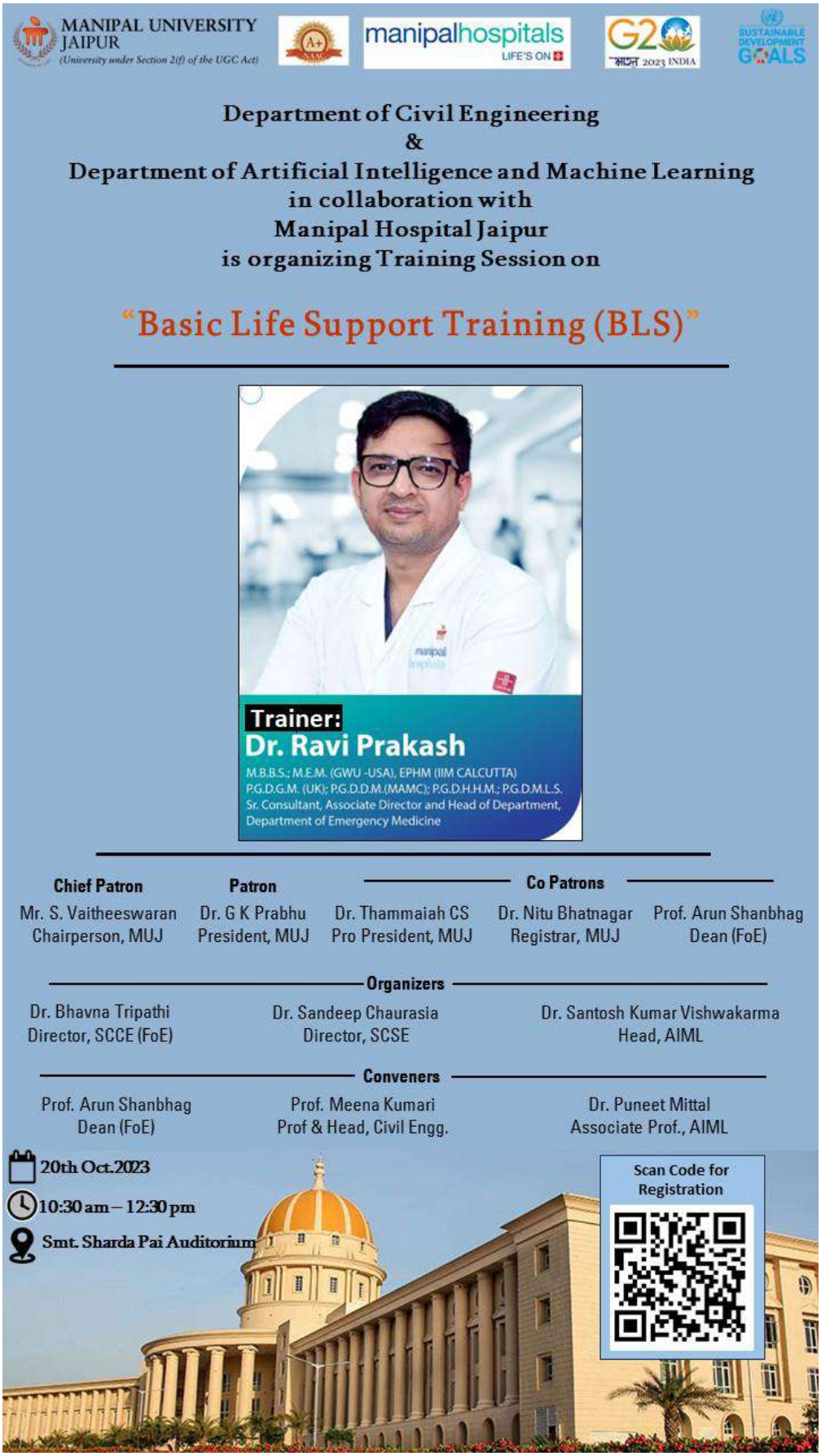
## 6. Geo Tagged Photographs



RAINING
October 2023
am to 12: 30 pm
University Jaipur
APERTURE


APERTURE

## 7. Brochure or creative of the event



## 8. Schedule of the event (insert in the report)

Date: 20 October, 2023

Time: 10:30 am – 12:30 pm

Mode: Offline

## 9. Attendance of the Event

**Total attendees:** 66

| S.No. | Name | MUJ ID | Department |
|---|---|---|---|
| 1 | MUJ1591 | Dr. Preeti Narooka | AIML |
| 2 | MUJ0527 | Sandeep Chaurasia | CSE |
| 3 | MUJ1160 | Dr. Sumit Dhariwal | IT |
| 4 | MUJ1571 | Dr. Puneet Mittal | AIML |
| 5 | MUJ1185 | Dhananya Kumar Singh | IT |
| 6 | MUJ1517 | Surbhi Sharma | CSE |
| 7 | MUJ1376 | Dr Sakshi Shringi | COMPUTER SCIENCE ENGINEERING |
| 8 | MUJ1604 | Dr. Sukhwinder Sharma | DATA SCIENCE & ENGINEERING |
| 9 | MUJ1698 | Dr. Amit Kumar Sharma | COMPUTER AND COMMUNICATION ENGINEERING |
| 10 | MUJ1599 | Dr. Mohit Agarwal | CCE |
| 11 | MUJ1183 | Anil Kumar | CSE |
| 12 | MUJ1544 | Dr Gireesh Kumar | COMPUTER SCIENCE AND ENGINEERING |
| 13 | MUJ1689 | Dr. Sandeep Singh | DEPT. OF COMPUTER AND COMMUNICATION ENGINEERING |
| 14 | MUJ1550 | Dr Mayank Namdev | COMPUTER SCIENCE & ENGINEERING |
| 15 | MUJ1047 | Santosh Kumar Vishwakarma | ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING |
| 16 | MUJ1628 | Dr Nidhi Vyas | DOE |
| 17 | MUJ1090 | Vivek Sharma | CCE |
| 18 | MUJ1038 | Dr. Amit Kumar Bairwa | CSE-AIML |
| 19 | MUJ1664 | Priya | AIML |
| 20 | MUJ0660 | Anita Shrotriya | COMPUTER SCIENCE & ENGINEEINRG |
| 21 | MUJ1563 | Manish Rai | AIML |
| 22 | MUJ1444 | Shubh Lakshmi Agrwal | AIML |
| 23 | MUJ1417 | Dr. Yadvendra Singh | AIML |
| 24 | MUJ 1533 | Dr. Ankur Pandey | CSE |
| 25 | MUJ0719 | Dr Ginika Mahajan | DSE |
| 26 | MUJ1497 | Dr Sushila | CSE |
| 27 | MUJ1606 | Dr Saurav Mishra | IT |
| 28 | | Dr Sayar Singh Shikhawat | CSE |
| 29 | | Dr Laxmi Poonia | MATHS |
| 30 | MUJ1547 | Upendar Singh | AIML |
| 31 | MUJ1542 | Dr Praneet | CSE |
| 32 | MUJ1539 | Dr Neetu Gupta | CSE |

| | | | |
|---|---|---|---|
| 33 | MUJ1631 | Yaquika Sharma | DOE COMMERCE |
| 34 | MUJ1569 | Dr Hemlata | AIML |
| 35 | | Rs Bhasar | CCE |
| 36 | MUJCONO67 | Rayaz Khan | J&MC |
| 37 | | Dipati | NURSING |
| 38 | MUJ1638 | Jaydeep Kishore | AIML |
| 39 | MUJ1598 | Mr Vivek | AIML |
| 40 | | Bhawani | PHD SCHOLAR |
| 41 | MUJ1562 | Dr Dibakar Sinha | CSE |
| 42 | MUJ1581 | Pramod Rathore | CCE |
| 43 | MUJ0499 | Dr Arvind | CSE |
| 44 | MUJ1599 | Dr Mohit Agarwal | SCSE |
| 45 | MUJ1471 | Dr Ankur Jain | MATHS |
| 46 | MUJ1678 | Abhishek Kesarwani | AIML |
| 47 | MUJ1680 | Surendra Solanki | AIML |
| 48 | MUJ175 | Santoshi | CSE |
| 49 | MUJ16 | Nema Sikawar | CCE |
| 50 | MUJ1549 | Dr Pooja | CCE |
| 51 | MUJ1246 | Dr Varun | AIML |
| 52 | MUJ1662 | Atul Verma | CSE |
| 53 | MUJ31823 | Dipati | NURSING |
| 54 | | Sameer | NURSING |
| 55 | | Rakesh | NURSING |
| 56 | MUJ0711 | Arjun Singh | CCE |
| 57 | MUJ1040 | Vijay Kr Sharma | CCE |
| 58 | MUJ1396 | Shikha Chaudhary | IT |
| 59 | MUJ1516 | Rajat Goel | CSE |
| 60 | MUJ0155 | Sandeep Joshi | CSE |
| 61 | MUJ0366 | Anamika Jain | MATHEMATICS AND STATISTICS |
| 62 | MUJ1151 | Dr Deepika Shekawat | AIML |
| 63 | MUJ0446 | Dr. Meena Kumari | CIVIL |
| 64 | MUJ0575 | Dr. Tej Bahadur | CIVIL |
| 65 | MUJ0495 | Mr. Sagar Gupta | CIVIL |
| 66 | MUJ0764 | Dr. Rudhra Halder | CIVIL |

## 10. Feedback report of the Event

The Basic Life Support training conducted by Dr. Ravi Prakash was highly informative and beneficial for all attendees. Participants left with a heightened sense of confidence in their ability to respond effectively to life-threatening emergencies. The comprehensive content, hands-on practice, and expert guidance provided by Dr. Prakash made this training a resounding success.

21/10/2023

**Seal and Signature of Head with date**

MANIPAL UNIVERSITY
JAIPUR

MUJ/DSW/Student Clubs/2023/Biotech Club MUJ/9th September'23

# DIRECTORATE OF STUDENTS' WELFARE

# IMPORTANCE OF GUT MICROBE IN HUMAN HEALTH AND DISEASE

**Biotech Club, Manipal University Jaipur**

**Date of Event (9th September 2023)**

(Platform: Google Meet)

# Index

## 1. Introduction of the Event

The Biotech Club, Manipal University Jaipur organized an online Bio wellness session on 9th September'23. The convenor – Dr. Mousumi Debnath, Faculty Coordinator, Biotech Club, invited: Mr. Surendra K Chikara, founder and CEO of Bione Ventures Pvt. Ltd., Bengaluru, Mr. Prabhat Nath Jha, professor, BITS Pilani.

This Bio wellness session was organised for students to understand the importance of gut microbes in human health and diseases caused by them. Measures for keeping the body healthy and be deprived of diseases were discussed in meeting.

## 2. Objectives of the Event

- To increase the awareness about the various microbes found inside the human body, especially the gut and their roles in human health and how can they affect humans due to poor and malnourished diet.
- To discover how minor dietary adjustments can elevate the quality of these microorganisms serves as a catalyst, inspiring students to embrace healthier dietary choices and cultivate a wholesome lifestyle
- To understand the measures implemented to maintain body and keep state of mind healthy
- Understanding the wellness of gut and its environment and with help of an online test called "MyMicroBiome Test"

## 3. Beneficiaries of the Event

- MUJ students
- BITS PILANI students

## 4. Brief Description of the event

The Biotech Club at Manipal University Jaipur successfully hosted an enlightening online webinar titled "Importance Of Gut Microbes in Human Health and Diseases," skillfully guided by our esteemed faculty coordinator, Dr. Mousumi Debnath, from the Department of Biosciences. We were honored to welcome the distinguished guest, Mr. Surendra K Chikara, who graced the event with his expertise. The session commenced with an insightful opening address by Dr. Mousumi, setting the stage for an engaging and informative gathering. Dr. Surendra then assumed the role of guest lecturer, sharing his expertise and knowledge with our students.

He delivered a comprehensive presentation, elucidating the pivotal role of gut microbes in human health and disease. Dr. Surendra delved into the diverse array of microbes residing within the human body and the intricate relationship they share with our dietary choices. He expounded on the profound connections between gut microbes, diabetes, and obesity, emphasizing the transformative potential of personalized dietary recommendations in rejuvenating gut health. Dr. Surendra also introduced us to the innovative concept of the MyMicroBiome Test, a tool for analyzing gut health and tailoring balanced diets to maintain its well-being.

The session culminated in an engaging Q&A session, where Dr. Surendra K Chikara addressed students' inquiries, covering topics such as nutrition, gut health-related health issues, and dietary recommendations for nurturing and sustaining a healthy gut. In

closing, heartfelt gratitude was extended to all participants, speakers, and organizers for their invaluable contributions.

The online webinar proved to be an enriching and informative guide to holistic health, leaving a lasting impact on all those who attended.

## 5. Photographs


*Figure 1 Introduction to Speakers*


*Figure 2 Explanation of topic by Dr. Surendra K Chikara*

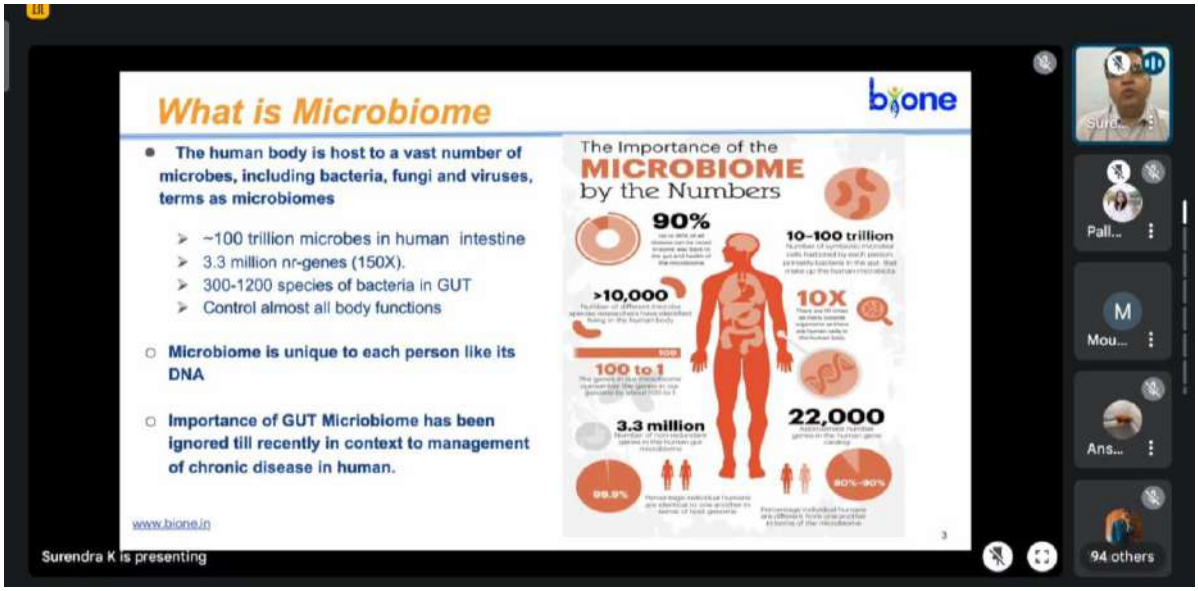



*Figure 3 Presentation by Mr. Chikara*


*Figure 4 Final address/ Vote of thanks*

## 6. Brochure or Creative of the Event

## 7. SCHEDULE OF THE EVENT:

The event was on the 9th September 2023 from 4:00 AM- 5:30 PM on Google Meet.

## 8. ATTENDANCE OF THE EVENT:

| S.No. | Name | Registration No. |
|---|---|---|
| 1. | Anshulika Saxena | 211002053 |
| 2. | Prachi Jain | 221002016 |
| 3. | Anvarshu Gopal | 211002011 |
| 4. | Anuj Kumar | 221002063 |
| 5. | Divyanshu Joshi | 221002056 |
| 6. | Arindam Yadav | 221003015 |
| 7. | Anshi Agarwal | 211002008 |
| 8. | Yashvardhan Gupta | 221002012 |
| 9. | Tanya Barua | 221002065 |
| 10. | Mohammad Aman | 221003012 |
| 11. | Poorvi Sharma | 221002074 |
| 12. | Vaishali Shahi | 23FS10BIO00056 |
| 13. | Tushar Pareek | 23FS10BIO00040 |
| 14. | Aishwarya Jaiswal | 23FS20MBO00014 |
| 15. | Pari Tayal | 23FS10BIO00049 |
| 16. | Simran maharshi | 23FS20MBO00022 |
| 17. | Garima | 23FS20MBO00011 |
| 18. | Nikita | 23FS20MBO00018 |
| 19. | Prashant pradhan | 23FS20MBO00015 |
| 20. | Tanishka | 23FS10BIO00048 |

| | | |
|---|---|---|
| 21. | Riya ranjan | 23FS10MIC00009 |
| 22. | Akshara Alex | 23FS10BIO00022 |
| 23. | Priya Agarwal | 23FS10BIO00042 |
| 24. | Pragya Chauhan | 23FS10BIO00006 |
| 25. | Kanushree Rathore | 23FS10BIO00055 |
| 26. | Juhi Garg | 23FS10BIO00036 |
| 27. | Aishwarya Rai Saxena | 23FS10BIO00065 |
| 28. | Radhika Rathore | 23FS20MBO00008 |
| 29. | Lavanya | 23FS20MBO00002 |
| 30. | Faizan Khan | 23FS10BIO00009 |
| 31. | Shreyas M Iyer | 2020PHXF0005P |
| 32. | Simran Khushwaha | 2018PHXF0406P |
| 33. | Muskan Yadav | 211002040 |
| 34. | Rochita Bani | 211002039 |
| 35. | Samrat Banerjee | 211003008 |
| 36. | Priya sharma | 2023PHXP0001P |
| 37. | Abhimanyu kumar | 2023PHXP0002P |
| 38. | Shivani Tiwari | 211002002 |
| 39. | Sakshi Gupta | 2023H1290008P |
| 40. | Dikshita Aneja | 231051005 |
| 41. | Siddharth | 2020B1A31392P |
| 42. | Yasaswini Reddy S | 2020B1A71892P |
| 43. | Harsh khandan | 2020B1A40601P |
| 44. | Anisha Saini | f2021B1TS2072P |

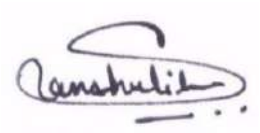
| | | |
|---|---|---|
| 45. | Ayush | 2020B1A70623P |
| 46. | Archi Jain | 2020B1A71380P |
| 47. | Ameya Aglawe | 2020B1A41913P |
| 48. | Suhani Gupta | 23FE10CSB00027 |
| 49. | Adya | 23FS10BIO00067 |
| 50. | Sahil Kumar | 23FS10BIO00046 |
| 51. | Namrata Yadav | 23FS10BIO00032 |
| 52. | Anukriti sharma | 23FS10BIO00052 |
| 53. | Ragini Singh Thakur | 23FS10BIO00051 |
| 54. | Akash Chandra | 211002036 |
| 55. | Avyakt Garg | 2020B1A71902P |
| 56. | Sahaj Tandi | 2020B1A31904P |
| 57. | Sylvia Parveen | 211003009 |
| 58. | Anushka Singh | 211002003 |
| 59. | Divya | 211002056 |
| 60. | Gourav verma | 2FS10BIO00017 |
| 61. | Kashish jain | 230115700 |
| 62. | Gaurav Jetlie | 23FS10MIC00003 |
| 93. | Thati Ameta | 23FS10BIO00031 |
| 64. | Abhishek | 2020B1A81914P |
| 65. | Saksham Kumar | 23FS10BIO00059 |
| 66. | Rohan Sharda | 2020B1A31610P |
| 67. | Nitya gupta | 23FS10BIO00039 |
| 68. | Jaspreet Marwaha | 23FS10MIC00011 |

| | | |
|---|---|---|
| 69. | Tejas Sangale | 23FE10BTE00034 |
| 70. | Aditi Mukherjee | 230106036 |
| 71. | Garima | 230111382 |
| 72. | Asmi Dhadiwal | 23FE10BTE00013 |
| 73. | Sheryl | 23FS10BIO00021 |
| 74. | Krishnendra Singh | 23FS10BIO00014 |
| 75. | Soumya | 23FS10BIO00002 |
| 76. | Sakshi Nirmal | 211002060 |
| 77. | Stephenie Namchyo | 230108439 |
| 78. | Bhumika Agarwal | 23FS10MIC00010 |
| 79. | Arun Ramanathan | 2020B1A41907P |
| 80. | Ishpreet Singh | 2020B1A40651P |
| 81. | Nihal Panchal | 23FS10BIO00010 |
| 82. | Shivali Sharma | 23FS10MIC00012 |
| 83. | Jayraj Kuntal | 23FS10BIO00018 |
| 84. | Samarth Trivedi | 2020B1A71605P |
| 85. | Gautam chikkara | MT230007 |
| 86. | Vanisha Sharma | 230201821 |
| 87. | Harshita | 211003011 |
| 88. | Smita Dey | 2019PHXF0419P |
| 89. | Sanyam Gupta | 2020B1A31910P |
| 90. | Mona singh | 23FS10BIO00035 |
| 91. | Avinash Gautam | RU2119424 |
| 92. | Jyoti yadav | BU0210257546 |

| | | |
|---|---|---|
| 93. | Gargi | 23FS20MBO00026 |
| 94. | Anirudha Kumar Sahu | 2018PHXF0408P |
| 95. | Deeya Pradhan | 23FS10BIO00023 |
| 96. | Jigyasha Rishu | 23FS10BIO00012 |
| 97. | Mariyam khan | 23FS10BIO00027 |
| 98. | Soubhik Ghosh | 221002009 |
| 99. | Aditi Rathore | 221002036 |
| 100. | Tanisha Singh | 221002003 |

## 9.POST EVENT LINK:

https://meet.google.com/okc-uans-dpd



Anshulika Saxena

President, Biotech Club MUJ

**Signature of the Student Coordinator**

Dr. Mousumi Debnath

School of Basic Sciences

**Signature of the Faculty Coordinator**

MANIPAL UNIVERSITY
JAIPUR

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MUJ/DSW/Society Connect/ 31 Oct 2023

MANIPAL UNIVERSITY
JAIPUR

# DIRECTORATE OF STUDENT'S WELFARE

# (SOCIETY CONNECT)

**And**

## Faculty of Management and Commerce

## Department of Business Administration

## Activity on

# SWACH BHARAT

**OCTOBER 31, 2023**

1. **Introduction of the Event**

School of Business and Commerce in collaboration with Directorate of Student Welfare (NCC, NSS) and Rotaract Club (Rotary Bapu Nagar) organized a "Awareness on Environment Protection" on October 31, 2023. 40 students and 2 faculty members participated in the campaign. The event took place in Dehmi Kalan hamlet.

2. **Objective of the Event**

The aim of the campaign was to raise awareness about plantation and Environmental Protection.

3. **Beneficiaries of the Event**

Through this initiative, students and villagers had better communication and understanding of the situation.

4. **Details of the Guests**

The event was laid by the students of BBA, BBA(BA), IMBA and Club Members of Rotaract Club MUJ

5. **Brief Description of the event**

School of Business and Commerce, Department of Business Administration in collaboration with Directorate of Student Welfare, Directorate of sports and NCC, NSS organized a plantation drive for creating awareness on environment protection on 31st October 2023. 20 students and 2 faculty members participated in the drive. The group visited various houses in the Begas Village Road and planted saplings and encouraged villagers to take care about environment and newly planted saplings. Students also learned various communication skills and interactive skills with the villagers.

6. **Photographs**

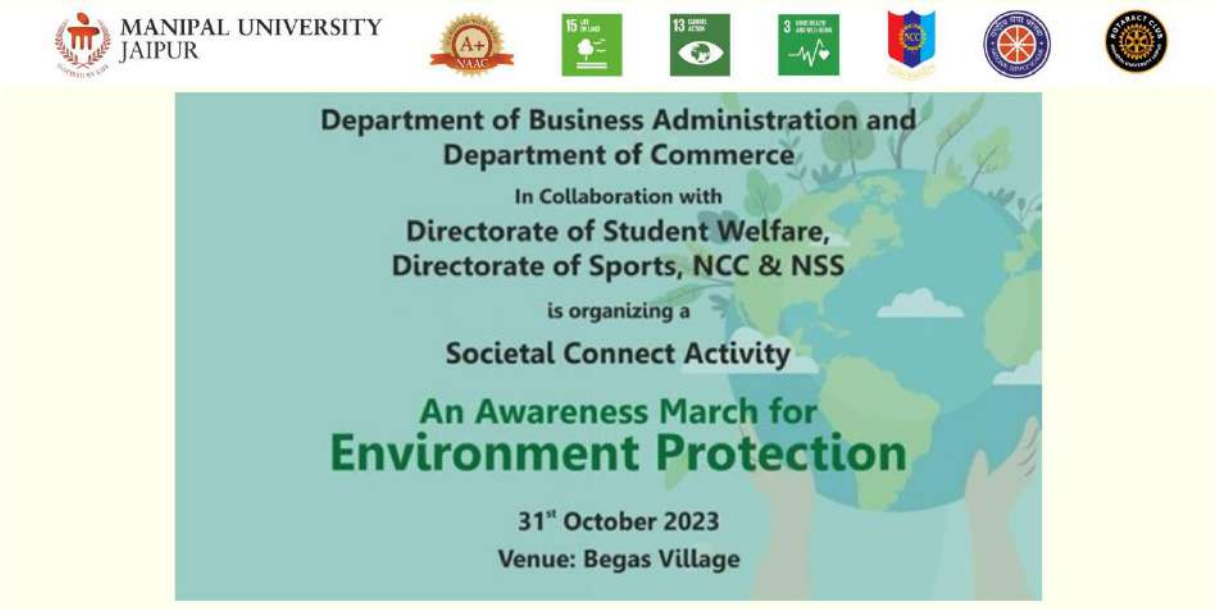

Fig 1 Students at Begus Village for Plantation

Fig 2 Students doing Plantation.


Fig 2 Students & Faculty doing Plantation.


Fig 4 Students & Faculty doing Plantation.

**7. Brochure or creative of the event**




**8. Schedule of the Event**

The event took place on October 31, 2023

**9. Attendance of the Event (60 student)**

| Sr. No | Registration No | Attendee Name | Name of Institution |
|---|---|---|---|
| 1 | 23FM10BBA00197 | VIPUL SHARMA | Manipal University Jaipur |
| 2 | 23FM10BBA00198 | MUKUND MAHESHWARI | Manipal University Jaipur |
| 3 | 23FM10BBA00199 | ROSHAN GUPTA | Manipal University Jaipur |
| 4 | 23FM10BBA00200 | VANSH MULCHANDANI | Manipal University Jaipur |
| 5 | 23FM10BBA00227 | PAWAN POTALIYA | Manipal University Jaipur |
| 6 | 23FM10BBA00232 | AKSHAT KUMARCHOUDHARY | Manipal University Jaipur |
| 7 | 23FM10BBA00233 | DHAIRYA BANSAL | Manipal University Jaipur |
| 8 | 23FM10BBA00230 | YASH ARORA | Manipal University Jaipur |
| 9 | 23FA10BSP00028 | Anupama Rustagi | Manipal Univesrity Jaipur |
| 10 | 23FE10CCE00085 | Siddhartha tiwari | Manipal Univesrity Jaipur |
| 11 | 23FA10BAP00002 | Tanisha Mathur | Manipal Univesrity Jaipur |
| 12 | 23FD10BFD00009 | Mariya Shabbir Baiwala | Manipal Univesrity Jaipur |
| 13 | 23FE10CDS00224 | Harsh Ajmera | Manipal Univesrity Jaipur |
| 14 | 23fe10cds00125 | Suryanshi Singh | Manipal Univesrity Jaipur |
| 15 | 23fs10mat00009 | Malavika ramdas | Manipal Univesrity Jaipur |
| 16 | 221007021 | Arshi Jain | Manipal Univesrity Jaipur |
| 17 | 23FE10CSE00137 | Stuti Dixit | Manipal Univesrity Jaipur |
| 18 | 23fe10cii00094 | Aarohi Tyagi | Manipal Univesrity Jaipur |
| 19 | 23FE10CSE00152 | Gautam Kakkar | Manipal Univesrity Jaipur |

| | | | |
|---|---|---|---|
| 20 | 23FE10CSE00318 | Krish Ray | Manipal Univesrity Jaipur |
| 21 | 23FE10CII00076 | Kriissh Marwaha | Manipal Univesrity Jaipur |
| 22 | 229310321 | Shiv Rajput | Manipal Univesrity Jaipur |
| 23 | 23FS10BIO00051 | Ragini Singh Thakur | Manipal Univesrity Jaipur |
| 24 | 23FS10BIO00052 | Anukriti sharma | Manipal Univesrity Jaipur |
| 25 | 220901073 | Diya Mittal | Manipal Univesrity Jaipur |
| 26 | 23FE10CSE00081 | Smmayan Gupta | Manipal Univesrity Jaipur |
| 27 | 229309083 | Raghav Gupta | Manipal Univesrity Jaipur |
| 28 | 23FE10CDS00397 | Hrishita Singh Timaney | Manipal Univesrity Jaipur |
| 29 | 23FE10ITE00203 | Sarah Sharda | Manipal Univesrity Jaipur |
| 30 | 23fa10bsp00025 | Jasleen kaur | Manipal Univesrity Jaipur |
| 31 | 23FA10BSP00039 | Jiya Kumar | Manipal Univesrity Jaipur |
| 32 | 23FA10BSP00004 | Aarya Mahale | Manipal Univesrity Jaipur |
| 33 | 220606020 | Chaarvi Kumar | Manipal Univesrity Jaipur |
| 34 | 23fa10bsp00058 | Kashvi Mahajan | Manipal Univesrity Jaipur |
| 35 | 229301095 | Shaurya Singh | Manipal Univesrity Jaipur |
| 36 | 23fe10ece00024 | Kushagra agrawal | Manipal Univesrity Jaipur |
| 37 | 23FA10BSP00017 | Megha  Sharma | Manipal Univesrity Jaipur |
| 38 | 23FM10BBA00162 | Alina Nadeem | Manipal Univesrity Jaipur |
| 39 | 23FM10BBA00178 | Avishi Akhaury | Manipal Univesrity Jaipur |
| 40 | 221007004 | Urvi Thakare | Manipal Univesrity Jaipur |
| 41 | 23FA10BAP00027 | Natasha Joan Menezes | Manipal Univesrity Jaipur |
| 42 | 23FA10BLE00004 | Tanisha chaturvedi | Manipal Univesrity Jaipur |
| 43 | 23fe10cai00579 | Arjun Malhotra | Manipal Univesrity Jaipur |
| 44 | 23FE10CAI00352 | Maanyata Aul | Manipal Univesrity Jaipur |
| 45 | 220901322 | Divyanshi Singh | Manipal Univesrity Jaipur |
| 46 | 229310412 | Jatin Verma | Manipal Univesrity Jaipur |
| 47 | 229301094 | Yashovardhan Pratap Singh | Manipal Univesrity Jaipur |
| 48 | 23FM10BBA00348 | Niska kedia | Manipal Univesrity Jaipur |
| 49 | 221105005 | Dhruv Nair | Manipal Univesrity Jaipur |
| 50 | 23FM10BBA00170 | Shambhavi Agrawal | Manipal Univesrity Jaipur |
| 51 | 23FE10CDS00241 | Armaan Setia | Manipal Univesrity Jaipur |
| 52 | 23FE10CAI00105 | Mritunjay Singh | Manipal Univesrity Jaipur |
| 53 | 229311075 | Aarna Tyagi | Manipal Univesrity Jaipur |
| 54 | 229302051 | Prince jindal | Manipal Univesrity Jaipur |
| 55 | 23FA10BHE00035 | Taneesha puri | Manipal Univesrity Jaipur |
| 56 | 220903033 | Suhani Jain | Manipal Univesrity Jaipur |
| 57 | 220901391 | Dipika Agarwal | Manipal Univesrity Jaipur |
| 58 | 229310222 | Aayush Sharma | Manipal Univesrity Jaipur |
| 59 | 221003007 | Yachna Jain | Manipal Univesrity Jaipur |
| 60 | 220901002 | Anshu jangir | Manipal Univesrity Jaipur |

MANIPAL UNIVERSITY
JAIPUR

Dr Narendra Singh Bhati Ho

HOD, BBA

(Hemant Kumar)
Assistant Director, Society Connect
Directorate of Student's Welfare

**(Prof. AD Vyas)**
**Director, Directorate of Student's Welfare**

DIRECTOR STUDENT WELFARE & PROCTOR
MANIPAL UNIVERSITY, JAIPUR

MANIPAL UNIVERSITY
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JAIPUR

MUJ/Q&C/021/F/1.01

MANIPAL UNIVERSITY
JAIPUR

# DIRECTORATE OF STUDENT'S WELFARE

# (SOCIETY CONNECT)

**And**

## Faculty of Management and Commerce

## Department of Business Administration

**Presents**

# SWACH BHARAT

# OCTOBER 25, 2023

1. **Introduction of the Event**

School of Business and Commerce in collaboration with Directorate of Student Welfare, Directorate of sports and NCC, NSS organized a "SWACH BHARAT" on October 25, 2023. 52 students participated in the campaign. The event took place in Dehmi Kalan hamlet.

2. **Objective of the Event**

The aim of the campaign was to raise awareness about Waste Segregation and encourage education on the SWACH BHARAT.

3. **Beneficiaries of the Event**

Through this initiative, students and villagers had better communication and understanding of the situation.

4. **Details of the Guests**

The event was laid by the students of BBA, BBA(BA), IMBA

**Rotary Club Jaipur Bapu Nagar**

Rotary started with the vision of one man — Paul Harris. The Chicago attorney formed the Rotary Club of Chicago on 23 February 1905, so professionals with diverse backgrounds could exchange ideas and form meaningful, lifelong friendships.

Over time, Rotary's reach and vision gradually extended to humanitarian service. Members have a long track record of addressing challenges in their communities and around the world.

Rotary is a global network of 1.4 million neighbors, friends, leaders, and problem-solvers who see a world where people unite and take action to create lasting change – across the globe, in our communities, and in ourselves. They provide service to others, promote integrity, and advance world understanding, goodwill, and peace through our fellowship of business, professional, and community leaders. We collaborate with community leaders who want to get to work on projects that have a real, lasting impact on people's lives. We connect passionate people with diverse perspectives to exchange ideas, forge lifelong friendships, and, above all, take action to change the world.

5. **Brief Description of the event**

The event was initiated to make students aware of their surroundings with respect to Waste and it consequences on the local community. The students went on a rally in groups, holding posters on Wet Waste and Dry Waste. They were chanting slogans "Alag Karo Alag Karo" Gila aur Sukha Kachara Alag Karo, to make the local community aware of the Waste Segregation process.

## 6. Photographs


Image 1 : Students with faculty


Image 2: Students walking with the Rally through the Village


Image 3: Team of MUJ Students at Village for Rally


Image 4: Team of MUJ Students at Village for Rally

## 7. Brochure or creative of the event


## 8. Schedule of the Event

The event took place on Ocotber 25, 2023

## 9. Attendance of the Event

| Sr. No | Name of Institution | Registration No | Attendee Name |
|---|---|---|---|
| 1 | Manipal University Jaipur | 23FM10BBA00122 | Naresh Choudhary |
| 2 | Manipal University Jaipur | 23FM10BBA00123 | Prem Singhrathore |
| 3 | Manipal University Jaipur | 23FM10BBA00124 | Yash Vardhansingh |
| 4 | Manipal University Jaipur | 23FM10BBA00125 | Krishna Snair |
| 5 | Manipal University Jaipur | 23FM10BBA00126 | Viyom Gupta |
| 6 | Manipal University Jaipur | 23FM10BBA00127 | Aditya Singh shekhawat |
| 7 | Manipal University Jaipur | 23FM10BBA00128 | Sheikh Tabish ahmed |
| 8 | Manipal University Jaipur | 23FM10BBA00129 | Bhavesh Aggarwal |
| 9 | Manipal University Jaipur | 23FM10BBA00130 | Riddhima Gupta |
| 10 | Manipal University Jaipur | 23FM10BBA00131 | Ishita Sharma |
| 11 | Manipal University Jaipur | 23FM10BBA00132 | Akshat Sharma |
| 12 | Manipal University Jaipur | 23FM10BBA00133 | Preksha Sood |
| 13 | Manipal University Jaipur | 23FM10BBA00134 | Tanisha Agarwal |
| 14 | Manipal University Jaipur | 23FM10BBA00135 | Ram Avtarchouhan |

| | | | |
|---|---|---|---|
| 15 | Manipal University Jaipur | 23FM10BBA00136 | Sourabh Shekhawat |
| 16 | Manipal University Jaipur | 23FM10BBA00137 | Abhishek Jain |
| 17 | Manipal University Jaipur | 23FM10BBA00138 | Priyanshu Yadav |
| 18 | Manipal University Jaipur | 23FM10BBA00139 | Riddhi Charan |
| 19 | Manipal University Jaipur | 23FM10BBA00140 | Akhil |
| 20 | Manipal University Jaipur | 23FM10BBA00141 | Shaily Kushwaha |
| 21 | Manipal University Jaipur | 23FM10BBA00142 | Deep Mittal |
| 22 | Manipal University Jaipur | 23FM10BBA00143 | Rahul Choudhary |
| 23 | Manipal University Jaipur | 23FM10BBA00144 | Ronil Joshi |
| 24 | Manipal University Jaipur | 23FM10BBA00145 | Arihant Jaisawal |
| 25 | Manipal University Jaipur | 23FM10BBA00146 | Ayush Kumarthakur |
| 26 | Manipal University Jaipur | 23FM10BBA00147 | Angad Yadav |
| 27 | Manipal University Jaipur | 23FM10BBA00148 | Shashank Chaudhary |
| 28 | Manipal University Jaipur | 23FM10BBA00149 | Khushi Gupta |
| 29 | Manipal University Jaipur | 23FM10BBA00150 | Garvita Rathore |
| 30 | Manipal University Jaipur | 23FM10BBA00151 | Anirban Bhattacharyya |
| 31 | Manipal University Jaipur | 23FM10BBA00152 | Keshav Badthuniya |
| 32 | Manipal University Jaipur | 23FM10BBA00153 | Yash Saini |
| 33 | Manipal University Jaipur | 23FM10BBA00154 | Vineet Kumar |
| 34 | Manipal University Jaipur | 23FM10BBA00155 | Bhavuk Parashar |
| 35 | Manipal University Jaipur | 23FM10BBA00156 | Mohit Oshu |
| 36 | Manipal University Jaipur | 23FM10BBA00157 | Honey Chandnani |
| 37 | Manipal University Jaipur | 23FM10BBA00158 | Veer Singh |
| 38 | Manipal University Jaipur | 23FM10BBA00159 | Naman Kriplani |
| 39 | Manipal University Jaipur | 23FM10BBA00160 | Himanshu Yogesh Mittal |
| 40 | Manipal University Jaipur | 23FM10BBA00161 | Amogh Goyal |
| 41 | Manipal University Jaipur | 23FM10BBA00162 | Alina Nadeem |
| 42 | Manipal University Jaipur | 23FM10BBA00163 | Prince Gandhi |
| 43 | Manipal University Jaipur | 23FM10BBA00164 | Devansh Devansh Tiwari |
| 43 | Manipal University Jaipur | 221016048 | Aarohi |
| 44 | Manipal University Jaipur | 229301387 | Soham maskara |
| 45 | Manipal University Jaipur | 229301650 | Karan Kapoor |
| 46 | Manipal University Jaipur | 229301552 | MONIL SHAH |
| 47 | Manipal University Jaipur | 229311009 | Krittika Wadhawan |
| 48 | Manipal University Jaipur | 229301034 | Maulik Mehrotra |
| 49 | Manipal University Jaipur | 229302340 | Shreya Saihgal |
| 50 | Manipal University Jaipur | 229302257 | Yash Dhruv |
| 51 | Manipal University Jaipur | 229302641 | Pankaj Patel |
| 52 | Manipal University Jaipur | 229310250 | Amrit Raj |
| 53 | Manipal University Jaipur | 220901154 | Mehul rawat |
| 54 | Manipal University Jaipur | 221201002 | Palak chawla |
| 55 | Manipal University Jaipur | 229309070 | Pranav Banker |
| 56 | Manipal University Jaipur | 229303128 | Mahi Bhardwaj |
| 57 | Manipal University Jaipur | 229303305 | Karshh Divekar |
| 58 | Manipal University Jaipur | 229310242 | Ashmit |

| | | | |
|---|---|---|---|
| 59 | Manipal University Jaipur | 229301681 | Armaan Deep Singh Bedi |
| 60 | Manipal University Jaipur | 229302281 | Shriyam Singh Tiwari |
| 61 | Manipal University Jaipur | 229301130 | Shreyansh Reddy |
| 62 | Manipal University Jaipur | 220901032 | Raj Singh |
| 63 | Manipal University Jaipur | 211103077 | Sanmai Pathak |
| 64 | Manipal University Jaipur | 211103075 | Anvesha Shekhar |
| 65 | Manipal University Jaipur | 219311129 | Shubham Yadav |
| 66 | Manipal University Jaipur | 221201033 | Divanshi Gupta |
| 67 | Manipal University Jaipur | 229310052 | Lakshya Khandelwal |
| 68 | Manipal University Jaipur | 229303191 | Krishang Shukla |
| 69 | Manipal University Jaipur | 221305050 | Baibhav Bhanu Naithani |
| 70 | Manipal University Jaipur | 229302371 | Rishika Bhagawati |
| 71 | Manipal University Jaipur | 229311168 | Rudra Nayyar |
| 72 | Manipal University Jaipur | 229311024 | Shivam Singh |
| 73 | Manipal University Jaipur | 229311289 | puneet more |
| 74 | Manipal University Jaipur | 229310200 | Nainish Mane |
| 75 | Manipal University Jaipur | 229310153 | Diksha M |
| 76 | Manipal University Jaipur | 221007068 | Akshita Pandey |
| 77 | Manipal University Jaipur | 229309068 | Rahul Trivedi |
| 78 | Manipal University Jaipur | 229309052 | Raeez Mohammed K P |

Dr Narendra Singh Bhati HoD, BBA

(Hemant Kumar)
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Directorate of Student's Welfare

**(Prof. AD Vyas)**
**Director, Directorate of Student's Welfare**

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MANIPAL UNIVERSITY, JAIPUR

MANIPAL UNIVERSITY
JAIPUR

## Department of Interior Design

## FACULTY OF DESIGN

# Make & Take

# Kokedama

# Hands-on Workshop

**22/11/2023**

# Content of Report

## 1. Introduction of the Event

The Department of Interior Design, Faculty of Design at Manipal University Jaipur organized a Kokedama Workshop on 22.11.2023, as a part of the curriculum for 3rd-year B.Des (ID) students. This workshop was conducted under the subject Interior Landscape (ID3105) to provide students with a practical, hands-on experience in the art of preparing Kokedamas. Along with 3rd year B. Des students, this workshop is open for all Manipal University Jaipur students (Diploma, Undergraduate and Postgraduate), Research Scholars, Academicians, Faculty Housing Women, And Industry Professionals with fees of Rs 300/- that included all the materials.

An introduction and demonstration to Kokedama was given by Ms. Geeta Ahluwalia, General Secretary, Kitchen Garden Association, Jaipur. Kitchen Garden Association is an all women lead non-profit organisation in Jaipur. Ar. Sneh Singh (HoD Interior Design) along with Ar. Megha Prabhu K (Asst. Professor, Interior Design) conducted a hands-on 'Make & Take' Kokedama Workshop.

## 2. Objective of the Event

- Provide 3rd-year B. Des (ID) students with a hands-on experience in the preparation of Kokedamas.
- Enhance the understanding of interior landscaping principles among participants and foster practical skills in crafting Kokedamas, focusing on plant selection, soil composition, and wrapping techniques.
- Facilitate knowledge exchange and collaboration among participants from diverse academic backgrounds, including students, research scholars, academicians, and industry professionals.
- Encourage creativity and innovation in Interior Design through the exploration of Japanese moss ball planters.
- Provide a platform for participants to engage in a Q&A session, allowing for a deeper understanding of the art of Kokedama.
- Create a supportive and inclusive learning environment for all attendees, fostering a sense of community and collaboration within Manipal University Jaipur.

## 3. Beneficiaries of the Event

The workshop was open to a diverse audience, including 3rd-year B.Des(ID) students, students from other programs (Diploma, Undergraduate, and Postgraduate) at Manipal University Jaipur, research scholars, academicians, Faculty Housing Women, and industry professionals. The inclusive nature of the workshop aimed to foster collaboration and knowledge exchange among participants.

## 4. Details of the Guests

The honoured guest for the event was Ms. Geeta Ahluwalia, the Secretary of the Kitchen Garden Association Jaipur. Kitchen Garden Association is an all women lead non-profit organisation in Jaipur. Ms. Ahuwalia's expertise in the field brought a valuable perspective to the workshop, and her presence added significant value to the overall learning experience for the participants.

## 5. Brief Description of the event

The Kokedama workshop provided a unique opportunity for participants to explore the creative and technical aspects of crafting Kokedamas, which are Japanese moss ball planters. The event kicked off with a warm welcome to all attendees, followed by an insightful introduction to the art of Kokedama and its relevance in interior design.

Participants were guided through the step-by-step process of creating their own Kokedamas, emphasizing the selection of suitable plants, soil composition, and wrapping techniques. Ms. Ahuwalia shared her expertise and provided practical tips, enriching the learning experience for everyone involved.

## 6. Photographs of the Event



Introduction and Demonstration given by Expert, Ms. Geeta Ahluwalia


Demonstration of Kokedama given by Expert, Ms. Geeta Ahluwalia


Participants showcasing their works

## 7. Poster of the event

## 8. Schedule of the event

| 'Make & Take'<br>Kokedama Workshop<br>22 November 2023, Wednesday | |
|---|---|
| Porch Area, 1st Floor, Administration Building, MUJ | |
| **Time** | **Event** |
| 09:30 am | Registration and Reporting |
| 10:30 am | Welcome address by Ar. Megha Prabhu Karkala<br>Introduction of the Guest<br>Adress by Dean, Prof. (Dr.) Madhura Yadav, Dean, FoD |
| 10:45 am | Expert Lecture and Introduction to Kokedama by Ms. Geeta Ahuwalia |
| 11:00 am | Practical Session: Crafting Kokedamas |
| 11:30 am | Making Kokedamas by students |
| 12:45 pm | Completion of Kokedamas and Q&A Session |
| 01:00 pm | Felicitation of Ms. Geeta Ahuwalia and Closing Remarks |
| 01:15 pm | Group Photographs and Exhibition of Students works |

## 9. Attendance of the Event

| Sl.No | Participate Name | Participant | Deparment | Registration No. |
|---|---|---|---|---|
| 1 | Kashish Kriplani | Student | B.Des (Interior Design) | 210606041 |
| 2 | Kartik Totla | Student | B.Des (Interior Design) | 210606011 |
| 3 | Aakash Singh | Student | B.Des (Interior Design) | 210501007 |
| 4 | Garima Vijaycharan | Student | B.Des (Interior Design) | 210606021 |
| 5 | Kumari Anjali | Student | B.Des (Interior Design) | 210606008 |
| 6 | Himanshi Sharma | Student | B.Des (Interior Design) | 210606028 |
| 7 | Esha Giri | Student | B.Des (Interior Design) | 210606031 |
| 8 | Anisha Chopra | Student | B.Des (Interior Design) | 210606020 |
| 9 | Rutu Shah | Student | B.Des (Interior Design) | 210606007 |
| 10 | Anushka Rai | Student | B.Des (Interior Design) | 210606019 |
| 11 | Rishika | Student | B.Des (Interior Design) | 210606029 |
| 12 | Paridhi Verma | Student | B.Des (Interior Design) | 210606017 |
| 13 | Naman | Student | B.Des (Interior Design) | 210606013 |
| 14 | Diya Ramchandani | Student | B.Des (Interior Design) | 210606039 |
| 15 | Krishangee Goyal | Student | B.Des (Interior Design) | 210606026 |
| 16 | Avinash Yadav | Student | B.Des (Interior Design) | 210606047 |
| 17 | Himanshi Yadav | Student | B.Des (Interior Design) | 210606014 |
| 18 | Hridyanshi Vyas | Student | B.Des (Interior Design) | 210606018 |
| 19 | Khushi Bhargava | Student | B.Des (Interior Design) | 210606010 |
| 20 | Madhu Tanwar | Student | B.Des (Interior Design) | 210606027 |
| 21 | Riddhi Agarwal | Student | B.Des (Interior Design) | 210606038 |
| 22 | Michelle Earnest | Student | B.Des (Interior Design) | 210606043 |

| | | | | |
|---|---|---|---|---|
| 23 | Pooja Jain | Student | B.Des (Interior Design) | 23fd10bid00020 |
| 24 | Shreshtha Gaur | Student | B.Des (Interior Design) | 210606012 |
| 25 | Geetika Gupta | Student | B.Des (Interior Design) | 210606037 |
| 26 | Manya Agarwal | Student | B.Des (Interior Design) | 210606015 |
| 27 | Riya | Student | B.Des (Interior Design) | 210606035 |
| 28 | Ananya Thakan | Student | B.Des (Interior Design) | 210606006 |
| 29 | Devanshi Jain | Student | B.Des (Interior Design) | 210606046 |
| 30 | Drishti Sharma | Student | B.Des (Interior Design) | 210606045 |
| 31 | Sejal Sharma | Student | B.Des (Interior Design) | 210606023 |
| 32 | Samarth Gandhi | Student | B.Des (Interior Design) | 210606003 |
| 33 | Saija Tanya | Student | B.Des (Interior Design) | 210606044 |
| 34 | Garvit Garg | Student | B.Des (Interior Design) | 210606001 |
| 35 | Shruti Dubey | Student | B.Des (Interior Design) | 210606022 |
| 36 | Keshav Katta | Student | B.Des (Interior Design) | 210606005 |
| 37 | Grishma Korjani | Student | B.Des (Interior Design) | 210606016 |
| 38 | Shweta Sharma | Non-Teaching Staff | Non- Teaching Staff | MUJ1134 |
| 39 | Megha Prabhu Karkala | Assistant Professor | Faculty of Design | MUJ1434 |
| 40 | Smriti Saraswat | Assistant Professor | Faculty of Design | MUJ1248 |
| 41 | Dr. Shilpi Gupta | Assistant Professor | Department of Economics | MUJ0403 |
| 42 | Malini G Prabhu | Faculty Housing Member | Faculty Housing Member | NA |
| 43 | Rajendar Kumar | Non-Teaching Staff | GSA | MUJ1300 |
| 44 | Reetika Choudary | Non-Teaching Staff | Admission Department | MUJ1406 |
| 45 | Priyanka Samarth | Non-Teaching Staff | Admission Department | MUJ1408 |
| 46 | Panchami Sharma | Non-Teaching Staff | HR Department | MUJ11002438 |
| 47 | Kusuma Jinka | Faculty Housing Member | Faculty Housing Member | NA |
| 48 | Madan | Non-Teaching Staff | GSA | |
| 49 | Gopal | Non-Teaching Staff | GSA | |
| 50 | Kush Jee Kamal | Assistant Professor | Faculty of Design | MUJ1714 |
| 51 | Man Mohan Mehta | Non-Teaching Staff | Admission Department | MUJ0170 |

| Manipal University Jaipur | | | |
|---|---|---|---|
| Department of Interior Design I FOD | | | |
| II Year III Semester - ID3105-Interior Landscape | | | |
| KOKEDAMA WORKSHOP - 22.11.2023 | | | |
| Sl. No. | ROLL. No. | NAME | SIGN |
| 1 | 210606001 | GARVIT GARG | |
| 2 | 210606003 | SAMARTH GANDHI | |
| 3 | 210606004 | VISHVA SAMIRBHAI DAVE | ABSENT |
| 6 | 210606005 | KESHAV KATTA | |
| 5 | 210606006 | ANANYA THAKAN | |
| 6 | 210606007 | RUTU DILIP KUMAR SHAH | |
| 7 | 210606008 | KUMARI ANJALI | |
| 8 | 210606010 | KHUSHI BHARGAVA | |
| 9 | 210606011 | KARTIK TOTLA | |
| 10 | 210606012 | SHRESHTHA GAUR | |
| 11 | 210606013 | NAMAN HODKASIA | ABSENT |
| 12 | 210606014 | HIMANSHI YADAV | |
| 13 | 210606015 | MANYA AGARWAL | |
| 14 | 210606016 | GRISHMA KORJANI | |
| 15 | 210606017 | PARIDHI VERMA | |
| 16 | 210606018 | HRIDYANSHI VIRESH VYAS | |
| 17 | 210606019 | ANUSHKA RAI | |
| 18 | 210606020 | ANISHA CHOPRA | |
| 19 | 210606021 | GARIMA VIJAY CHARAN | |
| 20 | 210606022 | SHRUTI DUBEY | |
| 21 | 210606023 | SEJAL SHARMA | |
| 22 | 210606026 | KRISHANGEE GOYAL | |
| 23 | 210606027 | MADHU TANWAR | |
| 24 | 210606028 | HIMANSHI SHARMA | |
| 25 | 210606029 | RISHIKA | |
| 26 | 210606031 | ESHA GIRI | |
| 27 | 210606034 | KREETI YADAV | ABSENT |
| 28 | 210606035 | RIYA GAUTAM ROY | |
| 29 | 210606036 | HRIDAY SINGH | ABSENT |
| 30 | 210606037 | GEETIKA GUPTA | |
| 31 | 210606038 | RIDDHI AGARWAL | |
| 32 | 210606039 | DIYA RAMCHANDANI | |
| 33 | 210606041 | KASHISH KRIPLANI | |
| 34 | 210606043 | MICHELLE EARNEST | |
| 35 | 210606044 | SAIJA TANYA | |
| 36 | 210606045 | DRISHTI SHARMA | |
| 37 | 210606046 | DEVANSHI JAIN | |
| 38 | 210606047 | AVINASH YADAV | |
| 39 | 210501007 | AKASH | |

| Manipal University Jaipur | | | | |
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| Department of Interior Design | | | | |
| Faculty of Design | | | | |
| KOKEDAMA WORKSHOP - 22.11.2023 | | | | |
| Sl. No. | MUJ ID/ Roll No | NAME | Department | SIGN |
| 1 | MUJ13 | | | |
| 2 | MUJ1406 | Reetika Choudhary | Admission | |
| 3 | MUJ1408 | | Admission | |
| 6 | | | | |
| 5 | MUJ11002438 | Panchami Sharma | HR | |
| 6 | FH member | Malini G Prabhu | Faculty Housing | Malini Prabhu |
| 7 | FH member | Rusuma Tinka | Faculty Housing | |
| 8 | MUJ403 | Dr. Dilipa Gupta | Economics. | |
| 9 | | Madan | GSA | |
| 10 | | Gopal | GSA - | |
| 11 | MUJ1134 | Sraveda Sharma | Senior - Personal Assistant | |
| 12 | MUJ1719 | Kush Jee Kaur | ID | |
| 13 | MUS0170 | Man Mohan Mulia | Administration | |
| 14 | | | | |

## 10. Link of MUJ social media page

LinkedIn: https://www.linkedin.com/feed/update/urn:li:activity:7134914090002526208
Facebook:

- https://www.facebook.com/share/p/veNm8xBHeCEpUkJh/?mibextid=WC7FNe
- https://www.facebook.com/share/p/SESHp8BN95zt4VCP/?mibextid=WC7FNe

Instagram:

- https://www.instagram.com/p/C0JntI-LnvS/?utm_source=ig_web_copy_link&igshid=MzRlODBiNWFlZA==
- https://www.instagram.com/p/C0Jwf4orIKQ/?utm_source=ig_web_copy_link&igshid=MzRlODBiNWFlZA==

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RESEARCH ARTICLE

# Geophysical and geostatistical assessment of groundwater and soil quality using GIS, VES, and PCA techniques in the Jaipur region of Western India

**Jabbar Khan[1] · Govind Gupta[1] · Naveen Kumar Singh[1] · Vivek Narayan Bhave[2] · Vinay Bhardwaj[2] · Pallavi Upreti[3] · Rani Singh[4] · Amarendra Kumar Sinha[5]**

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## Abstract

In present study, geophysical and geostatistical variability of ground water and agricultural soil investigated in the Jaipur region of Rajasthan (Western India) by applying the geographic information system (GIS), vertical electrical sounding (VES) ,and statistical analysis. Ground water and soil samples collected from different sites from the selected study area and variation pattern of quality parameters were assessed. A contour map analysis of distribution of metals and other contaminants in the samples was conducted using GIS. Maximum concentration of metals recorded in the soil samples in order of Fe, 11.25 mg $kg^{-1}$ > Mn, 8.6 mg $kg^{-1}$ > Zn, 7.2 mg $kg^{-1}$ > Cu, 0.455 mg $kg^{-1}$; however, maximum concentration of metals in the ground water samples was found as Zn, 2.64 mg $L^{-1}$ > Cu, 0.86 mg $L^{-1}$ > Fe, 0.39 mg $L^{-1}$ > Mn, 0.18 mg $L^{-1}$ > Pb, 0.065 mg $L^{-1}$ > Ni, 0.016 mg $L^{-1}$. Observed data emphasis variability in groundwater and soil quality parameter by PCA technique indicated 84.60% and 66.98% of variance, respectively. Soil quality index (SQI) value was observed as 0.482 indicating that 46% of soil sampling sites deteriorated and shown poor quality. Similarly, water quality index (WQI) value indicates good water quality at the sampling sites TW1, TW8, TW10, and TW12; however, TW3, TW4, TW6, TW19, TW20, and TW22 sites showed very poor water quality. The present study concludes that overexploitation of groundwater and unregulated discharge of wastewater leads to depletion of water and soil quality. Further, applying geographical and geostatistical techniques in assessing water and soil quality could be more effective tools in environmental monitoring and management for environmental and health safety.

**Keywords** Bioaccumulation · Bioavailability · Biotransformation · Contamination · Groundwater · Metals · Principal component analysis (PCA) · Water quality

## Introduction

Rapid urbanization leads to several environmental issues, including poor living conditions, changes in land use pattern, overexploitation of water and soil, transportation congestion, resettlement, disasters, and environmental pollution (Kalayci Onac et al. 2021; Aksoy et al. 2022; Tay and Ocansey 2022; Dogan et al. 2023). Fresh water including ground water is one of the most important components of the environment and essential for human survival and wellbeing (Gavrilescu 2021). However, extensive exploitation of water by human being leads to substantial environmental cost due to contamination, scarcity, and depletion of water resources affecting water supply and health safety (Tzanakakis et al. 2020; Singh et al. 2022). Scarcity of safe drinking water is now becoming a problem due to

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extensive urbanisation, industrialization, agriculture, and climate change affecting about 40% of human population globally (Calzadilla et al. 2011; Bilge Ozturk et al. 2022). Groundwater found underground in cracks and crannies in rock, sand, and soil is the main source of drinking water supply. Exploitation of groundwater may result in dissolution of numerous contaminants as it passes through the rocks and soil during leaching and percolation (Saleem et al. 2018). Trace metals emanating from different industrial, transportation, construction, and agricultural activities affect soil and water quality as recalcitrant and toxic contaminants (Romic and Romic 2003; Cetin et al. 2022a; Sahin et al., 2022). Link between soil quality and socioeconomic well-being of humans, particularly, global food security and human health have been reported (Yu et al. 2018; Kopittke et al. 2019). Soil and water contamination occurs due to various anthropogenic activities and geological processes releasing metals and other elements; therefore, assessment of soil and water quality is becoming more crucial in adapting appropriate strategies to prevent and preserve the land and water resources for human wellbeing (Ahmet et al. 2006; Cesur et al. 2021). More common metal contaminants in soil and water are Pb, Cr, As, Zn, V, Cd, Cu, and Sn reported with high levels of toxicity for biota (Yang et al. 2016; Hanfi et al. 2020; Cetin et al. 2022b).

India is one of the emerging nations with more industrial and other developmental activities having wastewater generation and discharge on the land and in the aquatic ecosystems leads to soil and water contamination (Tiwari et al. 2011). Metals persist in the soil and water, accumulates in the plants by roots uptake, and biomagnifies in the animals through food chain, which causes detrimental impact to the biota (Luo et al. 2012; Ali et al. 2019; Cetin and Abo Aisha 2023). Certain metals easily enter the food chain due to their bioavailability in the rhizosphere, uptake, and accumulation in the plants and can reach to other animals and humans through food (Gu et al. 2016; Rajendran et al. 2022). It has been reported that excessive accumulation of trace elements like cadmium, lead, and nickel in the plants causes toxicity and slows down the growth and productivity (Pandey and Sharma 2002; Zouboulis et al. 2004). A substantial threat to aquatic and terrestrial biodiversity as well as health hazards for humans posed by contaminated water and soil (Olayinka-Olagunju et al. 2021). Types of rock, physicochemical characteristics of soil, atmospheric precipitation, and surface geochemical processes affect the groundwater quality parameters and contamination (Garg and Hassan 2007; Cesur et al. 2021). Groundwater is most reliable source even in India because it provides a significant proportion of the country's drinking and agricultural water requirements (Mahmood and Kundu 2005).

Physico-chemical characteristics of soil also affects the water quality of groundwater at a given regions (Griffiths et al. 2010; Hermans et al. 2020). Different physio-chemical and biological indicators have been used in various studies to evaluate the soil quality (Filip 2002; Schloter et al. 2003). GIS has evolved into a trustworthy instrument for absorbing, analyzing, and displaying spatial data that can be utilized for environmental monitoring, planning, and resource management applications (Cetin 2015; Singha et al. 2015). The geographical information system (GIS) has become an important tool in research for resource management as it allows users to use geographical data in a variety of context and way in an integrated approach. Remote sensing (RS) and GIS studies in integration make it easier to work in relatively broad areas, particularly in environmental impact assessment for sustainable urban planning and resource utilization (Cetin 2019; Pekkan et al. 2021; Cetin et al. 2022c). Convergence of data concerning environmental assessment-related issues as well as the manipulation of spatial data into various forms in response to geosocial requirements may be accomplished using GIS (Cetin et al. 2022d). The principal component analysis (PCA) is a prominent statistical analysis tool for investigating data patterns thorough factor analysis approach. Basic purpose of PCA is to create new variables as principal components, from a set of existing original variables (Wu et al. 2020). Potential of geophysical information system-based geostatistical methodologies in assessing the region's groundwater and soil quality as well as its susceptibility to water-borne diseases reported (Ali and Ahmad 2020).

The Sanganer, Jaipur region of Rajasthan, Western India, having more industrial activities specially printing and dyeing operations leads to huge amount of wastewater generation and discharge in water and agricultural soil through unregulated disposal and irrigation practices. Very limited data are available related to using geographical information system and geostatistical techniques in the ground water and soil quality assessment. Therefore, the present study was conducted to assess ground water and soil quality at different sites based on a minimal set of interconnected geophysical and chemical criteria at Sanganer, Jaipur region of Rajasthan, Western India, and apply geophysical and geostatistical including GIS, VES, and PCA techniques to emphasize the water and soil quality parameters for environmental monitoring and assessment.

## Materials and methods

### Study area

The whole study conducted in the industrial and agricultural tracts in the north of Jaipur–Sanganer regions at different selected sampling sites, situated between 26° 49° and 26° 51° N and 75° 46° and 75° 51° E in the Jaipur district,

Rajasthan, Western India (Fig. 1). One selected study site, the Sanganer, is famous for its hand-printed textiles have land size of 78.24 square kilometres, situated on NH-12, 10 kilometres to the southwest of Jaipur City. The Sanganer is well-known for its distinctive type of printing "Sanganer Printing" basically in the small-scale industries of the Chippas community, involving dyeing and printing of textiles (Dadhich et al. 2016). Dyeing and printing processes release wastewater during water-based color fixing procedure and discharged in the surrounding areas which pollutes water and soil. The chippas community either transport the textiles to a well dug on the bank of the Dravyawati River or

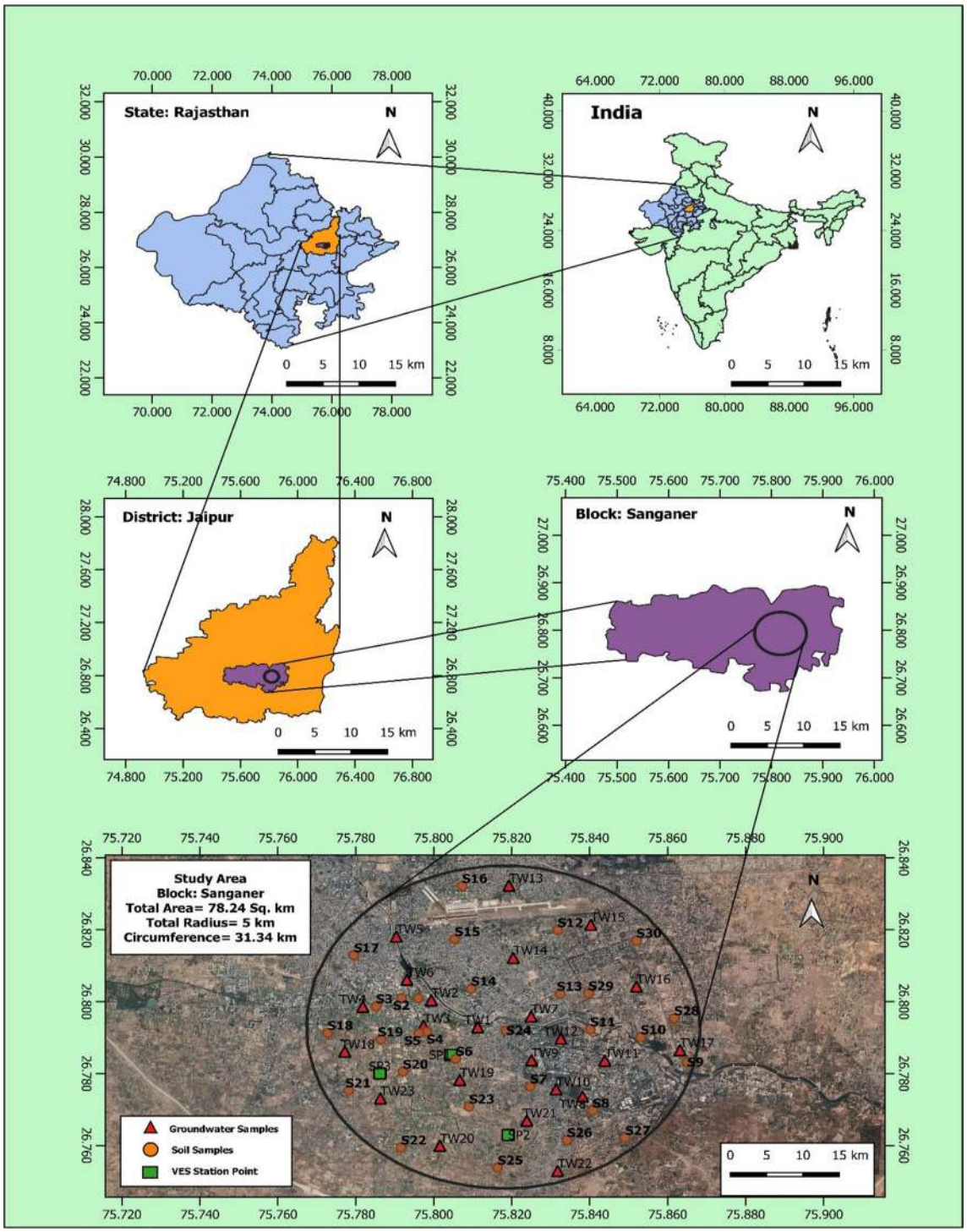



**Fig. 1** Sampling sites of soil and ground water selected in the study area, Sanganer, Jaipur, Rajasthan, India

wash it at their wells in the city at various places randomly. Textile wastewater along with sewage from across the of Jaipur city discharged directly into the Dravyawati river in the selected study area is being polluted. Historically, Sanganer was primarily an agricultural region; however, during the last decade, the textile and dying industries have dramatically risen in the area and encroached the previously untapped agricultural land. With more than 250 separate printing units connected, it has emerged as one of the major centers of the printing and dying industries nowadays today in India. Growing demand and low production costs leads to the introduction of synthetic and chemical dyes, which have several environmental impacts. The regions of Jaipur–Sanganer with a high number of dyeing and printing industrial units releasing tonnes of waste into the aquatic environment, agricultural fields, and on open spaces nearby, polluting the water and soil (Sharma et al. 2014). Contamination of water and soil have negative impact on nutrition and human health due to deterioration of drinking water quality and food quality; however, at severe stage, poor quality may prevent soil from performing its natural physio-chemical and biological functions and deteriorate region's overall productivity of the terrestrial ecosystem.

## Sampling sites and sampling

One-liter capacity plastic bottle rinsed with distilled water used to collect the groundwater samples. Grab sampling conducted for groundwater water sampling and samples preserved in the bottles with adjusted pH 2 and stored in refrigerator at 4 °C with slightly acidified with nitric acid ($HNO_3$) for analysis of water quality parameters including metals (Mn, Cu, Ni, Zn, Pb, and Cu). In Sanganer industrial region, having a new industrial area (RICCO) and an industrial zone (RSMDC), a quantitative soil and water sampling conducted to evaluate the water and soil quality parameters of the agricultural land as well as the degree of contamination in water due to industrial activities. Soil samples (250 g) taken from 30 randomly selected sites with a depth of 45 to 60 cm within a 5-kilometer radius of the Sanganer industrial zone and packed in fresh plastic zip-lock bag separately to determine the soil quality parameters (Fig. 2). All the sampling sites were precisely geotagged and labeled from S1 to S30 using a Garmin GPS device (model 68 s), allowing for the retrieval of a variety of location-specific data (Luo et al. 2011). Description of location and sampling sites are shown in the Table 1. The geoelectrical resistivity approach used to conduct field surveys in the study region which requires injecting a man-made current through several electrodes (AB) into the subsurface medium and observing the voltage changes at the potential electrodes (MN) to assess the variation in the ground's resistivity (Binley et al. 2015).

## Analysis of soil and water quality parameters

Collected soil samples analyzed for 10 functional indicators parameters (i.e., pH, EC, OC, P, S, K, Zn, Fe, Cu, and Mn) for soil quality (YanBing et al. 2009). Similarly, collected water samples from different selected sites analyzed for water quality parameters in the laboratory. Average of all sets of triplicates calculated and values recorded into the data system (Juhos et al. 2019). All the analysis conducted following the procedure established by the American Public Health Association (Baird and Bridgewater 2017). A typical laboratory digital micro-processor pH meter used to estimate hydrogen ion concentration (pH) in the water samples (Salem et al. 2020). Similarly, electrical conductivity (EC) determined using an electrical conductivity meter (an EC probe and equipment that had been calibrated) by following the procedure of McNeill 1992. A digital water quality test kit used to evaluate total dissolved solids (TDS); however, EDTA titration method was used to calculate total hardness in the water samples. An argentometric titration used to quantify the amount of chloride in a water sample followed by alkalinity determined using the titrimetric method. UV-visible spectrophotometer used to determine the amount of fluoride in the collected water samples. Titration method used to estimate soil organic carbon (SOC) in the soil samples (Walkley and Black 1934) which involves oxidizing organic material in sulfuric acid with a predetermined quantity of chromate (Sato et al. 2014; Gelman et al. 2012). The Johnson–Nishita procedure used to measure sulfur content in the soil samples (Dean 1966). Sulfur and other minerals present in soil solution specially $SO_4$ ions adsorbed are the principal source of sulfur in soil. The replacement of $SO_4$ ions is of the utmost importance, and phosphate ions substituted wherever possible for adsorption and monocalcium phosphate, or phosphate ions, are present in the soil. The $SO_4$ ions are replaced with $CaCl_2$ ions in a more effective way throughout the extraction process and $SO_4$ extract turbulence determined by using a spectrophotometer. Potash content in soil samples estimated using a flame photometer following the procedure of Brondi et al. (2016).

## Metal estimation

The concentration of Fe, Cu, Zn, Ni, Mn, and Pb in groundwater samples, whereas the metal Fe, Zn, Cu, and Mn analyzed in the soil samples estimated after complete digestion in $HClO_4$ and $HNO_3$ (3 : 1), using hollow cathode lamp at a certain wavelength into an atomic absorption spectrophotometer (AAS, Shimadzu) in comparison to standard metal solutions.

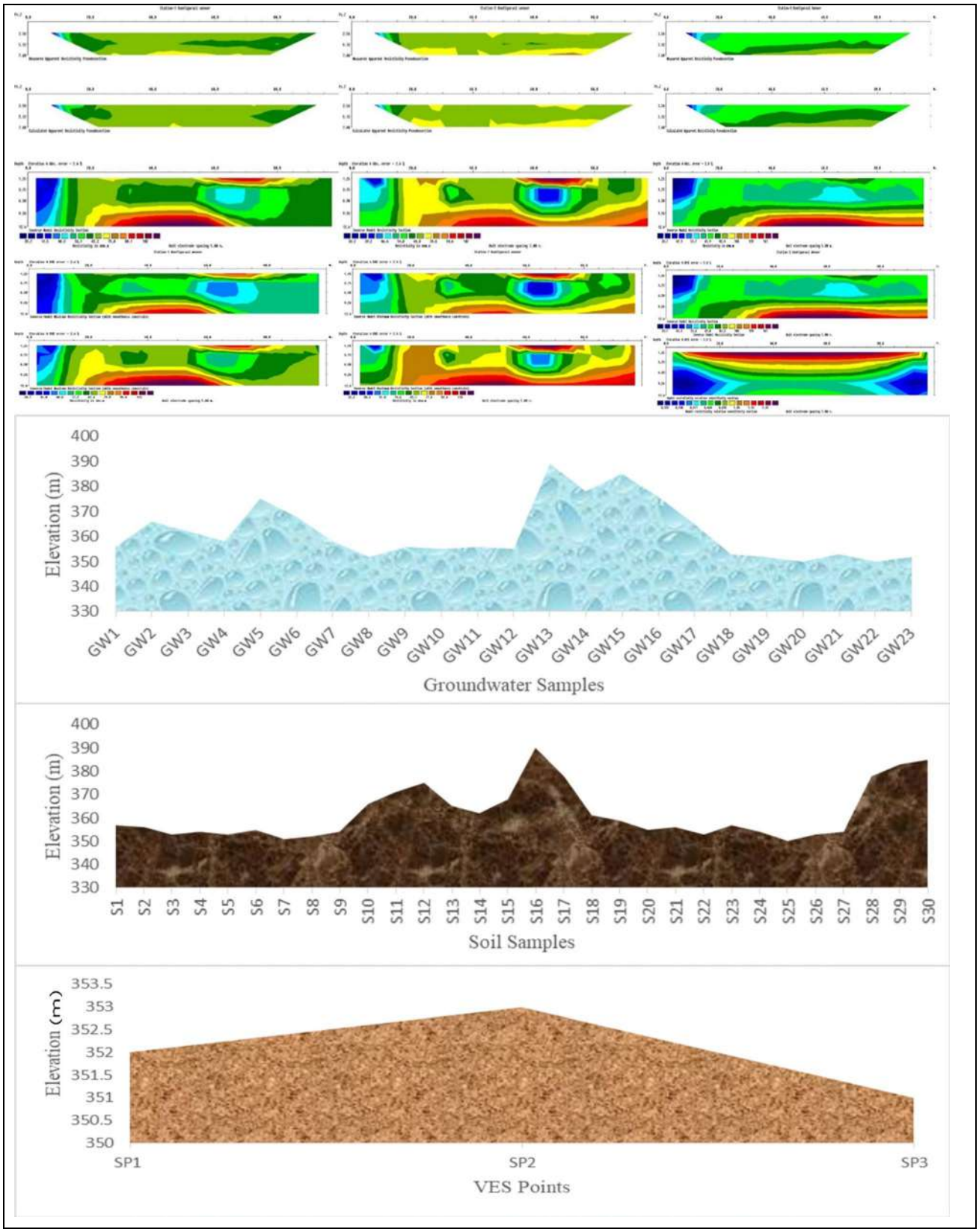



**Fig. 2** Geoelectrical layers and elevation point of different sampling sites at the study area, Sanganer, Jaipur, Rajasthan, India

**Table 1.** Description of sampling sites of ground water samples, soil samples and VES station selected at Sanganer study area, Jaipur (Rajasthan), India

| Ground water sample | | | Soil samples | | |
|---|---|---|---|---|---|
| Sampling site | Latitudinal and longitudinal position | Elevation (m) | Sampling site | Latitudinal and longitudinal position | Elevation (m) |
| GW1 | 26.7929 N, 75.8113 E | 357 | S1 | 26.8010 N, 75.7960 E | 354 |
| GW2 | 26.8004 N, 75.7994 E | 356 | S2 | 26.8010 N, 75.7917 E | 350 |
| GW3 | 26.7933 N, 75.7974 E | 353 | S3 | 26.7987 N, 75.7852 E | 353 |
| GW4 | 26.7986 N, 75.7818 E | 354 | S4 | 26.7916 N, 75.7982 E | 354 |
| GW5 | 26.8181 N, 75.7904 E | 353 | S5 | 26.7912 N, 75.7962 E | 378 |
| GW6 | 26.8061 N, 75.7931 E | 355 | S6 | 26.7841 N, 75.8057 E | 383 |
| GW7 | 26.7959 N, 75.8250 E | 351 | S7 | 26.7764 N, 75.8248 E | 385 |
| GW8 | 26.7736 N, 75.8382 E | 352 | S8 | 26.7697 N, 75.8408 E | 356 |
| GW9 | 26.7837 N, 75.8251 E | 354 | S9 | 26.7832 N, 75.8650 E | 366 |
| GW10 | 26.7756 N, 75.8314 E | 366 | S10 | 26.7901 N, 75.8531 E | 362 |
| GW11 | 26.7836 N, 75.8439 E | 371 | S11 | 26.7923 N, 75.8402 E | 358 |
| GW12 | 26.7897 N, 75.8326 E | 375 | S12 | 26.8199 N, 75.8318 E | 375 |
| GW13 | 26.8323 N, 75.8193 E | 365 | S13 | 26.8022 N, 75.8324 E | 368 |
| GW14 | 26.8122 N, 75.8204 E | 362 | S14 | 26.8036 N, 75.8096 E | 358 |
| GW15 | 26.8214 N, 75.8403 E | 368 | S15 | 26.8174 N, 75.8054 E | 352 |
| GW16 | 26.8042 N, 75.8520 E | 390 | S16 | 26.8322 N, 75.8073 E | 356 |
| GW17 | 26.7865 N, 75.8632 E | 378 | S17 | 26.8129 N, 75.7795 E | 355 |
| GW18 | 26.7861 N, 75.7772 E | 361 | S18 | 26.7913 N, 75.7728 E | 356 |
| GW19 | 26.7782 N, 75.8067 E | 359 | S19 | 26.7895 N, 75.7865 E | 355 |
| GW20 | 26.7599 N, 75.8016 E | 355 | S20 | 26.7805 N, 75.7921 E | 389 |
| GW21 | 26.7669 N, 75.8239 E | 356 | S21 | 26.7753 N, 75.7782 E | 378 |
| GW22 | 26.7529 N, 75.8318 E | 353 | S22 | 26.7594 N, 75.7916 E | 385 |
| GW23 | 26.7731 N, 75.7863 E | 357 | S23 | 26.7708 N, 75.8091 E | 376 |
| | | | S24 | 26.7920 N, 75.8186 E | 365 |
| | VES | | S25 | 26.7538 N, 75.8164 E | 353 |
| SP1 (VES) | 26.7852 N, 75.8044 E | 352 | S26 | 26.7615 N, 75.8342 E | 352 |
| SP2 (VES) | 26.7629 N, 75.8191 E | 353 | S27 | 26.7621 N, 75.8491 E | 350 |
| SP3 (VES) | 26.7800 N, 75.7862 E | 351 | S28 | 26.7954 N, 75.8617 E | 353 |
| | | | S29 | 26.8023 N, 75.8397 E | 350 |
| | | | S30 | 26.8170 N, 75.8520 E | 352 |

## Geostatistical analysis

To assess overall quality of water and soil samples collected from the different sites in the study area, data of soil and water quality parameters analysed thoroughly by applying geostatistical tools. Quantitative evaluation's framework combines geotechnical and physicochemical analysis of water and soil samples with descriptive statistics and statistical modelling. Outcome data is gathered after the laboratory chemical analysis of selected soil and water samples, followed by review with analysis of data on SPSS software (version 22 for Windows). Discriminating analysis (correlation) of data performed using Statistical Package for the Social Sciences (SPSS) for Windows, version 23.0. (Ukah et al. 2019, 2020). Several statistical methods used in data analysis and models including MV, SD, and CV (Li et al. 2016; Zhu et al. 2019). Further, water quality index (WQI) and soil quality index (SQI) evaluated to assess the region's overall variations and patterns of water and soil quality parameters using site-specific indicator evaluation outputs. Weighted arithmetic mean technique for WQI was used in this investigation (Tyagi et al. 2013).

$$WQI_A = \sum_{i=1}^{n} qi\ X\ Wi,$$

$$\sum_{i=1}^{n} Wi = 1,$$

where $Wi$ is the unit weight of each parameter, $qi$ is the 0–100 subindex rating for each variable, and $n$ is the number

of subindices aggregated. Multivariate statistical technique, the principal component analysis (PCA), was used to reduce the dataset into new variables, create a minimum data set (MDS), and analyze relationships between different metal contents in the water and soil samples and other quality parameters including pH, TOC, and EC along with factor analysis (FA) to identify specific factor weight of a particular metal (Weissmannová and Pavlovský 2017). The SAS Systems for Windows 10 platform and Statistica 12.5® software used to perform principal component analysis (PCA), followed by a Varimax rotation used to rotate each PCA component. The Varimax rotation method of factor analysis and the principal component primary result analysis performed by following the procedure of Kaiser 1958 and Maiz et al. 2000. For the GIS-based evaluation, SQI and WQI maps, spatial distribution maps, area maps, and thematic maps for the region produced by using Sentinel 2 Satellite data (March 2021) in bands: 3, 4, 8 developed on ArcGIS software 10.8 (2020).

## Results

Groundwater samples (23) and soil samples (30) collected from selected sampling sites of the study area, Jaipur regions of Rajasthan, Western India, analyzed for quality parameters. Based on the sounding data, the present study inferred with three geoelectrical layers comprising topsoil, unsaturated, and saturated zones (Fig. 2). For all the sections topmost layer assumed to be topsoil, above the water table and substantially drier more often reflects greater resistivity. Peat investigated in the topsoil layer by resistance correlation with soil lithology from neighboring boreholes. Regional lithology of Sanganer shown in the Table 2 which indicates formation depth range as alluvium, 0.0–95 m; weathered, 0.69–128 m; and hard rock, 9.2 m. In present study, the third layer of all the sections represent highest concentration of geoelectrical sections with low resistivities (less than 10 m). Values and their variation pattern of water quality parameters in 23 groundwater samples at different sites of the study area depicted in Fig. 3. Maximum values of different parameters of groundwater samples recorded as pH, 8.0; electrical conductivity (EC), 3.01 S/m, TDS, 1501 mg/l; fluoride, 1.9 mg/l; total hardness, 273 mg/l; Ca, 88.1 mg/l; Mg, 12.67 mg/l; chloride, 227.42 mg/l; $HCO_3$, 61.87 mg/l; and $CO_3$, 58.29 mg/l. However, maximum metal concentration in groundwater samples recorded as Zn, 2.64 mg/l; Cu, 0.862 mg/l; Fe, 0.392 mg/l; Mn, 0.181 mg/l, Pb, 0.065 mg/l; and Ni, 0.016 mg\l. pH and TDS level in the ground water samples found in the range of 7.0 to 8.0 and 559 to 1501 mg/l, indicate that values are within the range of 6.5 to 8.5 and 500 to 1500 mg/l, respectively, as per WHO standard of water quality. Similarly, for 30 soil samples, maximum values of soil quality parameters recorded as pH, 8.4; electrical conductivity (EC), 0.27 µS/m; organic carbon, 0.23 %; phosphorous, 50.23 mg/kg; potash, 786 mg/kg; sulfur, 29.68 mg/kg. However, maximum metal concentration in the soil samples recorded as Fe, 11.25 mg/kg; Mn, 8.65 mg/kg; Zn, 7.26 mg/kg; and Cu, 0.45 mg/kg as shown in Fig. 4. Result shows that none of the parameters including pH have a strong correlation. Samples' scores and loadings plots together showed physio-chemical characteristics of soil that affect each order on the score plots. Retained variables divided into groups using the factor analysis technique in accordance with statistical factors and correlation matrix (Table 3). As depicted in the Table 4, maximum WQI found in groundwater sample collected at sampling site TW22 and minimum in the sample collected from TW12. Results of PCA and FA analysis for groundwater revealed that the first component (PC1), which accounted for 39.12% of the total variance, included Mn, pH, and EC; however, S, OC, and P made the second component (PC2) with a total variance of 12.54%. Similarly, pH, Mn,

**Table 2.** Regional lithology of the study area, Sanganer, Jaipur (Rajasthan), India

| Aquifers depth (m) | Aquifers | Geological formation | Depth (m) | Laboratory experiment model |
|---|---|---|---|---|
| 0–95 | Alluvium | Surface soil, sandy clay | 0–4 |  |
| | | Clayey sand | 4–13 | |
| | | Clayey kankar | 13–19 | |
| 0.6–128 | Weathered | Sandy clay with kankar | 19–29 | |
| | | Kankar and clay | 29–38 | |
| | | Kankar and sand | 38–47 | |
| 9.2 | Hardrock | Weathered schist | 47–73 | |
| | | Schist | 73–150 | |

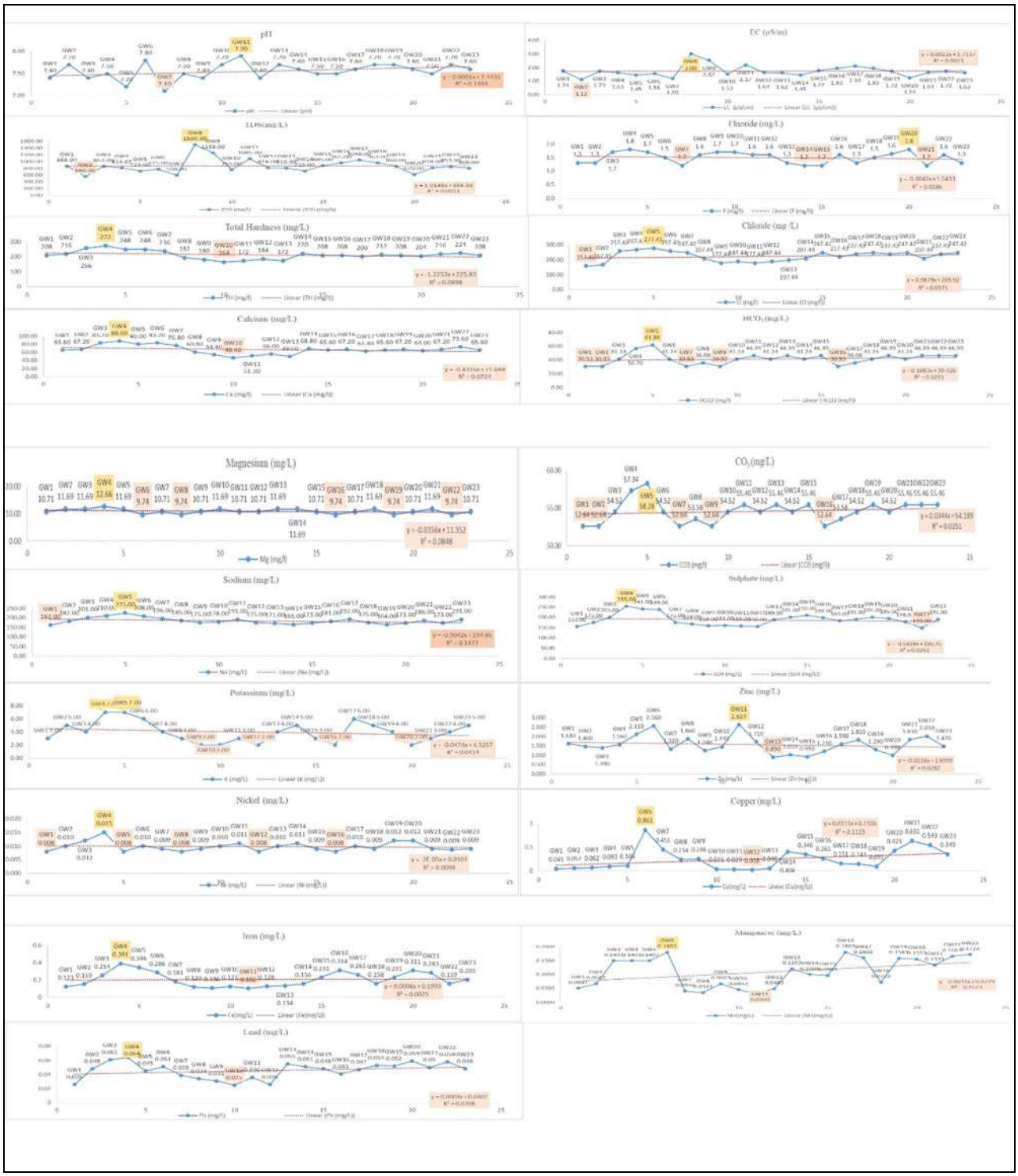



**Fig. 3** Variations in water quality parameters of ground water samples collected from in different sites at the study area, Sanganer, Jaipur, Rajasthan, India

and Cu made PC3 with a total variance of 11.42% followed by phosphorous made PC4 a total variance of 9.06%, while all four extraction factors accounted for 72.15% of the overall variation. However, in case for soil samples Mn, pH, and EC produced the first component (PC1) with 24.26% of the variance followed by the second component (PC2) produced included S, OC, and P with a total variation of 17.48%, while PC3 made up of pH, Cu, and Mn with a total variance of

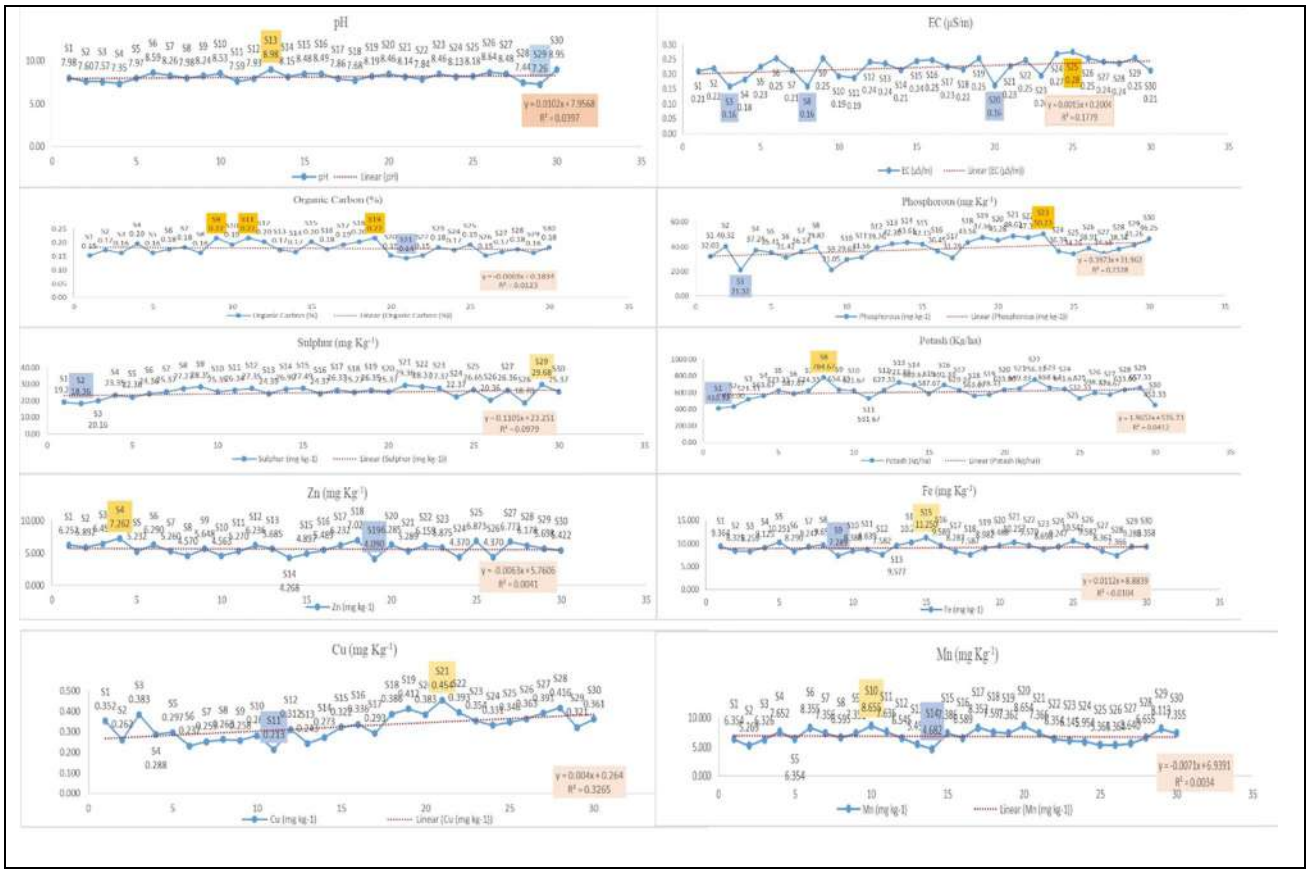



**Fig. 4** Variations in soil quality parameters of soil samples collected from different sites at the study area, Sanganer, Jaipur, Rajasthan, India

13.65% and PC4 contained phosphorus with a total variance of 11.58% (Fig. 5A). Result shows that water quality of groundwater samples collected at TW1, TW8, TW10, and TW12 sampling sites in the Sanganer area are in very good quality category; however, groundwater samples from TW3, TW4, TW6, TW19, and TW22 sites recorded under very poor water quality category with high level of contaminants (Fig. 5B). Similarly, total 9 soil quality parameters including pH, EC, OC, P, S, K, Zn, Fe, and Mn used to evaluate the soil quality index (SQI), and an average soil quality index (SQI) value 0.517 recorded for the selected study area based on MDS, with a range of 0.341 to 0.635 (Fig. 5B). According to the suggested framework, the SQI values for the entire selected region divided into three categories viz; category 1 (C1), SQI value less than 0.4 (degraded); category 2 (C2), SQI value between 0.41 and 0.5 (moderately degraded); and category 3 (C3), SQI value greater than 0.51(least degraded). SQI revealed that soil samples at S19 site showed highest SQI score, 0.636, followed by S6, S7, S12, S13, S15, S16, S17, S18, S20, S21, S22, S23, S25, S27, S29, and S30 more than average as shown in Fig. 5B. Data shows that 13.3% of the soil samples from the study area have low soil pollution with good soil health; however, 40% of the soil samples have moderate contamination with SQI values in the range of 0.41 to 0.5 and 46.6% of soil samples shown as degraded soil under the poor-quality category with SQI values more than 0.51. At 5 kilometers away from the Sanganer industrial regions, high-intensity farming techniques, and conventional farming practices, excessive fertilizer use may be responsible for the soil degradation in the selected sites. Based on SQI score, the S19 site showed highly contaminated soil in the study area; however, it is crucial to note that the high score may be due to increased chemical build-up and other components like sulfur rather than trace metals having low concentration; however, it may be useful in environmental health assessment. Results of the factor analysis (FA) recorded insufficient if the Kaiser–Meyer–Olkin (KMO) test result value found to be less than 0.5; however, KMO found less FA findings in the test's outcome than the chemical examination of soil samples. FA did not alter KMO testing significantly because there is no related cut-off point, and the results for the sample given a less clear indication of the applicability of the FA as KMO values estimated 0.487 and 0.466 (less than 0.5) for the groundwater and soil samples, respectively. Percentage (%) of variance evaluated by placing three components out of

**Table 3.** Correlation matrix[a] of ground water and soil samples collected from different sites at Sanganer study area, Jaipur, Rajasthan, India

| Groundwater quality parameters | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | pH | EC | TDS | F | TH | Ca | Mg | Cl | $HCO_3$ | $CO_3$ | Na | K | $SO_4$ | Zn | Ni | Mn | Cu | Fe | Pb |
| Correlation | pH | 1.000 | .080 | .082 | .047 | − .348 | − .338 | − .– | − .207 | .078 | .078 | − .284 | .008 | − .087 | .250 | .300 | .121 | .047 | − .213 | .219 |
| | EC | .080 | 1.000 | 1.000 | .217 | − .366 | − .327 | − .371 | − .211 | − .185 | − .185 | − .088 | − .251 | − .282 | .214 | − .241 | − − .241 | − .147 | − .309 | − .326 |
| | TDS | .082 | 1.000 | 1.000 | .217 | − .367 | − .328 | − .370 | − .212 | − .185 | − .185 | − .088 | − .252 | − .279 | .212 | − .239 | − .242 | − .149 | − .308 | − .326 |
| | F | .047 | .217 | .217 | 1.000 | .068 | .074 | − .040 | .194 | .267 | .267 | .257 | − .111 | .155 | .213 | .337 | .131 | − .259 | .240 | .036 |
| | TH | − .348 | − .366 | − .367 | .068 | 1.000 | .993 | .217 | .695 | .320 | .320 | .605 | .671 | .698 | .153 | .351 | .491 | .322 | .693 | .599 |
| | Ca | − .338 | − .327 | − .328 | .074 | .993 | 1.000 | .096 | .705 | .282 | .281 | .586 | .641 | .676 | .180 | .307 | .517 | .374 | .687 | .580 |
| | Mg | − .132 | − .371 | − .370 | − .040 | .217 | .096 | 1.000 | .028 | .361 | .361 | .241 | .346 | .280 | − .190 | .399 | − .131 | − .366 | .156 | .244 |
| | Cl | − .207 | − .211 | − − .212 | .194 | .695 | .705 | .028 | 1.000 | .538 | .538 | .572 | .569 | .734 | .044 | .295 | .645 | .345 | .735 | .659 |
| | $HCO_3$ | .078 | − .185 | − .185 | .267 | .320 | .282 | .361 | .538 | 1.000 | 1.000 | .441 | .480 | .560 | .242 | .343 | .381 | − .032 | .462 | .449 |
| | $CO_3$ | .078 | − .185 | − .185 | .267 | .320 | .281 | .361 | .538 | 1.000 | 1.000 | .441 | .480 | .560 | .242 | .343 | .381 | − .032 | .462 | .449 |
| | Na | − .284 | − .088 | − .088 | .257 | .605 | .586 | .241 | .572 | .441 | .441 | 1.000 | .615 | .590 | .498 | .154 | .288 | .115 | .582 | .215 |
| | K | .008 | − .251 | − .252 | − .111 | .671 | .641 | .346 | .569 | .480 | .480 | .615 | 1.000 | .672 | .284 | .314 | .411 | .074 | .459 | .529 |
| | $SO_4$ | − .087 | − .282 | − .279 | .155 | .698 | .676 | .280 | .734 | .560 | .560 | .590 | .672 | 1.000 | − .010 | .451 | .589 | .185 | .811 | .590 |
| | Zn | .250 | .214 | .212 | .213 | .153 | .180 | − .190 | .044 | .242 | .242 | .498 | .284 | − .010 | 1.000 | − .145 | − .054 | .175 | − .008 | − .143 |
| | Ni | .300 | − .241 | − .239 | .337 | .351 | .307 | .399 | .295 | .343 | .343 | .154 | .314 | .451 | − .145 | 1.000 | .281 | − .117 | .388 | .604 |
| | Mn | .121 | − .241 | − .242 | .131 | .491 | .517 | − .131 | .645 | .381 | .381 | .288 | .411 | .589 | − .054 | .281 | 1.000 | .393 | .750 | .695 |
| | Cu | .047 | − .147 | − .149 | − .259 | .322 | .374 | − .366 | .345 | − .032 | − .032 | .115 | .074 | .185 | .175 | − .117 | .393 | 1.000 | .270 | .288 |
| | Fe | − .213 | − .309 | − .308 | .240 | .693 | .687 | .156 | .735 | .462 | .462 | .582 | .459 | .811 | − .008 | .388 | .750 | .270 | 1.000 | .582 |
| | Pb | .219 | − .326 | − .326 | .036 | .599 | .580 | .244 | .659 | .449 | .449 | .215 | .529 | .590 | − .143 | .604 | .695 | .288 | .582 | 1.000 |

| Soil quality parameter | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | pH | EC | OC | Phosphorus | Sulfur | Potash | Zn | Fe | Cu | Mn |
| Correlation | pH | 1.000 | .163 | − .071 | .166 | .148 | .111 | − .324 | .291 | − .039 | − .089 |
| | EC | .163 | 1.000 | .125 | .059 | .113 | .075 | − .064 | .079 | .131 | − .264 |
| | OC | − .071 | .125 | 1.000 | − .237 | .226 | − .174 | .023 | − .382 | − .331 | .288 |
| | Phosphorus | .166 | .059 | − .237 | 1.000 | .290 | .250 | − .178 | .385 | .400 | − .109 |
| | Sulfur | .148 | .113 | .226 | .290 | 1.000 | .493 | − .101 | .202 | − .026 | .314 |
| | Potash | .111 | .075 | − .174 | .250 | .493 | 1.000 | − .291 | .160 | − .064 | − .012 |
| | Zn | − .324 | − .064 | .023 | − .178 | − .101 | − .291 | 1.000 | − .362 | .149 | .110 |
| | Fe | .291 | .079 | − .382 | .385 | .202 | .160 | − .362 | 1.000 | .054 | − .234 |
| | Cu | − .039 | .131 | − .331 | .400 | − .026 | − .064 | .149 | .054 | 1.000 | − .059 |
| | Mn | − .089 | − .264 | .288 | − .109 | .314 | − .012 | .110 | − .234 | − .059 | 1.000 |

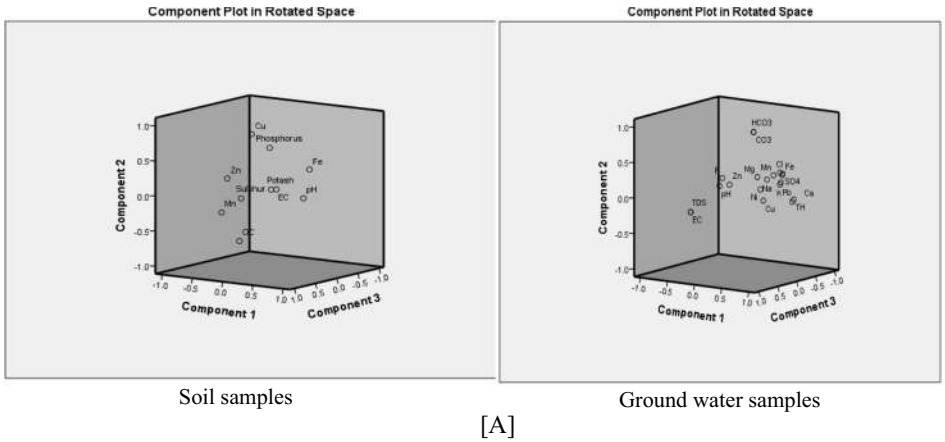
**Table 4.** Water quality and soil quality Index

| Groundwater quality index | | | | | | |
|---|---|---|---|---|---|---|
| Parameters | Quantity of sample | WQI (mean) | Std. deviation | Std. error | Maximum | Minimum |
| pH | 23 | 7.5522 | .0035 | .0020 | 8.0000 | 7.0000 |
| EC (µS/m) | 23 | 1.7400 | .0027 | .0015 | 3.0100 | 1.1100 |
| TDS (mg/l) | 23 | 868.7246 | .7633 | .4407 | 1501.0000 | 559.0000 |
| Fluoride (mg/l) | 23 | 1.4928 | .0054 | .0031 | 1.9000 | 1.1000 |
| TH (mg/l) | 23 | 211.1304 | .5325 | .3074 | 273.0000 | 163.0000 |
| Ca (mg/l) | 23 | 66.5043 | .0035 | .0020 | 88.1000 | 46.3000 |
| Mg (mg/l) | 23 | 10.9249 | .0009 | .0005 | 12.6700 | 9.7300 |
| Cl (mg/l) | 23 | 221.7787 | .0025 | .0014 | 277.4200 | 157.4400 |
| $HCO_3$ (mg/l) | 23 | 41.6862 | .0041 | .0024 | 61.8700 | 30.9200 |
| $CO_3$ (mg/l) | 23 | 54.6017 | .0082 | .0047 | 58.2900 | 52.6300 |
| Na (mg/l) | 23 | 184.0000 | .6035 | .3484 | 226.0000 | 161.0000 |
| K (mg/l) | 23 | 3.9565 | .6745 | .3894 | 8.0000 | 1.0000 |
| $SO_4$ (mg/l) | 23 | 188.2609 | .8165 | .4714 | 256.0000 | 148.0000 |
| Zn (mg/l) | 23 | 1.5612 | .0083 | .0048 | 2.6400 | 1.6000 |
| Ni (mg/l) | 23 | 0.0098 | .0010 | .0006 | .0160 | .0011 |
| Mn (mg/l) | 23 | 0.1099 | .0004 | .0002 | .1810 | .0300 |
| Cu (mg/l) | 23 | 0.2442 | .0008 | .0005 | .8620 | .0170 |
| Fe (mg/l) | 23 | 0.2068 | .0008 | .0005 | .3920 | .1010 |
| Pb (mg/l) | 23 | 0.0456 | .0008 | .0004 | .0650 | .0240 |
| Soil quality index | | | | | | |
| Parameters | Quantity of sample | SQI (mean) | Std. deviation | Std. error | Maximum | Minimum |
| pH | 30 | 8.11 | .0064 | .0037 | 8.40 | 7.98 |
| EC (µS/m) | 30 | .2240 | .0008 | .0005 | .2760 | .1580 |
| Organic carbon (%) | 30 | .1793 | .0061 | .0035 | .2300 | .1400 |
| Phosphorous (mg $kg^{-1}$) | 30 | 38.1197 | .0009 | .0005 | 50.2310 | 21.0500 |
| Sulfur (mg $kg^{-1}$) | 30 | 24.9634 | .0006 | .0004 | 29.6810 | 18.3620 |
| Potash (kg/ha) | 30 | 607.1889 | .7385 | .4264 | 786.00 | 410.00 |
| Zn (mg $kg^{-1}$) | 30 | 5.6635 | .0010 | .0006 | 7.2630 | 4.0890 |
| Fe (mg $kg^{-1}$) | 30 | 9.0579 | .0006 | .0003 | 11.2510 | 7.2890 |
| Cu (mg $kg^{-1}$) | 30 | .3261 | .0005 | .0003 | .4550 | .2130 |
| Mn (mg $kg^{-1}$) | 30 | 6.8290 | .0007 | .0004 | 8.6560 | 4.6810 |

the four PC ranges (component based on Jolliffe's criterion) and recorded 84.60% and 66.98% for groundwater and soil samples, respectively (supplementary data).

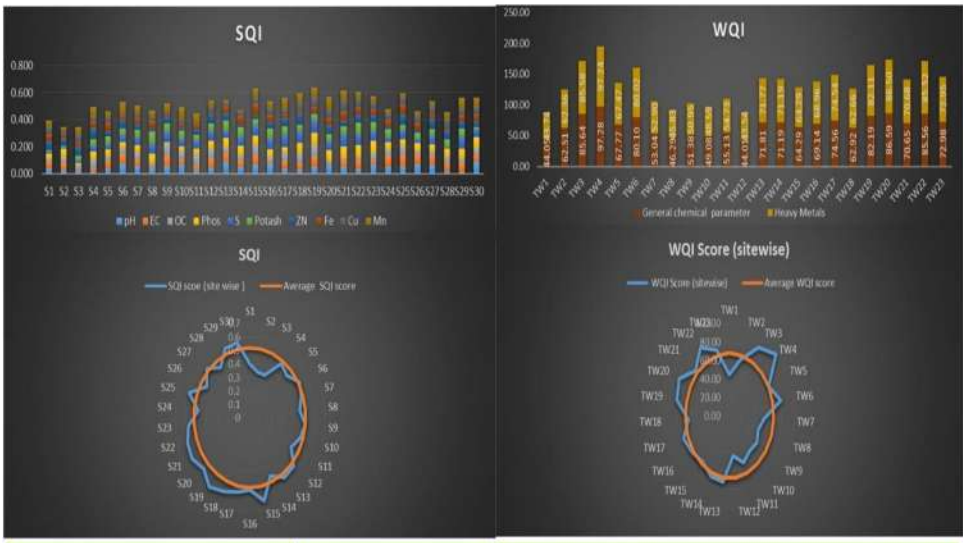
## Discussion

Collected samples from the selected study area, Jaipur regions of Rajasthan, Western India, evaluated for water and soil quality parameters which indicate slightly basic in nature as pH varied within the ranged of 7.0 to 8.0 in the samples. pH is one of the essentially functional parameters for evaluating the quality of soil and water (Filip 2002). Depending on the underlying geological units' actual resistivity, the geoelectrical characteristics utilized to create earth models which displayed as subsurface stratigraphy and from which possible aquifer zones mapped for sampling and assessing the groundwater quality parameters at different sites in the selected region (Mogaji and Omobude 2017). Higher value of EC in groundwater samples indicates impurity as compared to pure water which is not an excellent conductor of electricity having a lower EC than the groundwater. According to previous studies, groundwater exhibits low resistivities between 10 and 100 Ωm in the context of sedimentary (Adagunodo et al. 2018). Kaiser's criterion replaced with Joliffe's criterion since it is too high and allows for a graphic representation of the factor loading through a dipole using the first three components (Jolliffe 1972). However, soil solutio"s EC indicates total amount of salts and ions present in the soil (Bronson et al. 2005; Peralta and Costa 2013). A significant indicator of the soil quality is electrical conductivity, which reflects the salinity of the soil




Soil samples Ground water samples

[A]




| | | |
|---|---|---|
| Category-A | 0-25 | Excellent |
| Category-B | 26-50 | Good |
| Category-C | 51-75 | Poor |
| Category-D | 76-100 | Very Poor |

[B]

**Fig. 5** Component plot of ground water and soil samples (**A**). Soil quality index (SQI) and water quality index (WQI) of collected samples (**B**)

(Hardie and Doyle 2012). Studies revealed that low resistivity values inside the underlying strata likely caused by high ion concentrations and fine-grained sediments like silt and clay (Amaya et al. 2018). Another soil quality parameter of soil is known as soil organic carbon (SOC) contains organic remains of dead animals and plants at various stages of decomposition which affects physicochemical characteristics of the soil (Campbell 1978). Concentration of SOC in the soil samples is one of the fundamental criteria for soil quality (Unger 1997). Agricultural production, plant development, and soil fertility also depend on phosphorus content, which is the second-most important macronutrient in soil after nitrogen (Malhotra et al. 2018). Similarly, soil fertility, pH levels, plant development, and efficient nitrogen fixation processes dependent on its existence in the soil (Jordan and Ensminger 1959). Potash content is another essential macronutrient for preserving soil fertility and pH homeostasis. Fertilizer used usually to supplement K into the soil in case of its deficiency because plants require K for their growth and development during the life cycle (Morgan and Connolly 2013). However, high concentration of potash in soil also effects soil quality and causes soil degradation (Sillanpaa 1982). Water and soil quality assessment studies have sparked interest on a global scale due to growing

attention on the depletion of water and soil quality to assess the environmental impact of anthropogenic activities for environmental sustainability (Raiesi and Kabiri 2016). Various attempts have been made to measure the quality of the soil and water using different indicators (Armenise et al. 2013; Seybold et al. 2018). Water quality index makes it possible to examine water quality in a variety of ways that affect a stream's ability to sustain by its processes and to ensure sustainable use of water resources to minimize risks and preserve aquatic ecosystems (Akkaraboyina and Raju 2012). WQI is an important distinctive grade which summarizes overall quality of water and helps in selecting the most effective treatment strategy for wastewater before its final discharge and disposal to prevent water contamination (Tyagi et al. 2013). Status and level of contamination of water has been evaluated by using water quality parameters and quality index (Shah and Joshi 2017). The WQI and SQI approach is one of the best and most widely used techniques for assessing the quality of soil and water for adapting treatment and conservation strategies (Arshad and Martin 2002; YanBing et al. 2009). Physio-chemical and biological characteristics of soil indicated by the soil quality which is crucial to its long-term functionality and productivity and sustainability. An encompassing view of the region's overall soil quality evaluated assessing the soil quality index (Bhattacharyya 2017). Similarly, minimum data set (MDS) for the data reflecting the soil's functional capacity used in evaluating the soil quality index (Klimkowicz-Pawlas et al. 2019). By using multivariate geostatistical techniques, contemporary data analysis and metal content estimation of four metals (Zn, Cu, Mn, and Fe) in the soil and six metals (Zn, Cu, Mn, Fe, Pb, and Ni) in groundwater emphasis water and soil quality (Lu et al., 2010). Metals Zn, Ni, Mn, Cu, Fe, and Pb chosen based on PCA, FA, and CA investigations as reference elements for soil and groundwater contamination. Several studies evaluated metal contamination of soil and water in the different urban and industrial regions using principal component analysis (Manta et al. 2002; Skrbic and Djurisic-Mladenovic, 2007, Guo et al., 2013). PCA technique used to show the relationship among metals concentration and other parameters (pH, EC, TOC) in the soil and water (Weissmannová and Pavlovský 2017). FA produced using a constant value for all the soil and water quality parameters with a correlation matrix to minimize the effect of varying units on the variables (Lin et al. 2002). Kaiser–Meyer–Olkin (KMO) test used to evaluate whether the sample is large enough to use factor analysis (Kaiser 1974). In principal component analysis (PCA), variables referred to as principal components (PC) used to illustrate the relation between two elements (Esbensen and Geladi 2010). In similar study, Tripathi and Singal (2019) evaluated water quality of the Ganga River using PCA technique. In contrast, Praus (2019) used primary component weighted index (PCWI) for assessing the quality of both untreated and treated wastewater to evaluate WQI. Data indicate that unregulated discharge of wastewater including urban sewage contaminate water and soil by the process of seepage and leaching or irrigation with wastewater leads to depletion of groundwater and soil quality. High concentration of metals and other contaminants in the soil and groundwater may be due to continuous and long-term disposal of wastewater containing metals from industrial units leading to health hazards (Wuana and Okieimen 2011). Therefore, applying geographical and geostatistical techniques with an integrated approach could be more effective ways in environmental monitoring and assessment of soil and water contamination to ensure environmental and health safety.

## Conclusion

Groundwater and soil quality parameters of water and soil samples varied with different sites of the selected study area, indicate about 13.3% of the sites found to have good soil health with minimum contamination level followed by 40% of sites with moderate contamination; however, 46.6% of sites shown high level of contamination of soil. Evaluating WQI and SQI values in the present study offers insightful information about site-wise variation pattern of quality parameters including metals identifying the sites with high level of contamination to opt appropriate strategies and mitigation measures to ensure preserving groundwater and soil quality. Further, a study concludes that contamination of water and soil with metals and other contaminants leads to depletion of quality parameters which affects nutrients cycling in the aquatic and terrestrial ecosystem with more imbalances in availability of NPK. GIS-based WQI maps provide more description of sites in categorizing contaminated regions to ensure safe water supply and developing wastewater treatment facilities for sustainable urban planning. Besides, water and soil quality assessment using GIS and geostatistical technique provide regional and spatial variability of contaminants with their correlation to establish standards of soil health and drinking for effective natural resource management in a particular region. Therefore, the present study could be a new insight in in environmental monitoring involving quantitative and qualitative assessment of water and soil quality for sustainable resource utilization and conservation applying geographical and geostatistical techniques.

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**Author contribution** All authors contributed to the study conception and design. Sampling of water and soil samples, analysis, and drafting of manuscript were performed by J. Khan and G. Gupta. All authors commented on previous versions of the manuscript. Hypothesis and designing of the experiment were done by N. K. Singh; data analysis and improving the manuscript were done by V.N. Bhave and V. Bhardwaj; map designing and statistical analysis were done by P. Upreti and R. Singh; and geophysical analysis and editing were done by A. K. Sinha. All authors read and approved the final manuscript.

**Data availability** This is not applicable.

## Declarations

**Ethical approval** This is not applicable.

**Consent to participate** The authors mutually agreed to submit the manuscript in the esteemed journal ESPR.

**Consent to publish** All authors are mutually agreed to publish the manuscript in the journal ESPR.

**Competing interests** The authors declare no competing interests.

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- Manipal University Jaipur
  - Government Project
    - Department of Science and Technology
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  - International funded Project
    - BMGF & IHE funded
    - Asian Development Bank Institute
    -  ADB funded
    - Water & Sanitation for Urban Poor

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MUJ received an approved grant of 363,000=00 USD ( 2.6 Crores) from Bill & Melinda Gates Foundation through top Global Institute , IHE Delft Netherlands to run

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b) Diploma Courses in Non Sewered Sanitation
c) MTech in Non Sewered Sanitation

Principal Investigator : Prof A D Vyas
Co PI : Dr Meena Kumari Sharma
Dr Monika Sogani
Mr Sagar Gupta

Duration: Aug 2019- Dec 2023

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# Journey in Sanitation Sector

| S.No. | Lead/Principal Investigator (PI) | Co-PI (If any) | Title of Project | Funding Agency | Sanction Order/Reference | Amount of Financial Assistance Received in INR | Current Status |
|---|---|---|---|---|---|---|---|
| 1 | **Dr Monika Sogani** | Prof A D Vyas, Meena Kumari, Sagar Gupta | Delawas STP & its impact on socio economic conditions | Asian Development Bank Institute, Japan | | 3,35,000 | Approved 5000 USD |
| 2 | **Prof A D Vyas** | Dr. Monika Sogani, Dr Meena Kumari Sharma and Mr Sagar Gupta | Short term actions in FSM, awareness in academic institutions | UNESCO/IHE Delft, Netherlands and Bill and Melinda Gates Foundation | | 16,00,000 | Approval Granted for 50,000 USD in coordination with CDD (MUJ to receive 25000 USD) |
| 3 | **Dr. Meena Kumari Sharma** | Prof. A.D. Vyas & Mr. Sagar Gupta | Performance of low cost community based onsite sanitation system in Ambient Environment | DST, Rajasthan | P.8(9) V.PRO./S.S.D./2016/PART-1/3809 | **21,21,000** | Approved, Granted |
| 4 | **Prof. A D Vyas** | Dr. Meena Kumari Sharma, Dr Monika Sogani, Mr. Sagar Gupta | On line course on Faecal Sludge Management | UNESCO/IHE, Delft, Netherlands and Bill and Melinda Gates | | **10,00,000** | Approved, Granted for 15000 USD |



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# Journey in Sanitation Sector

| S.No. | Lead/Principal Investigator (PI) | Co-PI (If any) | Title of Project | Funding Agency | Sanction Order/Reference | Amount of Financial Assistance Received in INR | Current Status |
|---|---|---|---|---|---|---|---|
| 5 | **Dr Monika Sogani** | Dr Meena Kumari Sharma & Prof. A. D. Vyas | Enhanced biodegradation of organic pollutants as well as micro-pollutants | Science and Engineering Research Board (SERB), DST, Govt. of India | ECR/2016/000271 | **30,09,600** | Approved, Granted |
| 6 | **Prof Lalita Ledwani,** | Prof. A D Vyas, Dr Pushpendra Kr | Water sector Grant | Kurita Water Environment Fund, Japan | | **1,77,000** | Approved, Granted for 300,000 YEN |

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# Journey in Sanitation Sector

| S. No. | Funding Agency | Details | Amount (INR ) | Duration | Status |
|---|---|---|---|---|---|
| 1 | WSUP, **UK** | Water /Sanitation & retrofitting of toilets in Visakhapatnam, AP. The major focus was to prepare guidelines for government of Andhra Pradesh on rehabilitation of various community toilets. Also prepared a detailed project report on different aspects of toilet designs, models which are defunct, preparing a manual for engineers. This was as per SBM guidelines. | 3.5 lacs | 6 months | **Completed,** **A D Vyas & Dr Gaurav Sancheti** |
| 2 | OFDA/**USAID** ( United States Agency for International Development), through MSI,USA (Sudan Humaid) | Water & Sanitation in Sudan, Africa.The major focus besides reviewing various technical documents, reviewing M & E tools, training of trainers of IOM participants for Darfur area in WASH sector | 25 lacs | Feb,2015 to April,2016 | **Completed,** **A D Vyas** |
| 3 | **French & Italian government agencies** & EIB ( European Investment Bank) | Feasibility Study for an urban water supply and sanitation program in small and medium towns in Ethiopia, Africa. | 10 lacs | June,2014 to Nov, 2014 | **Completed,** **A D Vyas** |
| 4 | Athena Infocom via **Bill & Melinda Gates Foundation** | Non Sewered Sanitation/Faecal Sludge Management studies in various towns of India. | 30 Lacs | Indefinite | On Halt A D Vyas |
| 5 | **Asian Development Bank** for RUIDP ( Rajasthan Urban Infrastructure Development Program) | Study of Water & Sanitation in 15 towns of Rajasthan, India. The focus was on mid-term review of water & sanitation interventions done by Asian Development Bank in coordination with RUIDP & the impact of these interventions on end users & beneficiaries. | 50 lacs | March 16-July 2017 | On Halt A D Vyas & Team Civil |

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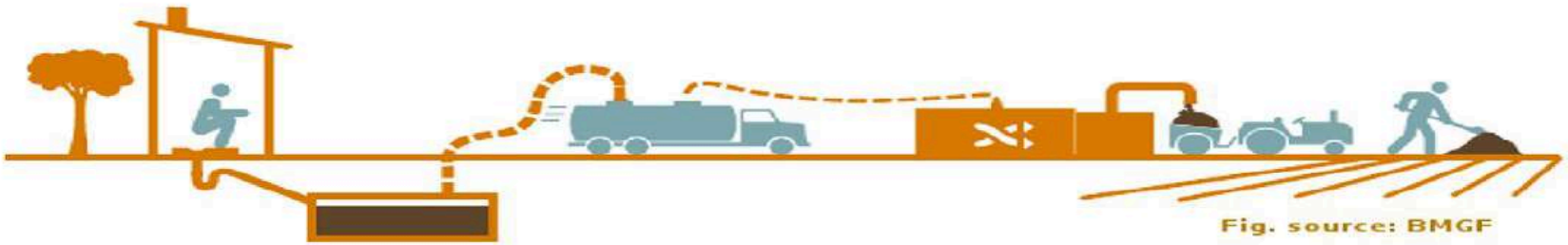

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