BEFORE THE NATIONAL GREEN TRIBUNAL SOUTHERN BENCH CHENNAI

ORIGINAL APPLICATION NO. 185 OF 2024 (SZ)

IN THE MATTER OF:

Tribunal on its own motion SUO MOTU based on the news item published in The Hindu, Chennai Edition dt. 24.05.2024 titled, "Microplastics found in Ashtamudi Lake".

AND

The Principal Secretary to Govt. of Kerala, Environment Department, Thiruvananthapuram and Ors.

... RESPONDENTS

INDEX

S.No	Particulars	Page Nos.
1.	Reply Affidavit on Behalf of The Respondent No. 4, The Central Pollution Control Board (CPCB)	01 - 07
2.	**Annexure-I** –Report submitted before Hon'ble tribunal in OA No. 99 of 2021 (SZ)	08 - 42
3.	**Annexure-II-** Report submitted by CPCB in OA NO. 251 of 2022	43 - 122
4.	**Annexure –III** – Action Plan prepared by MoEF&CC	123- 128
5.	**Annexure –IV-** A copy of the MoEF&CC notification dated September 25, 2000 on Primary Water Quality Criteria for Bathing notified under Environment (Protection) Rules, 1986	129 - 132
6.	**Annexure-V-** A copy of CPCB letter dated 1.05.2024 requesting the states to identify sources of pollution and take necessary measures for improvement of water quality of Ramsar sites	133

Signed and verified on this 19th day of August, 2024 at Bengaluru

DEPONENT

Counsel for

4th Respondent

REGIONAL DIRECTORATE BENGALURU CENTRAL POLLUTION CONTROL BOARD MINISTRY OF ENVIRONMENT, FORESTS & CLIMATE CHANGE, GOVT OF INDIA B'LURU-79 - 560079

J. Chandra Babu
REGIONAL DIRECTOR
CENTRAL POLLUTION CONTROL BOARD
REGIONAL DIRECTORATE - BENGALURU
(MIN.OF ENV,FOREST & CC, GOVT OF INDIA)
BENGALURU - 560 079. MOB: 9868278903

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... RESPONDENTS

REPLY ON BEHALF OF THE RESPONDENT NO. 4, THE CENTRAL POLLUTION CONTROL BOARD (hereinafter referred as CPCB)

1. That, Hon'ble NGT (SZ) vide order dated 29.05.2024 in the instant case has sought the reply from answering Respondent herein i.e CPCB over the instant matter. Thereby, the reply is made in succeeding paragraphs

2. That, CPCB is a statutory Board constituted under Section 3 of The Water (Prevention and Control of Pollution) Act, 1974. It performs the functions under The Water (Prevention and Control of Pollution) Act, 1974, The Air (Prevention and Control of Pollution) Act, 1981 and The Environment (Protection) Act, 1986.

B/8/2024

J. Chandra Babu
REGIONAL DIRECTOR
CENTRAL POLLUTION CONTROL BOARD
REGIONAL DIRECTORATE - BENGALURU
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BENGALURU - 560 079. MOB: 9868278903

POINT WISE REPLY

4. That it is humbly submitted that, the paper article communicates about the micro plastic pollution in Ashtamudi lake based on the R &D study conducted by Department of Aquatic Biology and Fisheries, University of Kerala.

5. That it is humbly submitted that CPCB is not associated with the above study carried out by Department of Aquatic Biology and Fisheries, University of Kerala. However, it is submitted that CPCB has undertaken following work w.r.t studies of Microplastics.

6. That it is humbly submitted that in compliance of Hon'ble NGT order in the matter of OA No. 99 of 2021(SZ) taken up by the Hon'ble NGT Suo Motu case based on the News item published in Times of India Newspaper titled "Chennai you are breathing micro-plastics" a study was carry out in Chennai by the joint committee consisting of the members from Anna University, Chennai, Central Pollution Control Board (CPCB), Regional Directorate – Chennai & Tamil Nadu Pollution Control Board (hereinafter referred as TNPCB), Chennai. Study report has indicated significant levels of microplastic contamination at the Kodungaiyur and Perungudi dumpsites, with microplastics detected in leachate, canal water, and groundwater. Airborne microplastics were also found at notable levels at both sites. Detailed report submitted to Hon'ble NGT in the matter is enclosed as **Annexure-I**.

13/8/2024

J. Chandra Babu
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CENTRAL POLLUTION CONTROL BOARD
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7. That, it is humbly submitted that further vide order dated 05.04.2022 in O.A. No 251/2022 Hon'ble NGT directed that "*There is need for further studies, considering the studies already conducted, to be steered by the Committee comprising of CPCB, ICMR, Central Institute of Petrochemicals Engineering & Technology (CIPET), NCSCM, and any other expert institutions as required, under the Nodal coordination of CPCB. Such studies and recommendations/ suggestions may cover standards for safe environment, remedial steps to reduce menace of micro plastic and addressing other incidental issues. CPCB may incur expenditure on studies and other incidents out of Environmental Compensation funds*".

8. That it is humbly submitted that in compliance of Hon'ble NGT's order as mentioned above CPCB has filed report dated 10.02.2023. The report highlights Microplastics contamination across environments and organisms. Microplastics enters water primarily through sewage, wastewater, and surface runoff, persisting due to inadequate filtration in treatment systems and contributions from plastic infrastructure. Micro plastic is also prevalent in bottled water. Airborne Micro plastic poses inhalation risks in urban settings, while soil contamination occurs via plastic films and waste. Micro plastic has been found in human biological samples, suggesting potential health impacts from ingestion and inhalation routes. However, presently there are no studies on the impacts of ingested microplastics on human health.

19/8/2024

J. Chandra Babu
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CENTRAL POLLUTION CONTROL BOARD
REGIONAL DIRECTORATE - BENGALURU
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Report submitted before Hon'ble NGT is enclosed at **Annexure-II.** In compliance of Hon'ble NGT directions dated 01.03.2023 on the matter, MoEF&CC has prepared an action plan, specifying activities related to microplastics to be taken up by CPCB. The Action Plan is given at **Annexure-III**.

9. That it is humbly submitted that CPCB in association with the State Pollution Control Boards (hereinafter referred as SPCBs) in the States and Pollution Control Committees (hereinafter referred as PCCs) in Union Territories has established a water quality monitoring network under National Water Quality Monitoring Programme (hereinafter referred as NWMP) to assess status of water quality of water resources in the States/UTs to facilitate for prevention and control of pollution in the water bodies.

10. That it is humbly submitted that Ashtamudi Wetland was designated Ramsar site in 2002. CPCB periodically reviews the water quality status of Ramsar sites in the country including Kerala which was monitored under NWMP by concerned SPCBs.

19/8/2024

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11. That it is humbly submitted that CPCB vide its letter dated 1st May, 2024 communicated to the States having Ramsar Sites including Kerala SPCB wherein it was informed that the water quality data during the year 2023 of Ramsar sites on 04 locations at Ashtamudi Lake was non-complying with respect to Primary Water Quality Criteria for Bathing, notified under The Environment (Protection) Rules, 1986. A Copy of the said notification September 25, 2000 is enclosed as **Annexure- IV.** Vide afore-said letter dated 01.05.2024, CPCB also requested the States to identify the sources of pollution specially at the non-complying locations and to take necessary measures for improvement of water quality of Ramsar sites and submit the action taken report to CPCB. A copy of the said letter is enclosed as **Annexure-V**.

12. The answering respondent craves leaves of the Hon'ble Tribunal to file additional reply, in future, if required.

That in light of the above submission, it is respectfully submitted that this Answering respondent i.e. CPCB, shall abide by any order(s) or direction(s) passed by this Hon'ble tribunal in the instant OA.

DEPONENT

COUNSEL FOR
RESPONENT No. 4

J. Chandra Babu
REGIONAL DIRECTOR
CENTRAL POLLUTION CONTROL BOARD
REGIONAL DIRECTORATE - BENGALURU
(MIN.OF ENV,FOREST & CC, GOVT OF INDIA)
BENGALURU - 560 079. MOB: 9868278903

BEFORE THE NATIONAL GREEN TRIBUNAL

SOUTHERN BENCH CHENNAI

ORIGINAL APPLICATION NO. 185 OF 2024 (SZ)

IN THE MATTER OF:

Tribunal on its own motion SUO MOTU based on the news item published in The Hindu, Chennai Edition dt. 24.05.2024 titled, "Microplastics found in Ashtamudi Lake".

AND

The Principal Secretary to Govt. of Kerala, Environment Department, Thiruvananthapuram and Ors.

..... RESPONDENTS

AFFIDAVIT

I, J Chandra Babu, son of late Shri. J Balaramaiah, aged 56 years, having office at the Regional Directorate (Bengaluru), Central Pollution Control Board (CPCB), 1st & 2nd Floors, Nisarga Bhavan A- Block, Thimmaiah Main Road, 7th D Cross, Shivanagar, Bengaluru – 560 079, Karnataka, do hereby solemnly affirm, declare on oath and state as under: -

AFFIDAVIT

1. That I, the deponent herein is authorized representative to represent the Respondent CPCB in the present case, and as such, I am well conversant with the facts and circumstances of the present case on the basis of the information derived from the official records, and hence, I am competent and authorized to verify, sign and swear this affidavit on behalf of the Respondent CPCB.

19/8/2024

J. Chandra Babu
REGIONAL DIRECTOR
CENTRAL POLLUTION CONTROL BOARD
REGIONAL DIRECTORATE - BENGALURU
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BENGALURU - 560 079. MOB: 9868278903

2. That the accompanying reply may be read part and parcel of the present affidavit as I am competent to swear this affidavit.

3. That the accompanying reply has been drafted and filed under my instructions and authority the contents thereof are true and correct on the basis of the record maintained during ordinary course of business of CPCB and available records and documents and the contents of the same are read over and explained to me and are not repeated herein for the sake of brevity.

13/8/2024

DEPONENT

J. Chandra Babu
REGIONAL DIRECTOR
CENTRAL POLLUTION CONTROL BOARD
REGIONAL DIRECTORATE - BENGALURU
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REGIONAL DIRECTORATE BENGALURU CENTRAL POLLUTION CONTROL BOARD
MINISTRY OF ENVIRONMENT, FORESTS & CLIMATE CHANGE, GOVT OF INDIA
B'LURU-79
560079

VERIFICATION

Verified at Bengaluru on this day of 19th August 2024 that the contents of the above reply are correct and true on the basis of the record of the cases as mentioned in the day to day affairs of the CPCB. Nothing has been concealed therefrom or mis-stated.

13/8/2024

DEPONENT

J. Chandra Babu
REGIONAL DIRECTOR
CENTRAL POLLUTION CONTROL BOARD
REGIONAL DIRECTORATE - BENGALURU
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BENGALURU - 560 079. MOB: 9868278903

Annexure -I

BEFORE THE NATIONAL GREEN TRIBUNAL
SOUTHERN BENCH, CHENNAI.

Original Application No. 99 of 2021(SZ)

Suo Motu based on the News item
in the Times of India Newspaper
Chennai edition dated 5.4.2021 under the
caption "Chennai you are breathing micro plastic"

Vs

The Chief Secretary to Government
Tamil Nadu, Chennai and Ors

...Respondents

INDEX

Filed by
Thiru. S. Sai Sathya Jith
Advocate, Chennai.

REPORT OF THE JOINT COMMITTEE IN THE MATTER OA NO. 99/2021 IN SUO MOTO REGISTERED ON THE BASIS OF NEWS PAPER REPORT PUBLISHED IN "THE TIMES OF INDIA CHENNAI EDITION" DATED 05.04.2021 UNDER CAPTION *"CHENNAI YOU ARE BREATHING MICRO PLASTIC"*

1.0 Background

It is informed that an Original Application No. 99 of 2021 taken up by the NGT Suo Motu case based on the News item published in the Times of India Newspaper, Chennai Edition, Dated 05.04.2021, under the caption "Chennai you are breathing micro Plastic". In this regard, the Hon'ble NGT has passed order dated 16.06.2021 and issued the following directions among other things inter alia as follows:

……. *"Para 5: we feel that it is necessary to appoint a Joint Committee to consider this aspect. So, we constitute Joint Committee consist of 1) Senior Scientist from Central Pollution Control Board, Integrated Regional Office, Chennai, 2) Senior Scientist from Tamil Nadu Pollution Control Board as designated by its Chairman and 3) Scientist having expertise in this filed from Center for Environment, Anna University, Chennai to inspect the area in question and also consider the problem that has been projected in the newspaper reports and come with a suitable recommendations and suggestions as to how this can be mitigated in an effective manner.*

6. Tamil Nadu Pollution Control will be the nodal agency for coordination and providing necessary logistic for this purpose.

7. The Committee is directed to take water samples from the nearby wells in and around the Perungudi dump yard and also consider the air samples from the available monitoring station near that place and also in Chennai area so as to find out whether micro plastic particles are found in groundwater as well as in the atmosphere which is being unknowingly consumed by the public resulting in other unknown diseases as well. The Committee is directed to submit the report to this Tribunal on or before 27.08.2021.

8. The Central Pollution Control Board, New Delhi is also directed to provide necessary logistic or other technical and expertise support, if any required for this Committee by deputing any suitable person as member of the Committee to do the study effectively".....

The case was taken up for hearing on 08.11.2021 and NGT directed the Joint Committee as follows:

"The learned Counsel appearing for the TNPCB submitted that they have already taken samples and they wanted some more time to file the report. The CPCB also wanted two months time for approving the Memorandum of Understanding (MoU), with Indian Institute of Technology (IIT), Kanpur and 12 months time for finalizing the report. Since it is quite a long time till then pollution of the environment cannot be allowed as it will have severe adverse impact on human health. The above officials are directed to submit the report to this Tribunal on or before 09.12.2021 by e-filing in the searchable PDF/OCR".

2.0 Constitution of Joint Committee

Tamil Nadu Pollution Control Board (TNPCB) as the nodal agency requested all the concerned authorities for the nomination of the officials from concerned organization for the formation of the joint committee as per the directions of NGT. Based on the nominations received from the Central Pollution Control Board (CPCB) Regional Directorate - Chennai and The Centre for Environmental Studies, Anna University; the joint committee was constituted with following members:

i. Dr. S. Kanmani, Director, Centre for Environmental Studies, Anna University, Chennai

ii. Smt. Poornima B.M, Scientist 'D', Central Pollution Control Board (CPCB), Regional Directorate - Chennai

iii. Thiru. V. Thyagarajan, Deputy Director (Labs), Tamil Nadu Pollution Control Board (TNPCB), Chennai

3.0 Meeting of the Joint Committee

The first meeting of Joint Committee was held on 16.08.2021 at Centre for Environmental Studies, Anna University. The Committee members deliberated upon samples, analysis of the samples and available air quality monitoring stations near that dumpsites place. The following decisions were made:

i. Visit and inspection of Perungudi and Kodungaiyur dumpsites by Joint Committee on August 25, 2021.
ii. To survey and finalize the surface & ground water sampling and ambient air quality monitoring stations locations in and around the two dumpsites on August 25, 2021.
iii. To identify laboratories for analyzing presence of micro plastics in water and ambient air samples before collection of samples.
iv. To finalize parameters for analyzing surface & ground water samples.
v. The Deputy Director (Labs) to collect details for analyzing micro plastics in water and air from the Central Institute of Plastics Engineering Technology (CIPET), Chennai.

4.0 Site Visit and Inspection of the Joint Committee

The joint committee carried out site visit of the two dumpsites located at Kodungaiyur & Perungudi on 25.8.2021 to ascertain the ground level conditions and also to identify/finalize locations for water & ambient air monitoring. During visit/inspection following officials were also present along with committee members. In addition, the supporting staffs of TNPCB Laboratory were also present and extended support for the committee members in sampling & monitoring. During visit/inspection following officials were also present along with committee members. In addition, the supporting staffs of TNPCB Laboratory were also present and extended support for the committee members in sampling & monitoring.

After the site inspection, the committee visited nearby residences and commercial places in and around Kodungaiyur & Perungudi dumpsites and identified locations for surface & ground water samples and ambient air quality monitoring.

4.1 General Observation on Kodungaiyur dumpsite

The following observations were made by the committee during site visit:

i. It was informed that Kodungaiyur dumpsite as an area of about 269 acres and operated from more than 35 years. The habitation is located within 500m from the dumpsite

ii. About 64.02 lakhs cubic meter of legacy waste is accumulated in dumpsite.

iii. During inspection it was noticed that fresh solid waste is being dumped on top legacy waste due to space constraints. The dumpsite has occupied about 90 % of available land and there is no space available for the fresh solid waste dumping. Hence the daily generated solid waste is dumped vertically creating hill like structures.

iv. It was reported that about 2600 to 2800 TPD of fresh solid waste generated from Zone 1 to 8 is being dumped in this site.

v. There was a lack of segregation of waste (dry & wet waste); the trucks carried unsegregated solid waste and being dumped.

vi. The garland drains have been created to collect the leachate generated from these dumps, during inspection oozing of leachates was noticed and all the drains were filled with leachates. The leachate was allowed to flow directly into the Kodungaiyur canal flowing in front of the dumpsite. This canal joins Buckingham canal, which is located adjacent to dumpsite and finally reaches the sea.

vii. In the dumpsite, Construction & Demolition waste processing facility of 600TPD capacity has been installed and is operating at trail run. GCC has obtained consent for establish and consent for operation from TNPCB.

viii. Greater Chennai Corporation (GCC) has not started bio-mining/bio-remediation process of legacy waste in Kodungaiyur dumpsite. It was reported that Detailed Project Report (DPR) is under preparation.

4.2 General observations on Perungudi dumpsite

The following observations were made by the committee during site visit:

i. It was informed that Perungudi dumpsite is spread in an area of about 220 acres land and is being operated from more than 30 years. The habitation is located within 500m from the dumpsite.

ii. About 34.29 lakhs cubic meter of legacy waste is accumulated in dumpsite. At present, 2400 to 2800 TPD of unsegregated fresh solid waste is being dumped in this site.

iii. This dumpsite has also accumulated maximum space and vertical dumping of fresh solid waste was noticed. The domestic solid waste generated from Zone 9 to Zone 15 is being dumped in this site.

iv. From the dumpsite it was noticed that segregation of waste is very poor in these zones.

v. The garland drains have been created around all dumps to collect the leachate generated, during inspection oozing of leachates were noticed and all the drains were filled with leachates. The leachate was allowed to flow directly into the storm water drains joining the canal and ultimately reaching the sea.

vi. The Perungudi marshland located at the backside of the dumpsite was found filled with leachates due to rainfall occurred previous day of the site visit.

vii. GCC has obtained solid waste authorization as per the Solid waste management Rules, 2016 for bio-mining/bio-remediation process of 34. 29 cubic meter of legacy waste from TNPCB on 09.08.2021 and valid up to 31.03.2022.

viii. GCC awarded work order for the biomining of legacy waste and during site visit; the erection of machineries for the bio-mining process was noticed.

5.0. Details of sampling locations

The surface & ground water locations are all within the 1km radius from the dumpsites and details of sampling location is depicted in table 1 & 2 and the ambient air quality monitoring stations details is depicted in table 3.

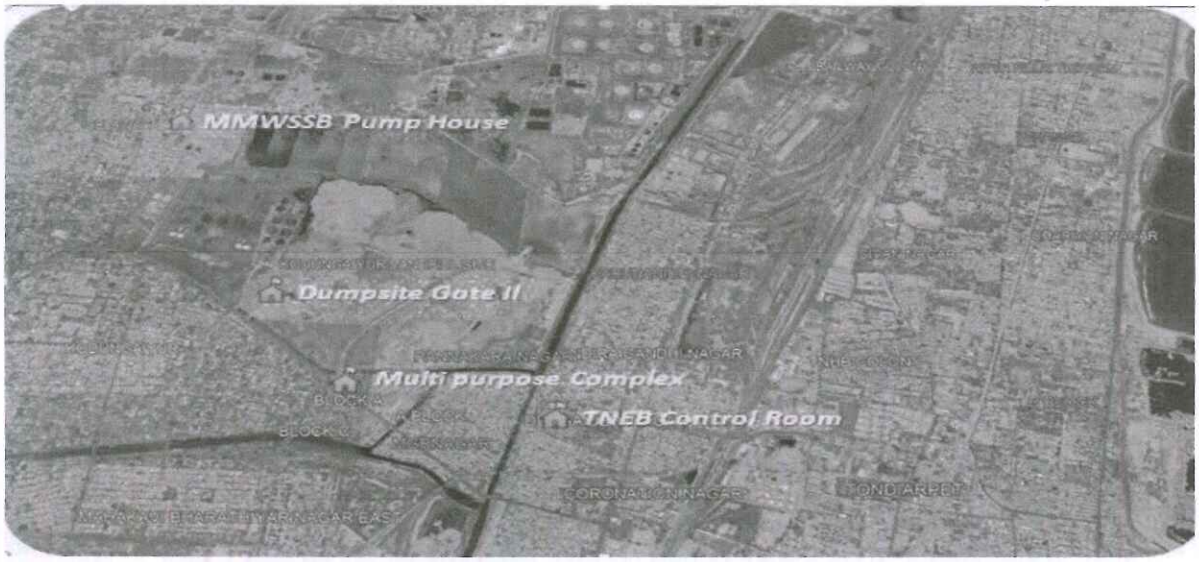
Table no. 1: Sampling locations of surface & ground water in Kodungaiyur dumpsite

S. No.	Type of sample	Sampling location	Latitude/ Longitude	Distance & direction from the dumpsite
1	Leachate	Leachate from dumpsite near Admin. Office	13.130697 N 80.274822 E	56m,SE
2	Canal	Kodungaiyur canal before the inlet of leachate	13.133098 N 80.276041 E	90m,E
3	Canal	B' Canal near mixing point of Outlet from CMWSSB sewage	13.135092 N 80.277154 E	150m, NE
4	Open well	Nethaji Nagar, 6th Street, No.17 Maiammal House	13.130542 N 80.267308 E	135m, S
5	Bore Well	Rajarathinam School, Govt. Chennai School 3rd Street, Kodungaiyur	13.13388 N 80.262069 E	130m, SW
Table 2: Sampling locations of surface & ground water samples at Perungudi dumpsite				
6	Bore well	Sh. Saravanan House Ist Cross Street Sarvana Nagar Perungudi	12.951626 N 80.21390 E	100m, SW
7	Open sump	Opposite to Admin, GCC office	12.949000 N 80.216634 E	100m, SW
8	Bore Well	Inside the dumpsite Fresh waste dumping area	13.955027 N 80.236146 E	0m
9	Open Well	Sh. T. S. Shanmuga Krishnan, Sri Sai Nagar, opp. to Park, Perungudi	12.951604 N 80.235080 E	900m, E
10	Bore Well	Sh. S. Kannan No. 1/137, Kulakarai	12.956177 N	500m, E

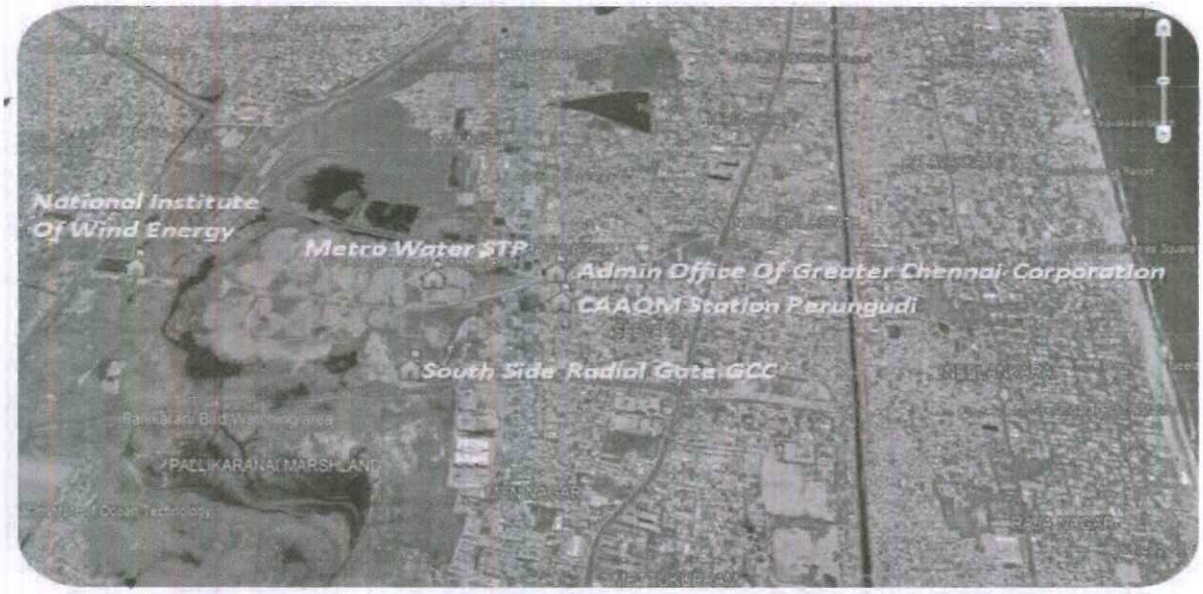
		Street	80.240164 E	
11	Surface water	Marsh Land behind dumpsite	12.950230 N 80.237345 E	100m, E

Table 3: Sampling locations of Ambient Air Quality monitoring stations (AAQMS) at Kodungaiyur & Perungudi dumpsites

In and around Kodungaiyur dumpsite			
S. No.	**Sampling Location**	**Latitude/ Longitude**	**Distance & direction from dumpsite**
1	On top of platform near TNEB control room (AD Office), Ennore High Road	13.12808 N 80.27559 E	350m, SE
2	On building top of Multipurpose complex, Corporation of Chennai, Tondiarpet High road	13.12935 N 80.26767 E	220m, W
3	On top of platform near Kodungaiyur Dumpsite Gate II	13.13389 N 80.264 E	0m, SW
4	On building top of MMWSSB pump house, Thendral Nagar, Kodungaiyur	13.14393 N 80.25801 E	850m, NW
In and around Perungudi dumpsite			
5	Metro water STP – eastern	12.9661 N 80.2428 E	1.5Km, NE
6	Admin office of Greater Chennai Corporation	12.5723 N 80.1359 E	30m, E
7	CAAQM station at Perungudi	12.9653 N 80.2461 E	65m, SE
8	South side Radial Gate of GCC (entrance of the dumpsite)	12.9655 N 80.2445 E	30m, S
9	National institute of wind energy, backside	12.9566 N 80.2143 E	180m, W



Picture 1: Representation of AAQMS at Kodungaiyur dumpyard



Picture 1: Representation of AAQMS at Perungudi Dumpyard

6. Analysis results of surface & ground water and ambient air quality at Kodungaiyur & Perungudi dumpsites

6.1 Analysis results of surface & groundwater samples

The surface & groundwater samples from the Kodungaiyur & Perungudi dumpsites as per the sampling locations mentioned in table 1 & 2 were collected on 24.09.2021. The samples were

analyzed at Central Laboratory, TNPCB and for Heavy metals parameters, samples were analyzed in M/s SGS Laboratory, Chennai. The table 4A, 4B & 5 depicts the analysis results of surface & groundwater samples from the Kodungaiyur & Perungudi dumpsites. The analysis results show

Table 4A: Analysis results of leachate & surface water samples in Kodungaiyur dumpsite

Parameters all in mg/L except pH	*Monitoring locations*		
	Leachate from dumpsite near Admin. Office	*Kodungaiyur canal before the inlet of leachate*	*B' Canal near mixing point*
Turbidity (NTU)	203	51.1	28.4
pH	7.4	7.0	**6.9**
Oil & Grease (mg/L)	8	<2	<2
COD	**1040**	**264**	**168**
BOD	**360**	**66**	**44**
TDS	**5130**	838	960
Nitrate	<1	<1	<1
Nitrite	<0.05	<0.05	<0.05
Total Residual Chlorine	<1	<1	<1
Cyanide	<0.05	<0.05	<0.05
Fluoride	0.52	0.34	0.5
Chloride	**1510**	**320**	**355**
Sulphate	80	163	168
Sulphide	<1	<1	<1
Total Hardness	1040	**325**	**380**
Phosphates	<0.5	0.58	0.65
Alkalinity	1390	**534**	**522**
Total Kjeldal Nitrogen	**336**	19	18
Ammonical Nitrogen	**186**	11	10
Phenolic compounds	**5.52**	2.8	1.8
Zinc	0.159	0.2	0.26
Nickel	0.283	0.2	<0.006
Copper	0.16	0.04	0.03

Hexavalent Chromium	<0.05	<0.05	<0.05
Total Chromium	<0.05	<0.05	<0.05
Lead	0.005	<0.015	<0.015
Manganese	0.404	0.21	0.16
Total iron	3.389	0.23	0.16

The untreated leachate generated from the dumpsite joins the Kodungaiyur canal which carries untreated sewage in turn joins the Buckingham canal. The treated sewage from the Kodungaiyur sewage treatment plant is also let into the canal. Hence in spite of dilution, the values of BOD, COD are higher and confirms the pollution of canal due to influx of leachate and untreated sewage which clearly indicates in the table 4A. The canal falls under class E as per the designated best use (DBU) water quality criteria.

Table 4B: Analysis results of ground water samples around Kodungaiyur dumpsite

Parameters all in mg/L except pH	***Monitoring Locations***		***Drinking water standards (BIS:IS:10500, 2012)***
	Nethaji Nagar, open well	***Rajarathinam Govt. School (Bore well)***	
Turbidity (NTU)	**12.6**	**1.69**	**1**
pH	**6.8**	**7.1**	6.5 – 8.5
Oil & Grease (mg/L)	<2	24	-
COD	144	40	-
BOD	13	8	-
TDS	**11314**	**684**	**500**
Nitrate	<1	6.6	45
Nitrite	<0.05	<0.05	-
Total Residual Chlorine	**42**	**<1**	**0.2 (only when water is chlorinated)**
Cyanide	<0.05	<0.05	0.05
Fluoride	0.13	0.1	1.0
Chloride	**4060**	190	**250**
Sulphate	**4756**	144	**200**
Sulphide	**<1**	**<1**	0.05
Total	**1920**	**270**	**200**

Hardness			
Phosphates	0.57	0.62	
Alkalinity	**538**	**406**	**200**
Total Kjeldal Nitrogen	4	<2	-
Ammonical Nitrogen	2.24	<2	-
Phenolic compounds	<0.1	<0.1	-
Zinc	0.23	<0.20	5
Nickel	<0.006	0.36	-
Copper	<0.0015	<0.0015	0.05
Hexavalent Chromium	<0.05	<0.05	-
Total Chromium	<0.05	<0.05	0.05
Lead	<0.015	<0.015	0.01
Manganese	0.86	0.079	0.1
Total iron	0.19	**<0.5**	**0.3**

The bore well samples taken from the residence near the Kodungaiyur dumpsite is not meeting the BIS drinking water standards and except heavy metals & phenolic compounds all other parameters are exceeding the standards.

Table 5: Analysis results of ground water samples from Perungudi dumpsite

Parameters all in mg/L except pH	***Monitoring locations***					
	Sh. Saravanan House	Open sump Opposite to Admin, GCC office	Inside dumpsite	Sh. T. S. Shanmuga Krishnan	Sh. S. Kannan	Marsh land behind dumpsite
Turbidity (NTU)	2.07	1.8	**2142**	**37.3**	0.48	**26.4**
pH	6.5	**7.1**	**7.4**	**6.8**	**6.9**	7.4
Oil & Grease (mg/L)	16	<2	**32**	<2	<2	<2
COD	200	128	**2560**	56	48	264

BOD	15	12	**840**	9	7	39
TDS	**24226**	**1288**	**7812**	**2228**	**2016**	**1718**
Nitrate	<1	<1	<1	<1	4.1	<1
Nitrite	<0.05	<0.05	<0.05	<0.05	0.6	<1
Total Residual Chlorine	<1	<1	<1	<1	**55**	<1
Cyanide	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Fluoride	0.15	0.29	0.58	0.22	0.26	0.58
Chloride	**11325**	**435**	**1820**	**935**	**775**	**570**
Sulphate	**1224**	70	**396**	**678**	**388**	59
Sulphide	<1	<1	28	<1	<1	<1
Total Hardness	**7600**	**370**	**2050**	**640**	**590**	**460**
Phosphates	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Alkalinity	**302**	**394**	**528**	**402**	**508**	**1216**
Total Kjeldal Nitrogen	<2	<2	**627**	5.6	3.3	74
Ammonical Nitrogen	<2	<2	**349**	3.4	2.2	41.4
Phenolic compounds	<0.1	<0.1	0.81	<0.1	<0.1	0.94
Zinc	0.16	0.13	0.27	0.14	0.26	0.14
Nickel	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
Copper	<0.015	<0.015	**0.644**	<0.015	<0.015	<0.015
Hexavalent Chromium	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Chromium	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Lead	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Manganese	**2.17**	<0.01	**1.21**	**0.41**	<0.01	0.16
Total iron	0.22	0.11	**45**	0.27	0.13	**0.59**

The ground water samples taken from the bore well located inside the dumpsites are at higher levels for all the parameters, which clearly suggest the ground water pollution due to dumpsite and mismanagement of leachates from the dumpsite. The ground water samples collected from the vicinity of the dumpsites are also not meeting the BIS drinking water standards.

6.2 *Analysis results of ambient air quality samples*

The monitoring of ambient air quality at five locations in & around Perungudi dumpsite was monitored during 15.09.2021 to 16.09.2021. The analysis results are depicted in table 6 & 7 below, the results shows that metro water STP, South gate of dumpsite & admin office located in dumpsite are not meeting the PM_{10} standard. The prominent wind direction during the day of monitoring at the stations was north east to south west direction. This may be due to movement of trucks carrying the solid waste for disposal in the dumpsite and also there is contribution of solid waste dumpsite for the increase in the concentration of PM_{10} at the downwind direction (South side radial gate GCC).

Table 6: Analysis results of AAQ at Perungudi dumpsites

S. No.	Pollutants concentration in µg/m3	NAAQM Standards for 24 hrs.	Monitoring Locations				
			Metro water STP	Admin office of GCC	Near CAAQM station Perungudi	South side radial gate GCC	National institute of wind energy
1	PM_{10}	100	**136.0**	**145**	67	**168**	62
2	$PM_{2.5}$	60	22	-	-	32	18
3	SO_2	80	13	11	9	13	9
4	NO_2	80	16	17	14	18	10

The monitoring of ambient air quality at four locations in & around Kodungaiyur dumpsite was monitored during 15.09.2021 to 16.09.2021. The analysis results are depicted in table 7 below, the results shows that TNEB control room and Multi-purpose complex, GCC locations are not meeting the PM_{10} standard. The prominent wind direction during the day of monitoring at the stations was north east to south west direction. This may be due to movement of traffic in the vicinity of dumpsite and also due to vehicular movement in the dumpsites.

Table 7: Analysis results of AAQ at Kodungaiyur dumpsites

S.	Pollutants	NAAQM	Monitoring Locations

No.	concentration in µg/m3	Standards for 24 hrs.	TNEB control room	Multi-purpose complex, GCC	Dumpsite gate II	MMWSSB pump house
1	PM_{10}	100	132	138	87	74
2	$PM_{2.5}$	60	40	-	35	-
3	SO_2	80	9	11	8	8
4	NO_2	80	14	14	14	12

7.0 Analysis of microplastics (MPs) in ground water and ambient air around the dumpsites

For the analysis of MPs in water and air, the sample preparation was done in the TSPCB, Central laboratory. The Morphological characterization for identifying colour and number of MPs present in the sample was carried out by Centre for Environment Science, Anna University. However the results were not satisfactory. Hence the committee decided to resample & analysis of the microplastics. The committee engaged National Centre for Sustainable Coastal Management (NCSCM), MoEF&CC located at Anna University, Kotturpuram, Chennai to carry out the possibility of microplastics leakage from the solid waste dumpsite of Greater Chennai Corporation. NCSCM research team has been actively working on the assessment of microplastics and marine debris and its impact on the marine environment. The work was awarded by TNPCB to NCSCM on 29-12-2021 for the qualitative & quantitative assessment of microplastics from the leachate, surface water, ground water and in ambient air around the Kodungaiyur and Perungudi dumpsites.

A joint field survey and sample collection was carried out by committee members & NCSCM to verify the status of microplastics pollution from the Kodungaiyur and Perungudi dumpsites on 06.01.2022 and 07.01.2022. A total of 12 samples were collected including the leachate and water samples within 500m radius of the landfill site. In case of ambient air, sampling carried out at 9 locations in and around the landfill sites by TNPCB was assessed from the filter papers by microscopic identification. The detailed information on the sample collection is given in Table 8

Table 8: Details of Microplastics Sample Collection from Kodungaiyur and Perungudi dumpsites

S. No.	Type of sample	Sampling location with code	Latitude/ Longitude	Distance from dumpsite
In and around Kodungaiyur dumpsite				
1	Leachate	Landfill leachate discharge point (K1)	N13°07'50.00" E80°16'01.80"	20m
2	Kodungaiyur Canal	Canal through the landfill (K2)	N13°07'49.80" E80°16'01.06"	50m
3	Buckingham Canal	Patel Nagar (School Backside) (K3)	N13°08'12.14" E80°16'36.58"	100m
4	Closed well	Patel Nagar (Residential) (K4)	N13°08'01.47" E80°16'34.38"	~100m
5	Borewell	Rajarathinam Govt. School (K5)	N13°07'41.99" E80°16'05.35"	~400m
6	Borewell	Kaviarasu Kannadhasan Nagar (K6)	N13°08'00.90" E80°15'42.70"	~100m
In and around Perungudi dumpsite				
7	Borewell	Perungudi STP opposite	N12°57'17.30" E80°14'09.80"	~500m
8	Open well	STP opposite to Perungudi dumpsite	N12°57'18.17" E80°14'10.12"	~500m
9	Leachate outlet	Landfill leachate	N12°57'16.27" E80°13'31.86"	30m
10	Borewell	Sai Nagar from the landfill	N12°57'06.10" E80°14'07.30"	~600m
11	Borewell	Thuraipakkam from the landfill	N12°57'08.70" E80°14'12.79"	~500m
12	Leachate outlet	Leachate outlet connected to marshland	N12°56'59.04" E80°13'33.24"	Backside of dumpsite

7.1 Methodology

Collection and extraction

A total of 12 samples were collected including the leachate and water samples from the canal and ground water within 500m radius of the landfill site (Table 8). Water samples of 2.5L to 20L were collected using a clean bucket and filtered through 20 µm mesh. The residue was

collected in 500ml glass containers, labeled, stored in ice box and transported to laboratory. All the materials used for sampling was previously washed with Milli-Q water and between the collection at each location. Similarly, ambient air sampling was carried out for PM_{10} and $PM_{2.5}$ by using Respirable Dust Sampler and Ambient Fine Dust Sampler, respectively, at 9 locations in and around the landfill sites (as in table 3). The air sampling was performed by TNPCB by following the standard protocols (IS 5182 Part-23: 2006; IS 5182 Part-24: 2019) and the filter papers were handed over to NCSCM with required information for further process

7.2. Spatial distribution of microplastics

The density of microplastics in the waters of leachate, canal and ground water ranged between 0.75 and 32.0 particles/L. The maximum density was found in the leachates, invariably at both the sites (Figure 1). The concentrations of microplastics in the leachate in the current study were comparable to those reported for other areas of the world where urban and industrial development have occurred (Table 9).

7.3 Morphological characteristics of microplastics

Microplastics were characterized in to different types and colors which determine the source, chemical composition, degradation state and palatability in the environment. Fiber/lines were the most abundant type of microplastics that accounted for 41.3% and 46.6% at Kodungaiyur and Perungudi, respectively. Other types in the order of abundance include fragment > film > foam > pellet at Kodungaiyur and film > fragment > foam > pellet at Perungudi (Figure 2 & 3).

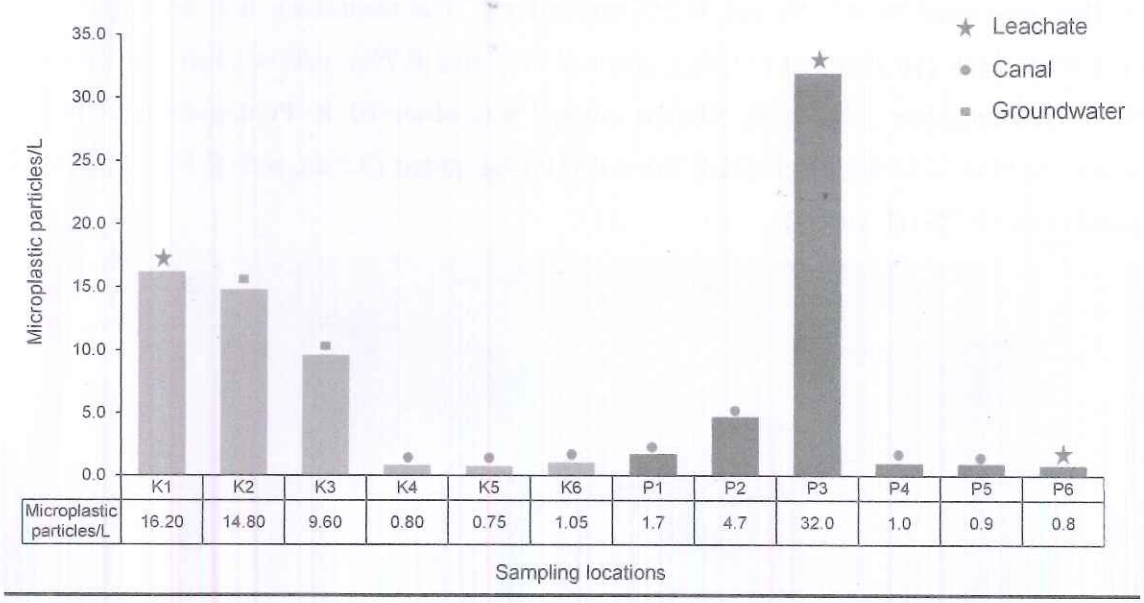


Figure 1: Abundance and distribution of microplastics detected in Kodungaiyur and Perungudi water samples.

Table 9: The microplastics concentrations revealed in Kodungaiyur and Perungudi were compared to worldwide values.

Location	Type of water	Microplastics concentration (particles/L)	Reference
South China	Leachate	3 to 25 particles/L	Wan et al., 2022
Suzhou, China	Leachate	235.4 ± 17.1 particles /L	Sun et al., 2021
China	Leachate	0.42 to 24.58 particles/L	He et al., 2019
Shanghai, China	Leachate	4 ± 13 particles/L	Su et al., 2019
Lahti, Finland	Leachate	1.97 particles/L	Praagh et al., 2018
Alfsnes, Iceland	Leachate	4.51 particles/L	Praagh et al., 2018
Kodungaiyur, India	Leachate	0.75 to 16.2 particles/L	Present study
Perungudi, India	Leachate	0.8 to 32 particles/L	Present study
South China	Groundwater	11 to 17 particles/L	Wan et al., 2022
Australia	Groundwater	16 to 97 particles/L	Samandra et al., 2022
Karst, US	Groundwater	15.2 particles/L	Panno et al., 2019
Kodungaiyur, India	Groundwater	0.87 particles/L	Present study
Perungudi, India	Groundwater	2.1 particles/L	Present study

Among the colors detected, white color was predominant in both Kodungaiyur and Perungudi waters that accounted for 47.1% and 44.2% respectively. The abundance was followed by blue (12.3%), black (10.2%), red (12.4%), green (8.7%), red (8.7%), yellow (6.8) and violet (3.9%) in Kodungaiyur (Figure 4). Similar pattern was observed in Perungudi with the abundance of blue (13.6%), black (12.6 %), red (10.2%), green (9.2%), red (8.7%), yellow (7.3) and violet (5.3%) (Figure 4).

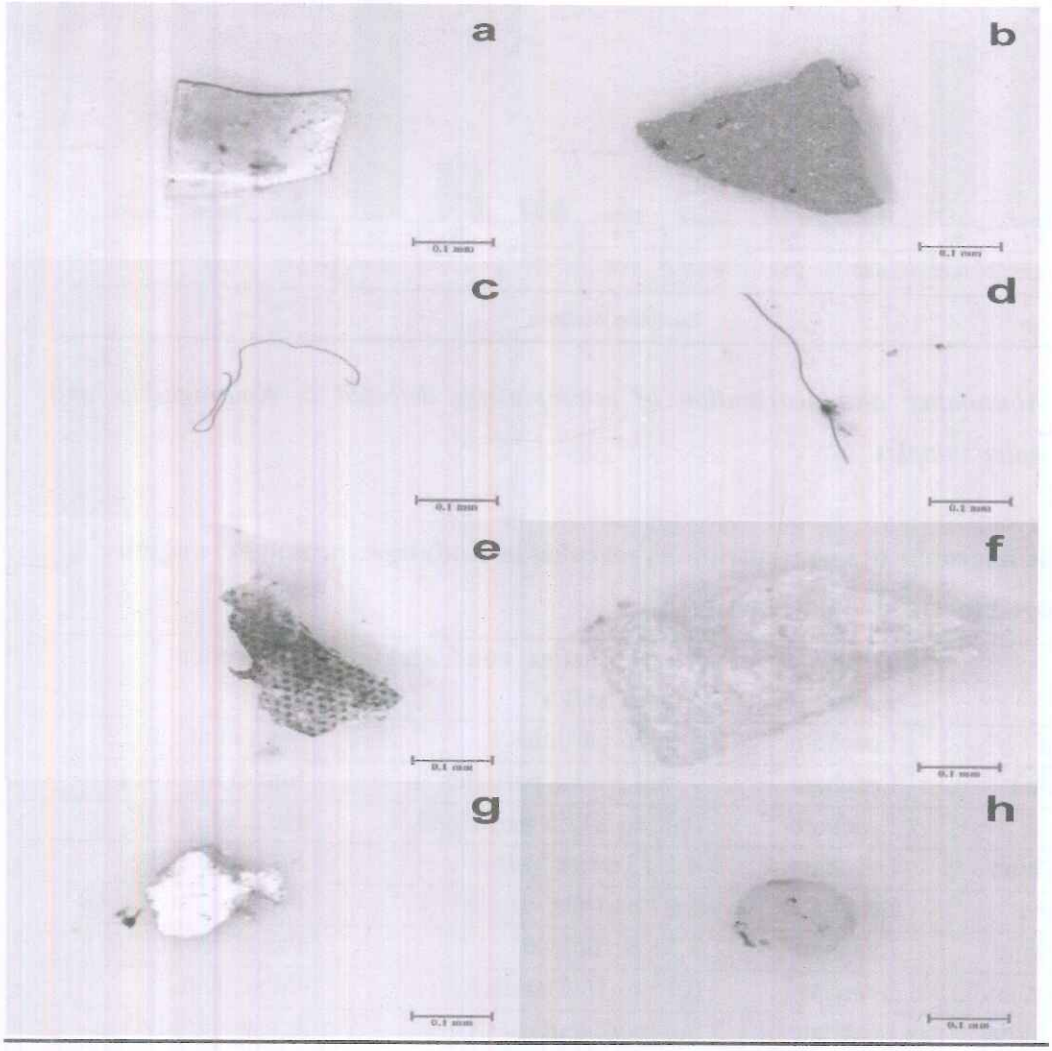


Figure 2: Micrographs showing different types of microplastics: (a & b) fragments, (c & d) fibre/line, (e & f) film (g) form and (h) pellet.

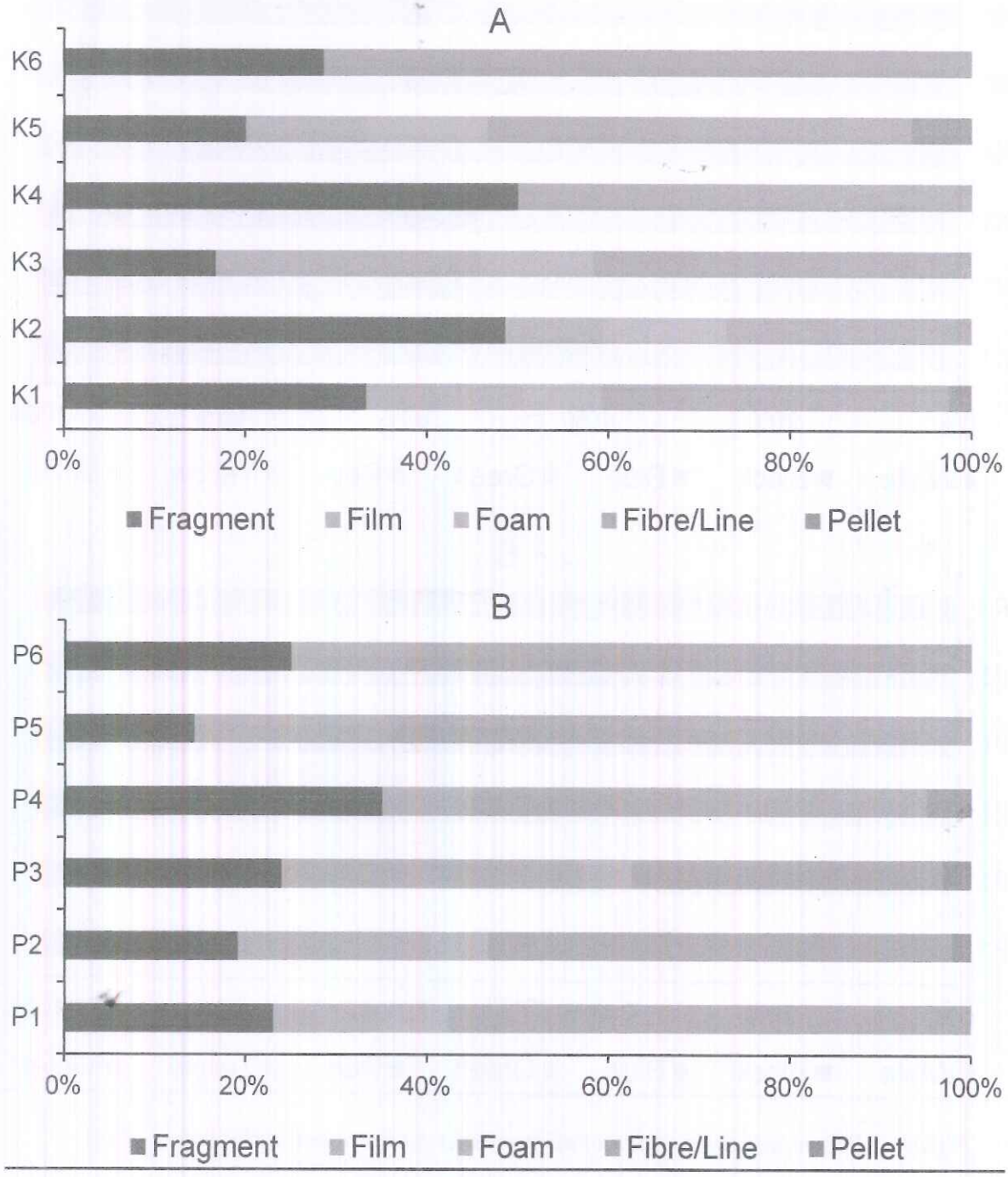


Figure 3: Percentage composition of microplastics types found in the waters of (A) Kodungaiyur and (B) Perungudi.

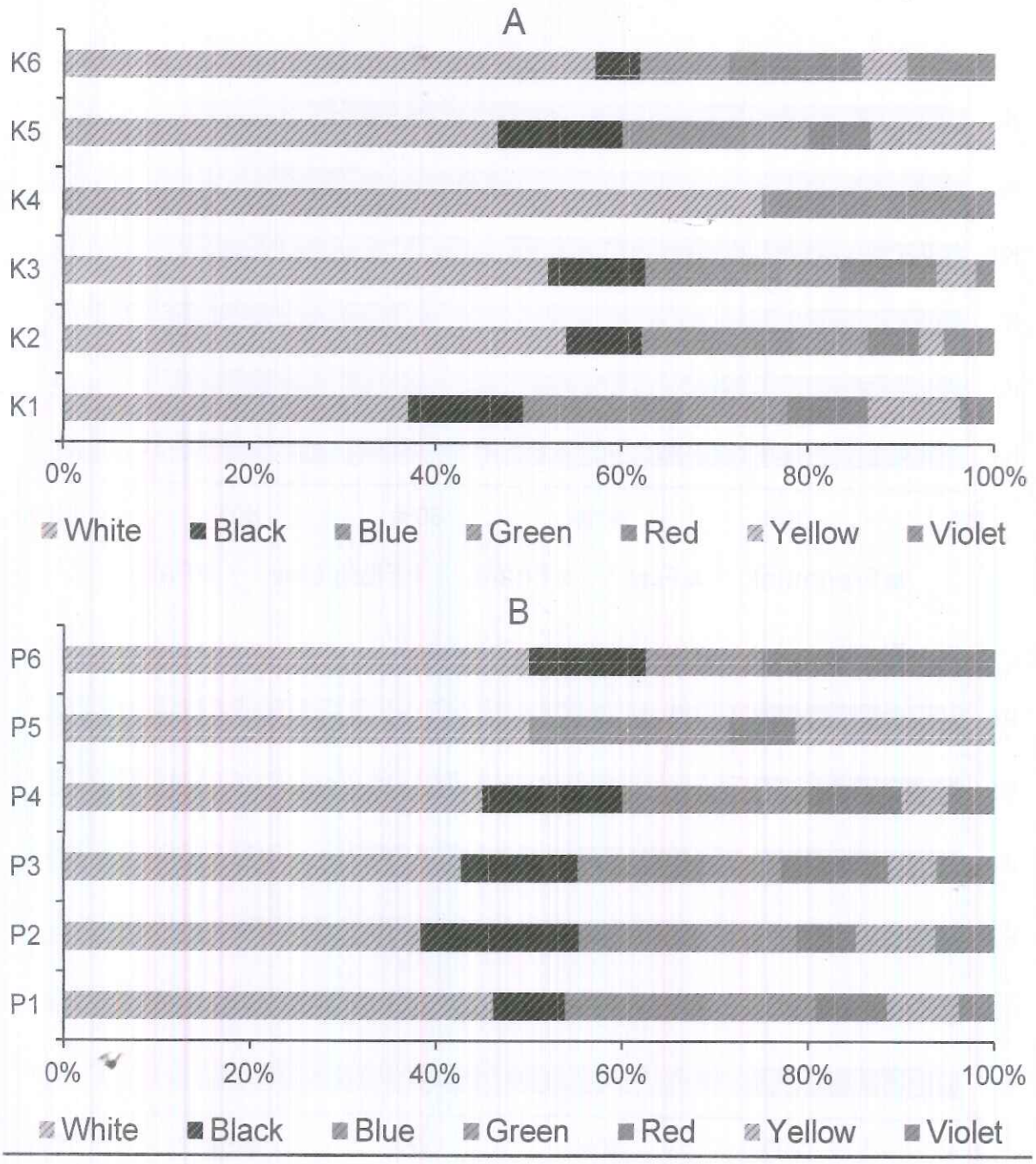


Figure 4: Percentage composition of microplastics colors found in the waters of (A) Kodungaiyur and (B) Perungudi.

7.4 Identification of microplastics using FTIR

A total of 11 polymer types were identified from the samples namely, Polyethylene (PE), Epoxy resin (ER), Polypropylene (PP), Poly cyclohexylenedimethylene terephthalate (PCT), Cellulose (CE), Vinyl acetate (VAC), Polyethylene terephthalate (PET), Polyamide (PA), Polystyrene (PS), Adhesive tape (AT), Poly(1-butene) isotactic (PB). Polyethylene includes Polyethylene chlorinated (PE-C) and Polyethylene high-density (PEHD).

At Kodungaiyur, 37 individual particles were identified for FTIR analysis under four major classes such as fibres/line (14), fragments (11), film (9) and foam (3). Among them, 16 items were identified as Polyethylene (PE), followed by Polypropylene (PP, 3 Nos.), Poly cyclohexylenedimethylene terephthalate (PCT, 1 No.), Polyamide (PA, 1 No.), Cellulose (CE, 1 No.) and Polystyrene (PS, 1 No.). Further, the composition of the other 14 particles had no similarity with the standard library and the concordance rate was less than 70%. Of the total particles analyzed, polymers that commonly found were PE (69.6%) > PP (13.0%) > PCT (4.3%) > PA (4.3%) > CE (4.3%) and PS (4.3%) (Figure 5). The percentage composition of microplastics in Kodungaiyur dumpsite leachate, canal and groundwater shown in figure 7.

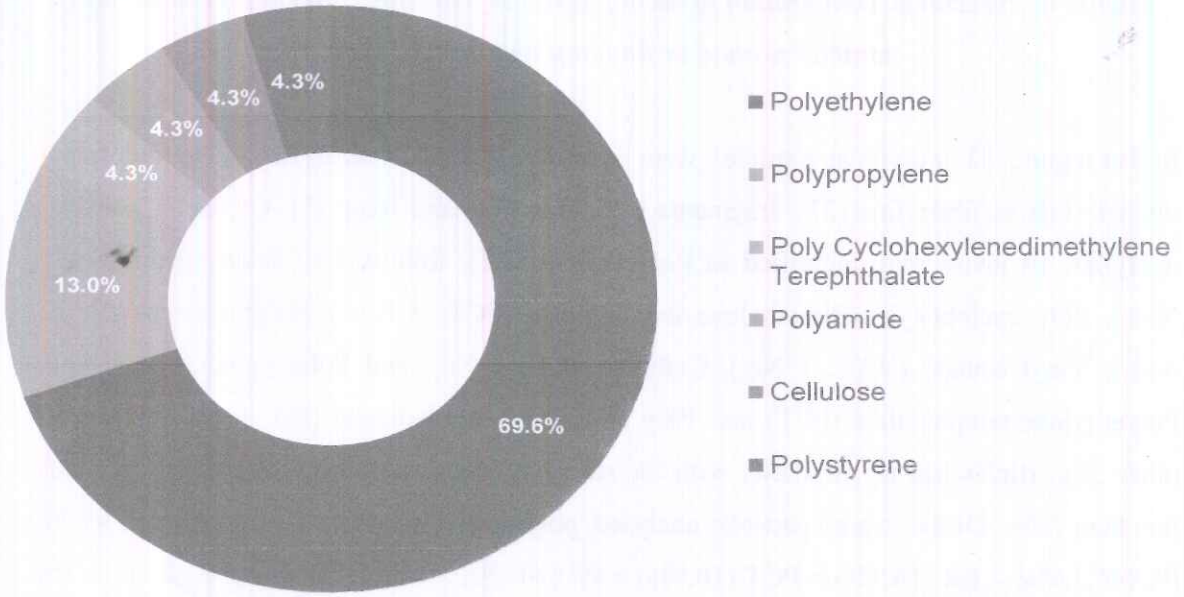


Figure 5: Chemical composition of microplastics samples collected from Kodungaiyur sites.

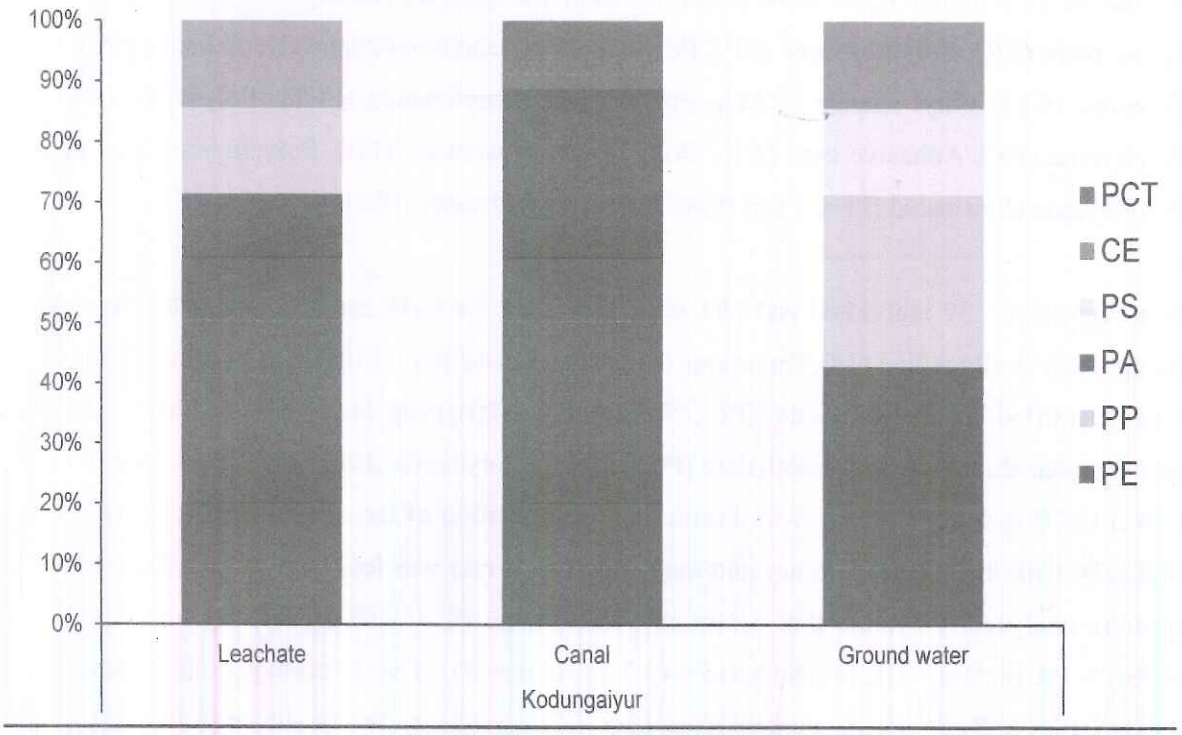


Figure 6: Percentage composition of microplastics in leachate, canal and groundwater samples around in Kodungaiyur landfill sites.

In Perungudi, 51 individual particles were identified for FTIR analysis under four major classes such as fibres/line (23), fragments (12), film (11) and foam (5). Of the 51 particles analyzed, 14 items were identified as Polyethylene (PE), followed by Epoxy resin (ER, 5 Nos.), Poly cyclohexylenedimethylene terephthalate (PCT, 3 Nos.), Polypropylene (PP, 3 Nos.), Vinyl acetate (VAC, 1 No.), Cellulose (CE, 1 No.) and Polystyrene (PS, 1 No.), Polyethylene terephthalate (PET) and Poly (1-butene) and isotactic (PB, 1 No.). Whereas, other 21 particles had no similarity with the standard library and the concordance rate was less than 70%. Of the overall particles analysed, polymers were most frequently found where PE (46.7.6%) > ER (16.7%) > PCT (10.0%) > PP (10.0%) > VAC (3.3%) > CE (3.3%) > PS

(3.3%) and PB (3.3%) (Figure. 7). The proportion of microplastics in Perungudi landfill leachate and groundwater shown in figure 8.

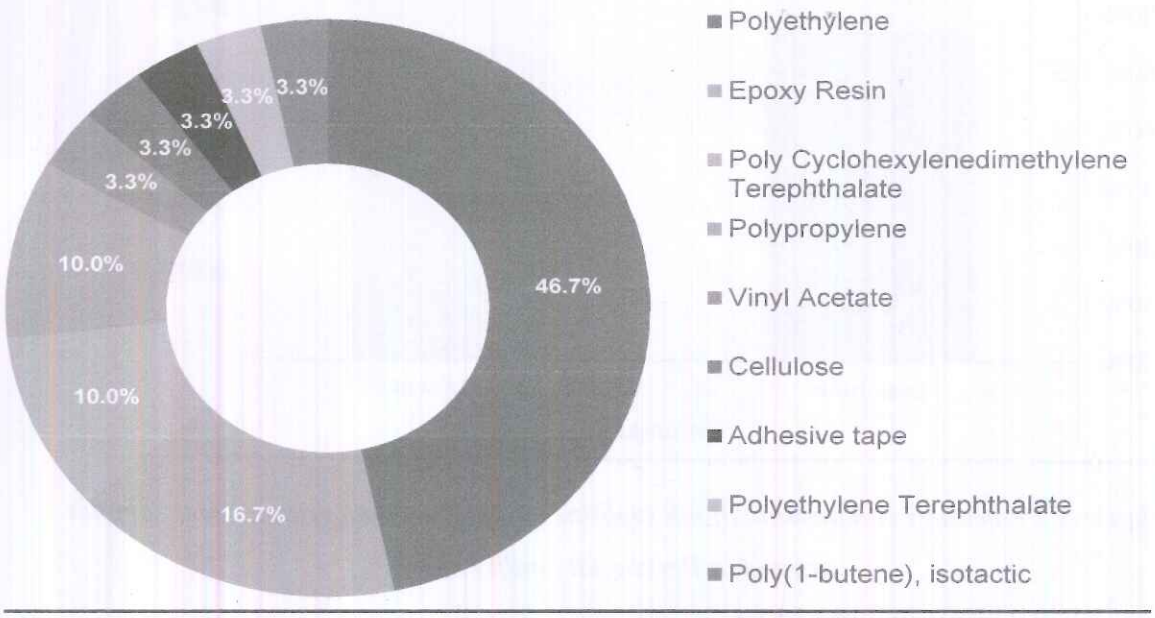


Figure 7: Chemical composition of microplastics samples collected from Perungudi sites.

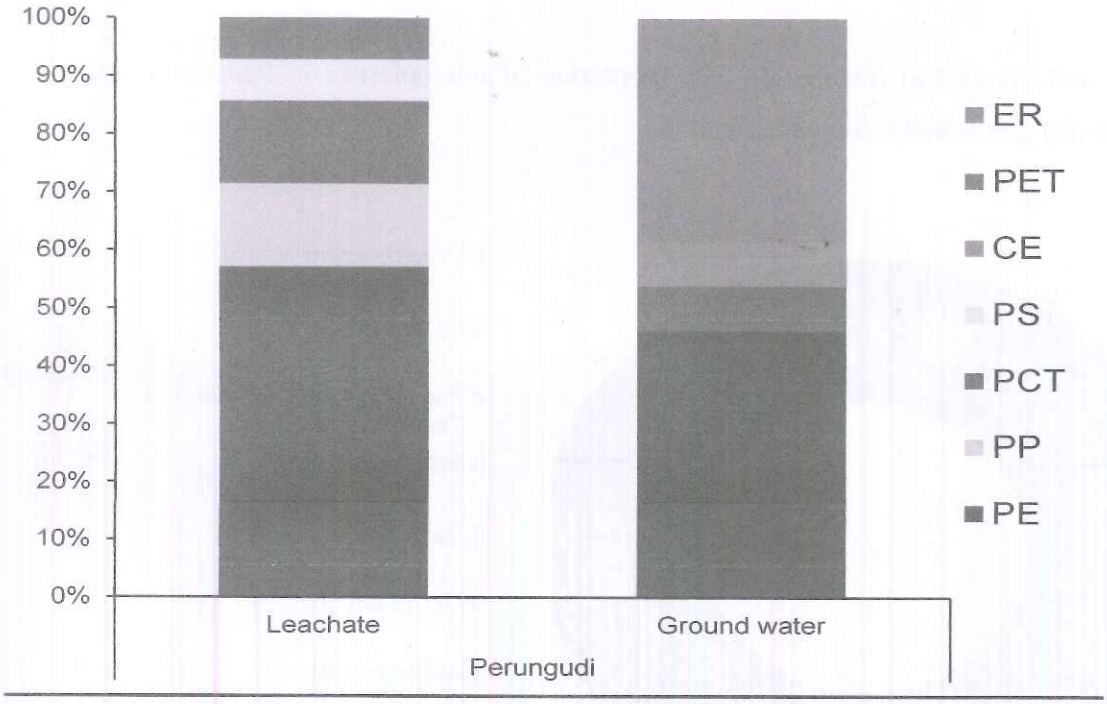


Figure 8: Percentage composition of microplastics in leachate and groundwater samples around in Perungudi landfill sites.

7.5 Microplastics in ambient air

Spatial distribution of microplastics

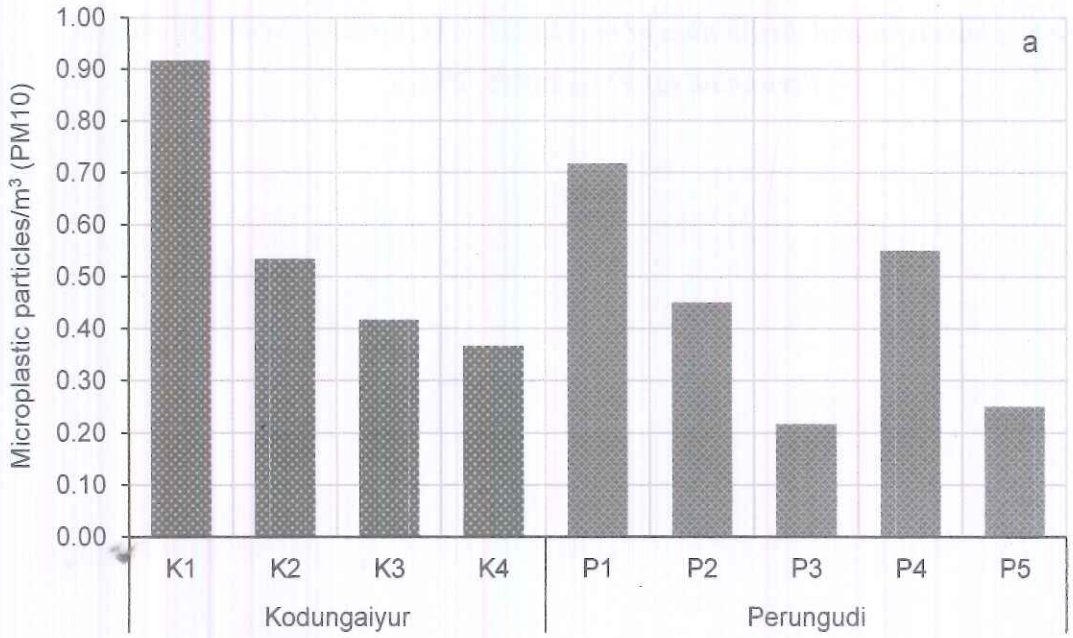
In the Kodungaiyur, microplastics particles in air represented between 0.37 and 0.92 particles/m^3 in PM_{10}, while 0.50 and 0.94 particles/m^3 in $PM_{2.5}$ with the overall mean of 0.56 particles/m^3 and 0.72 particles/m^3 respectively. The density of microplastics particles in both PM_{10} and $PM_{2.5}$ was recorded at K1 (AD office TMEB) which is in close proximity to the landfill area, whereas, a considerable reduction in the density of microplastics in air was observed at other locations (Figure 10 a & b).

Similarly, the density of microplastics at Perungudi ranged from 0.22 to 0.72 in PM_{10} and 0.50 to 3.88 particles/m^3 in $PM_{2.5}$ with a mean density of 0.44 particles/m^3 in PM_{10} and 1.58 particles/m^3 in $PM_{2.5}$ (Figure 10 a & b). The highest level of microplastics was found at P1 (Corp. Admin Office I), whereas the lowest being at P3 (Radial Station III) for PM_{10} and P5

(Perungudi CAAQM V) for $PM_{2.5}$ The concentration of microplastics in the present study was comparable to those reported for global values (Table 10).

7.6. Morphological characteristics of microplastics

Different types and colors of microplastics collected in the air (PM_{10} and $PM_{2.5}$) is shown in figure 11 & 12. Fiber/line was the predominant type found in PM_{10} and $PM_{2.5}$ at both the regions. The type of particles in PM_{10} and $PM_{2.5}$ at Kodungaiyur was fiber/line and fragment with the relative abundance of 77% and 23% and 84% and 16% respectively. Similarly, the particles in PM_{10} of Perungudi were accounted for 72% of fiber/line and 28% of fragments. Whereas in $PM_{2.5}$, fibre/line accounted for 71% of the total collection followed by fragments (29%) (Figure 11).



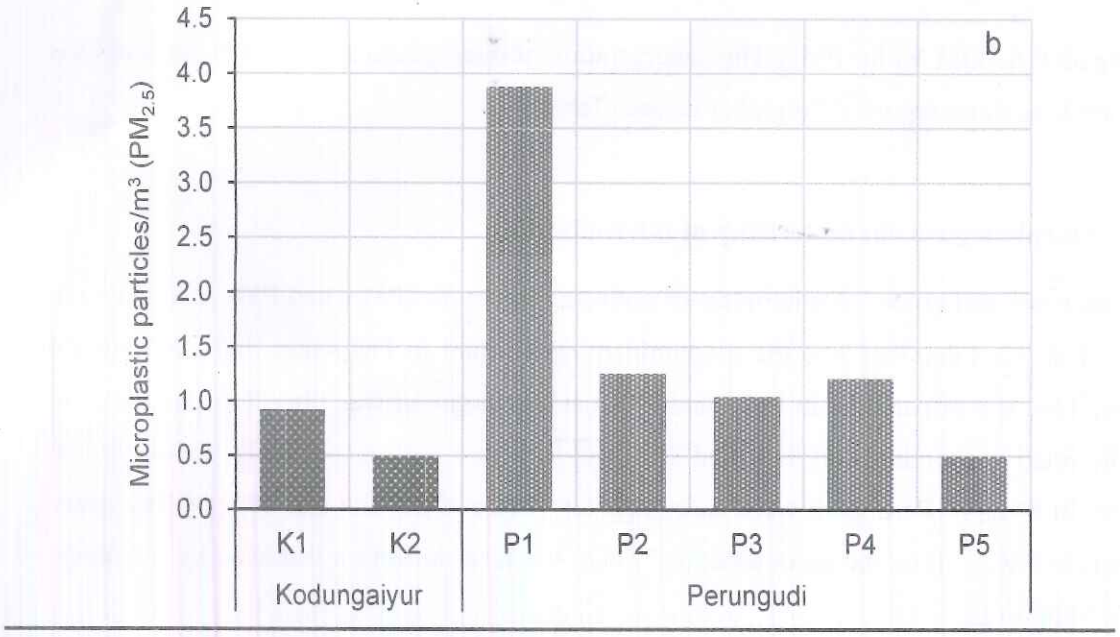


Figure 9: Abundance and distribution of microplastics in the air of Kodungaiyur and Perungudi (a) PM_{10} and (b) $PM_{2.5}$.

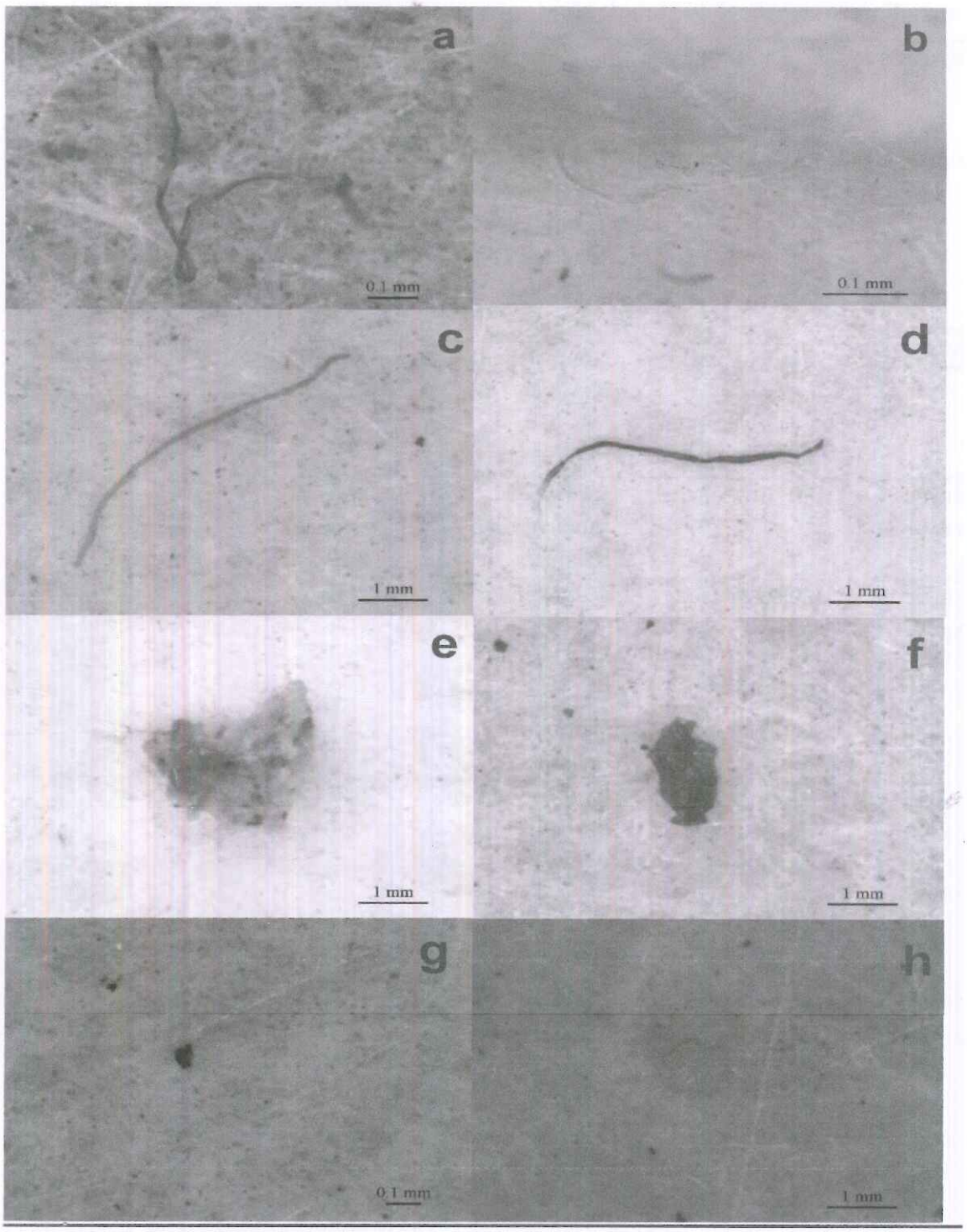


Figure 10: Micrographs showing different types of microplastics (a-d) fibers/lines and (e-h), fragments.

Table 10: Microplastics concentrations detected in the air of Kodungaiyur and Perungudi were compared to global values

Location	Samples Type	Method	Microplastics conc. (particles/m^3)	Reference
Shanghai, China	Urban megacity	KB-120F type intelligent middle flow total suspended particulate sampler	0–4.18	Liu et al., 2019a
Paris, France	Indoor and outdoor of Residential area of Paris city	Simple vacuum filtration array	0.3–1.5	Dris et al., 2017
Asaluyeh County, Iran	Industrial area	ECHO PM ambient filter sampler	0.3–1.1	Abbasi et al., 2019
West Pacific Ocean	Coastal area	KB-120F type intelligent middle flow total suspended particulate sampler	0.13 ± 0.24	Liu et al., 2019a
Cal State University, USA	Across 100 km of coastal Southern California, Semi-urbanized landscape	Simple vacuum filtration array	0.7–19.6	Gaston et al., 2020
Kodungaiyur, Chennai, India	Urban area, landfill site	High Volume Air Sampler	0.37–0.92 (PM10) 0.50–0.97 (PM2.5)	Present study
Perungudi, Chennai, India	Urban area, landfill site	High Volume Air Sampler	0.22–0.72 (PM10) 0.50–3.88 (PM2.5)	Present study

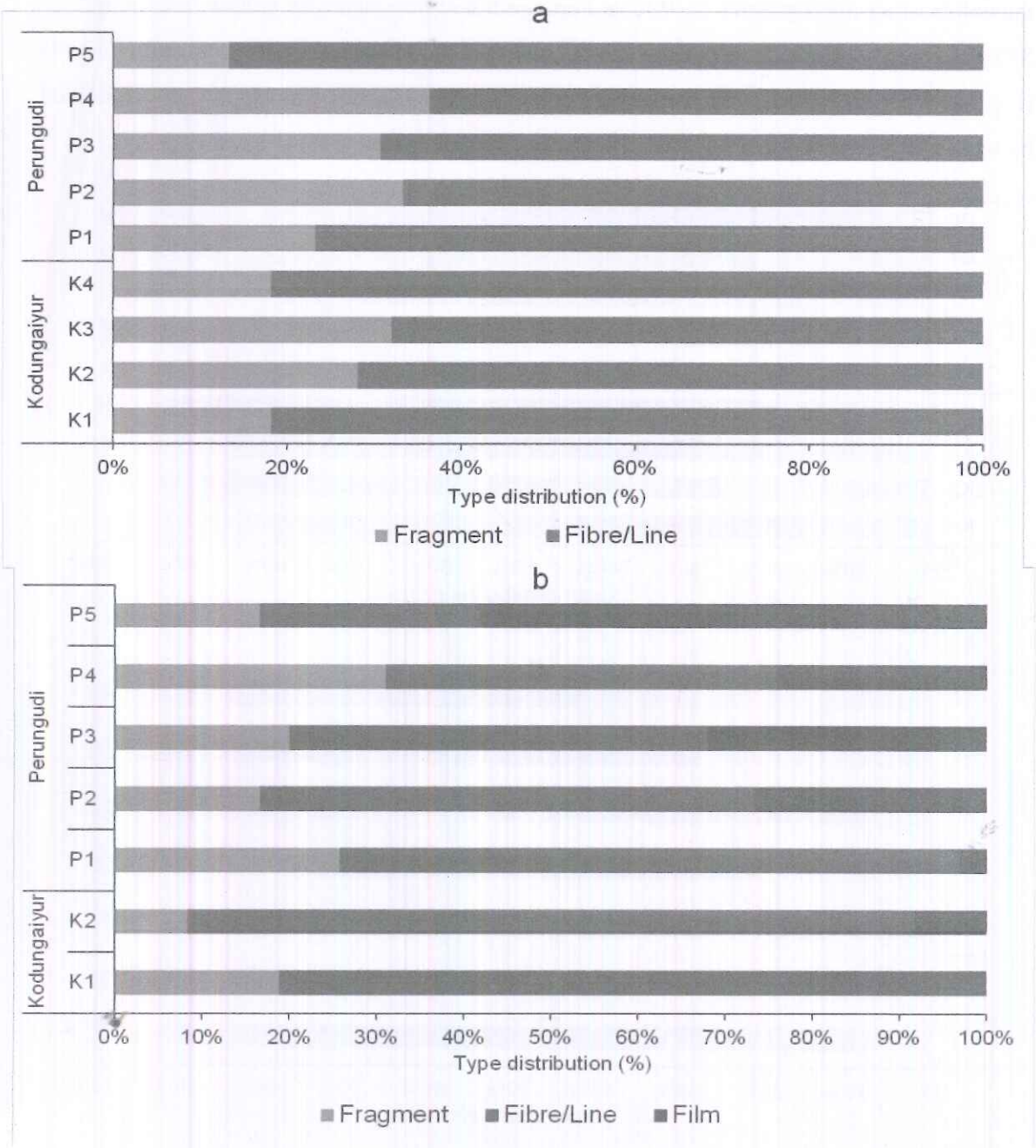


Figure 11: Percentage composition of microplastics types found in the air of Kodungaiyur and Perungudi (a) PM_{10} and (b) $PM_{2.5}$.

In the case of colored particle, black color was dominant in both PM_{10} and $PM_{2.5}$ with the relative contribution of 41% and 37% respectively at Kodungaiyur. The other colors in the order of abundance includes white (18%), yellow (16 %), blue (14%), red (10%) and green

(1%) in PM_{10} and blue (21%), yellow (18%), red (15%) and white (9%) in $PM_{2.5}$. Similarly, the colors of air microplastics in PM_{10} at Perungudi was dominated by yellow, accounting for 31% followed by black (26%), white (24 %), blue (12%), red (4%), green (2%) and violet (1) (Fig. 4). Whereas in $PM_{2.5}$ the dominatant colors of microplastics was black (24%) followed by white (23 %), yellow (21%), blue (18%), red (7%) and green (7%) (Figure 12).

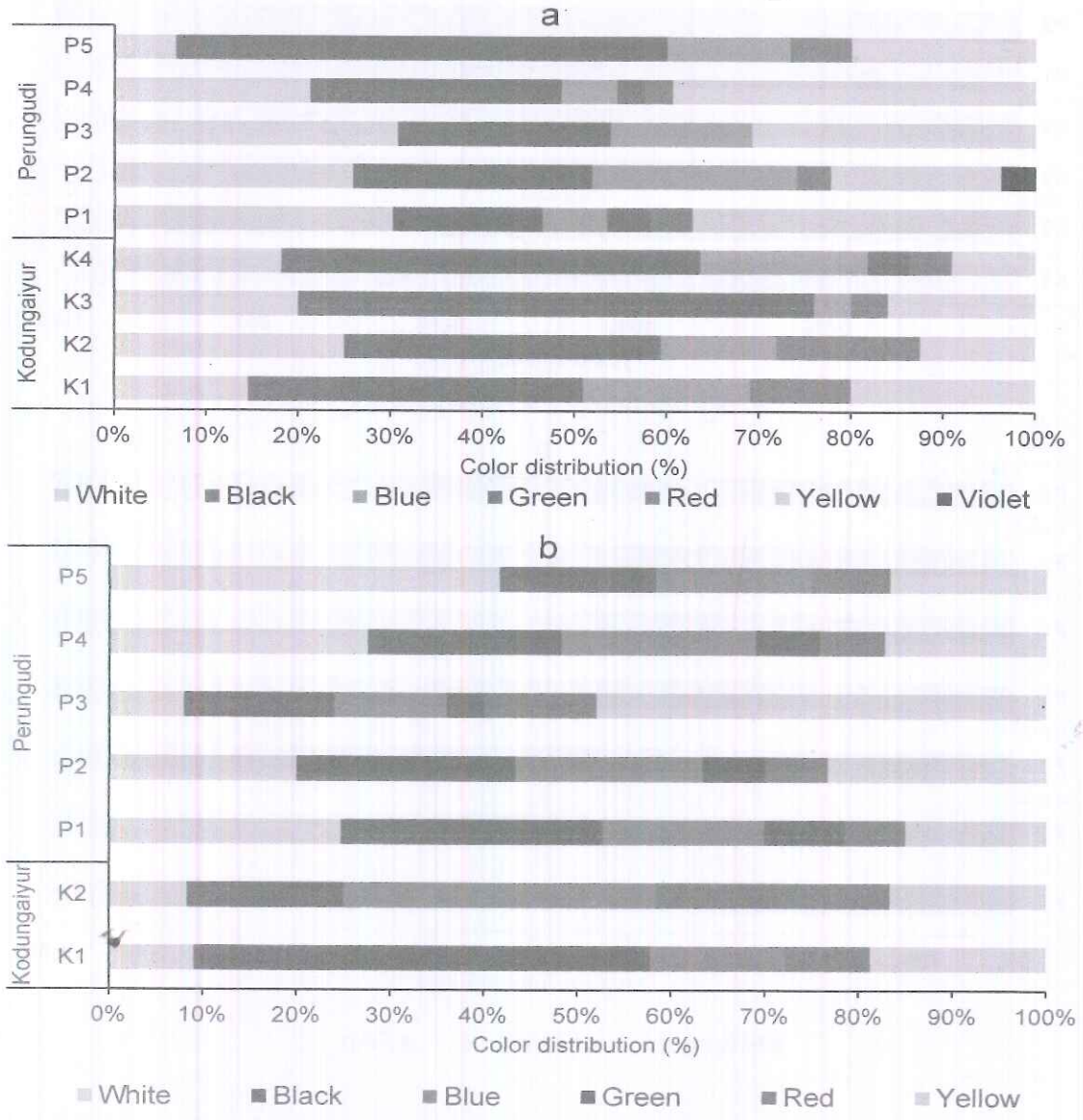


Figure 12. Percentage composition of microplastics colors found in the air of Kodungaiyur and Perungudi (a) PM_{10} and (b) $PM_{2.5}$.

9.0 Conclusions

i. GCC is not complying with the Solid Waste Management Rules, 2016 w.r.t. segregation, processing, disposal, leachate management and bio- remediation of legacy waste.

ii. Presently 4500-4800 TPD of fresh unsegregated solid waste is being dumped in two dumpsites (Kodungaiyur & Perungudi). GCC has not commenced the bio-mining/remediation of legacy waste at these dumpsites. However, in Perungudi dumpsites, the erection of machineries was under process for bio-mining.

iii. High value of COD (200-2500 mg/l), BOD (39-800 mg/l) & TDS (5000-25000 mg/l) reported in ground water samples collected from dumpsites confirms the pollution caused by dumpsites and also improper management of leachate generated from these dumpsites.

iv. Reported values of micro-plastics in leachate, ground water and ambient air are less as compared to those reported in similar samples in other countries (China, Iceland, Finland etc.)

v. The density of microplastics in the leachate, canal and ground water ranged between 0.75 and 32.0 particles/L. The maximum density was found in the leachates, invariably at both the sites.

vi. White colored particles were predominant in both Kodungaiyur and Perungudi waters with 47.1% and 44.2% respectively.

vii. A total of 11 polymer types were identified from the samples. At Kodungaiyur, 16 items were identified as Polyethylene (PE), followed by Polypropylene (PP, 3 Nos.), Poly cyclohexylenedimethylene terephthalate (PCT, 1 No.), Polyamide (PA, 1 No.), Cellulose (CE, 1 No.) and Polystyrene (PS, 1 No.).

viii. In Perungudi, 14 items were identified as Polyethylene (PE), followed by Epoxy resin (ER, 5 Nos.), Poly cyclohexylenedimethylene terephthalate (PCT, 3 Nos.), Polypropylene (PP, 3 Nos.), Vinyl acetate (VAC, 1 No.), Cellulose (CE, 1 No.) and Polystyrene (PS, 1 No.), Polyethylene terephthalate (PET) and Poly (1-butene) and isotactic (PB, 1 No.).

ix. An average of 0.56 particles/m^3 and 0.72 particles/m^3 of microplastics were recorded from PM10 and PM2.5 at Kodungaiyur. Similarly, a mean density of 0.44 particles/m^3 in PM_{10} and 1.58 particles/m^3 in PM2.5 at Perungudi.

x. Black color was predominant in both PM_{10} and $PM_{2.5}$ with the relative contribution of 41% and 37% respectively at Kodungaiyur. Whereas Yellow and black colored particles were dominant in PM_{10} and $PM_{2.5}$ of Perungudi respectively.

xi. The assessment of damage to environment in monetary terms and the cost of restoration can be assigned to NEERI or any other expert agencies.

10.0 Recommendations

Greater Chennai Corporation may be directed with following points for compliance of Solid Waste Management Rules, 2016:

1. GCC shall comply with Solid Waste Management Rules, 2016 w.r.t segregation, processing, leachate management and bio-mining /bio-remediation of the legacy waste.
2. To stop further dumping of unsegregated fresh solid waste on top of legacy waste and process the entire solid waste generated.
3. To initiate immediate necessary action to collect the leachate generated from the dumpsite and to treat in Leachate treatment plant. To ensure that no treated/untreated leachate reaches the nearby water bodies.
4. GCC shall expedite the process of bio-remediation of legacy waste in both dumpsites as per the CPCB guidelines and complete within shortest possible time (within one year).
5. Since the dumpsites are been operated from past 35 years in unscientific method, assessment of dumpsites w.r.t ground water, soil is required before utilizing the site.
6. Since the analysis results confirms the pollution of ground water and air in both dumpsites and also presence of microplastics in air and ground water around the dumpsites, the committee felt the assessment of damage to environment in monetary

terms and the cost of restoration can be assigned to NEERI or any other expert agencies.

TNPCB shall be directed with following:

1. To ensure that bio-mining/bio-remediation of legacy waste at two dumpsites are carried out as per the CPCB guidelines and to evaluate the works regularly.
2. To initiate necessary action against GCC for non-compliance of Solid Waste Management Rules, 2016.

Dr.S.Kaamiani,
Director
CentreforEnvironmental
Studies
AnnaUniversity, Chennai

Smt. Poornima B. M
Scientist 'D'
CPCB
Regional Directorate - Chennai

Thiru. V. Thyagarajan
Deputy Director (Labs)
TNPCB, Chennai

BEFORE THE NATIONAL GREEN TRIBUNAL SOUTHERN BENCH, CHENNAI.

Original Application No. 99 of 2021(SZ)

Suo Motu based on the News item in the Times of India Newspaper Chennai edition dated 5.4.2021 under the caption "Chennai you are breathing micro plastic"

Vs

The Chief Secretary to Government
Tamil Nadu, Chennai and Ors

...Respondents

Report of the Joint Committee in the matter of O.A.No.99 of 2021 in Suo Motu registtered on the basis of news paper report published in " The Times of India Chennai Edition" dated 05.04.2021 under caption "Chennai you are breathing micro plastic".

Advocate for Respondent: TNPCB
Thiru. S. Sai Sathya Jith,
Advocate, Chennai.

Date:31.03.2022

Hearing date on 28.04.2022

13

Annexure -II

BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL,

Principal Bench, New Delhi

Original Application No. 251/2022

In re: News item published in The Hindu dated 29.03.2022 titled "Detecting microplastics in human blood"

Index

S. No.	Particulars	Page No.
1.	**Report** in compliance of order dated 05.04.2022 in OA No. 251/2022, In re: News item published in The Hindu dated 29.03.2022 titled "Detecting microplastics in human blood".	
2.	**Annexure-1:** A copy of Minutes of Meeting on "Committee Meeting in compliance of Hon'ble NGT order in the matter of O.A. No. 251 of 2022" with CIPET/ICMR /NCSCM held on April 19th, 2022.	
3.	**Annexure-2 :** A copy of Hon'ble NGT order dated 05.04.2022.	

(Divya Sinha)
Scientist E
Central Pollution Control Board
Delhi-110032

Date: 10.02.2023
Place: Delhi

14

CENTRAL POLLUTION CONTROL BOARD
DELHI

Date: 08.02.2023

Report in the matter of Tribunal on its own motion SuoMotu based on the news item published The Hindu titled "Detecting Microplastics in human blood" dated March 29, 2022 (O.A. No. 251/2022)

A. BACKGROUND

Vide order dated 05.04.2022 in aforesaid matter, Hon'ble NGT issued the following directions

Para4: *There is need for further studies, considering the studies already conducted, to be steered by the Committee comprising of CPCB, ICMR, Central Institute of Petrochemicals Engineering & Technology (CIPET), NCSCM, and any other expert institutions as required, under the Nodal coordination of CPCB. Such studies and recommendations/ suggestionsmay cover standards for safe environment, remedial steps to reduce menace of micro plastic and addressing other incidental issues. CPCB may incur expenditure on studies and other incidents out of Environmental Compensation funds*

B. ACTION TAKEN REPORT

Three meetings of the Committee members representingCPCB, *ICMR, CIPET&, NCSCM*were held on April 19, July 27 & August 5, 2022 respectively through Video Conferencing.Issues related to microplastics were discussed during the Meetings. The Minutes of the Meetings are enclosed at Annexure I. Detailed assessment of the work done by individual organization as well as available information on Microplastics has been completed and the outcome of the same is enumerated below:

1.0 About Microplastics

Microplastics is used extensively to describe plastic particles with an upper size limit of 5 mm (UNEP). Occurrence of microplastics has been reported from oceans, sediments, surface water, ground water, wastewater, tap water, bottled water, air, food products, aquatic organisms, and human (Microplstics in Drinking Water WHO 2019). Based on their origin; microplastics can be categorized into primary and secondary microplastics. Primary microplastics are intentionally manufactured in size < 5 mm to be used in various applications such as cosmetics, clothing and other textiles, fishing nets, etc. (Mai et al.

2018). Secondary microplastics originate from the breakdown of discarded plastic waste by solar radiation, mechanical degradation, microbial action etc. (Rodrigues et al. 2018; Wagner and Lambert 2018).

These microplastic particles may be of various shapes such as fragments, pellets, beads, and fibres. (Figure1.1). Further classification of microplastics on the type of plastic and its density is given in Table 1.1

Figure 1.1: Micrographs showing different types of microplastics: (a&b) fragments, (c&d) fibre/line, (e&f) film (g) foam and (h) pellet.

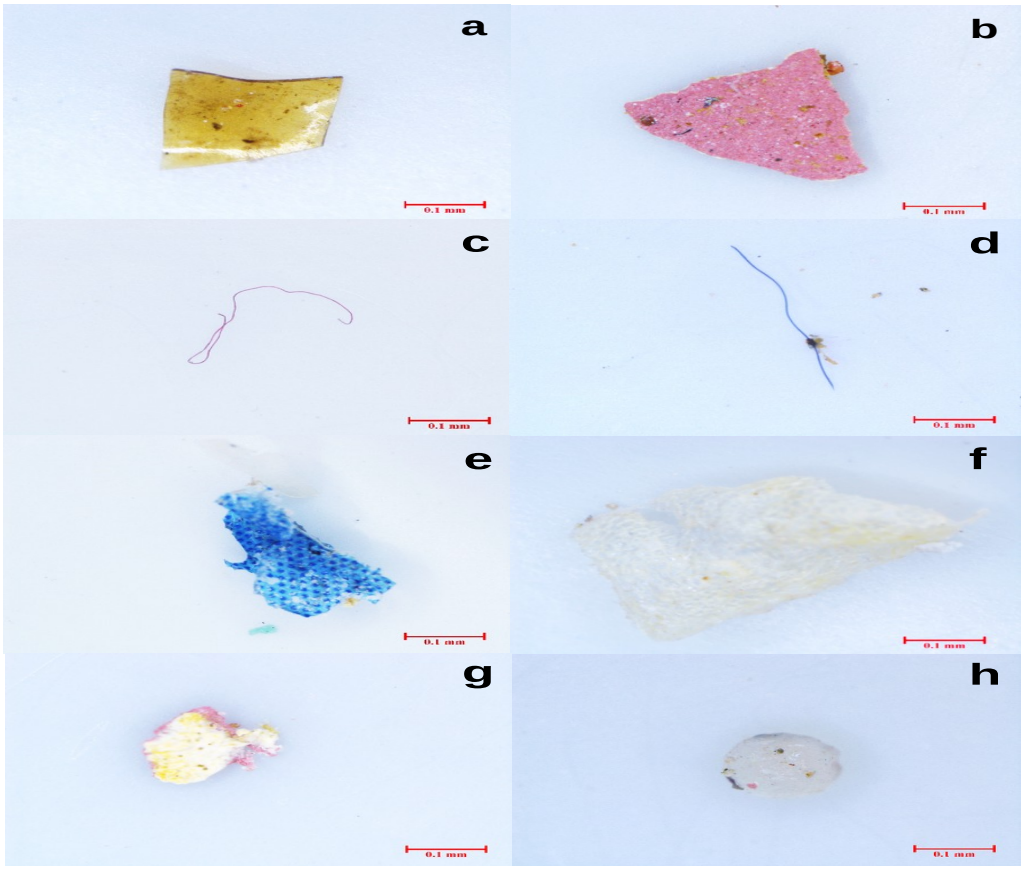
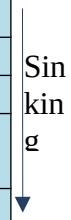


Table 1.1: Type & Density of Microplastics

Common Polymers of Microplastics	Common applications	Specific Gravity
Polyethylene (PE)	Plastic bags, six-pack rings,	0.91-0.94

Flo
ati
ng

	gear	
Polypropylene (PP)	Rope, bottle caps, gear, strapping	0.90-0.92
Polystyrene (expanded) (PS)	Bait boxes, floats, cups	0.01-1.05
Seawater		~1.02
Polystyrene (PS)	Utensils, containers	1.04-1.09
Polyvinyl Chloride (PVC)	Film, pipe, containers	1.16-1.30
Polyamide or nylon	Gear, rope	1.13-1.15
Polyethylene terephthalate (PET)	Bottles, strapping, gear	1.34-1.39
Polyester resin + glass fibres	Textiles	>1.35
Cellulose acetate	Cigarette filters	1.22-1.24



2.0 Sampling & Analysis of Microplastics

There is currently no standard method for sampling and analysis of microplastics in the environment. ISO is currently working on the subject (WHO Report :Microplastics in Drinking Water: 2019)

Sampling and analysis of microplastics, based on available literature, involves the following three steps:

a) Sampling;
b) Sample extraction and isolation &
c) Identification, characterization and quantification

2.1 Sampling

Microplastic samples can be acquired using trawl nets drawn across the surface of the water, or through collection of water samples from which the particles are extracted later.

2.2 Sample Extraction

Sample purification usually involves filtration, followed by some sort of extraction process such as density separation, in which samples are mixed with a liquid of defined density, allowing microplastic particles to float and heavier particles to sink. Further purification may require chemical or enzymatic methods to remove organic or inorganic contaminants (biofouling). The extent of the preparation is dependent on the nature of the samples: dirtier samples will require more preparation.

2.3 Analysis

2.3.1 Count of Microplastics

The simplest and the most common technique to quantify the microplasticsparticles is the optical microscopy where quantification is achieved through manual counting.Though this technique is simple, it poses limitations in terms of misidentification and reduced accuracy (underestimation (Loder et al. 2015) / overestimation (Lenz et al. 2015)). However,application of electron microscopic techniques, such as scanning electron microscopy can overcome this limitation up to some extent (Eriksen et al. 2013)

2.3.2 Chemical Composition

Two different approaches are available to determine the chemical composition: spectroscopic&thermoanalytical.

- **Spectroscopic methods**: Used to identify the specific chemical structure of polymers by comparing their absorption or emission spectra with reference spectra. Fourier transform infrared spectroscopy (micro FTIR) Fourier transform infrared spectroscopy and Raman spectroscopy are utilized for this purpose.
- **Thermo-analytical methods**, the sample ispyrolysed under inert conditions, so that specific decomposition products of the individual polymers can be analyzed. Pyrolysis-gas chromatography/mass spectrometry (GC/MS) can provide information on additives as well as the polymer

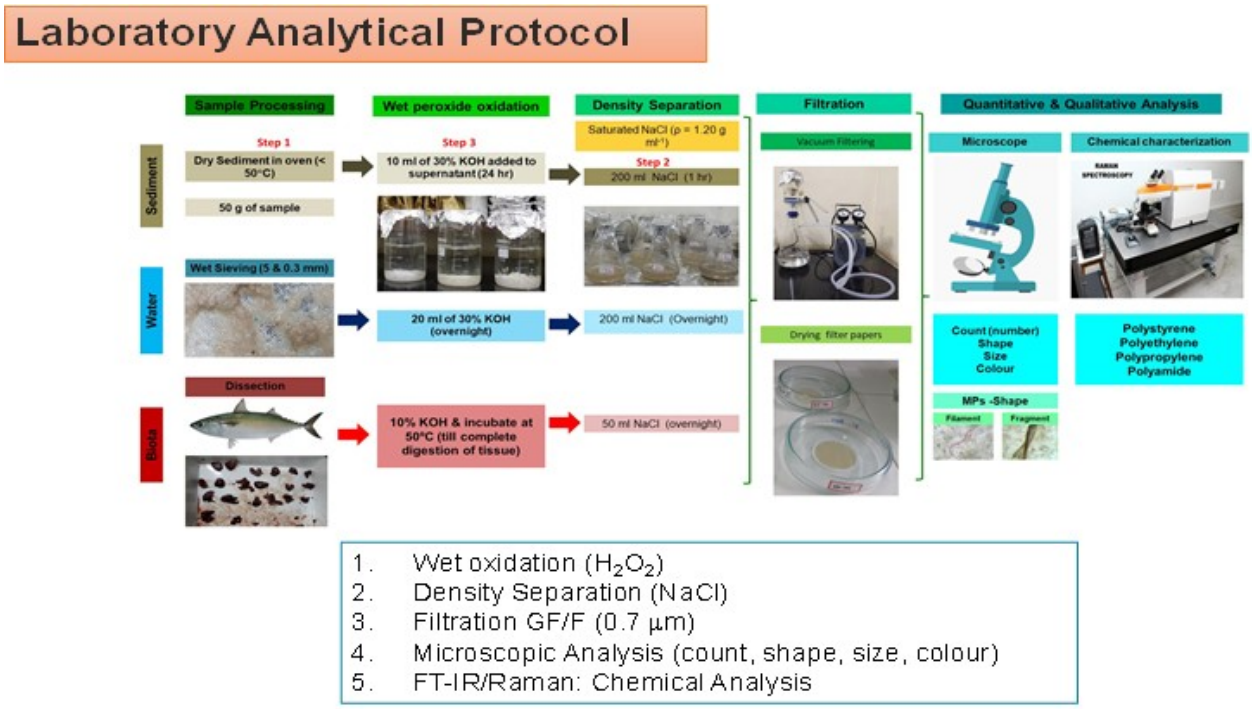
2.4. Sampling & Analysis Methods followed in India

2.4.1 Ministry of Earth Sciences (National Center for Coastal Research (NCCR))

(a) Sampling Methods

18

(b) Sample Extraction & analysis



1. Wet oxidation (H_2O_2)
2. Density Separation (NaCl)
3. Filtration GF/F (0.7 µm)
4. Microscopic Analysis (count, shape, size, colour)
5. FT-IR/Raman: Chemical Analysis

2.4.2 CIPET

(a) Sample extraction techniques:

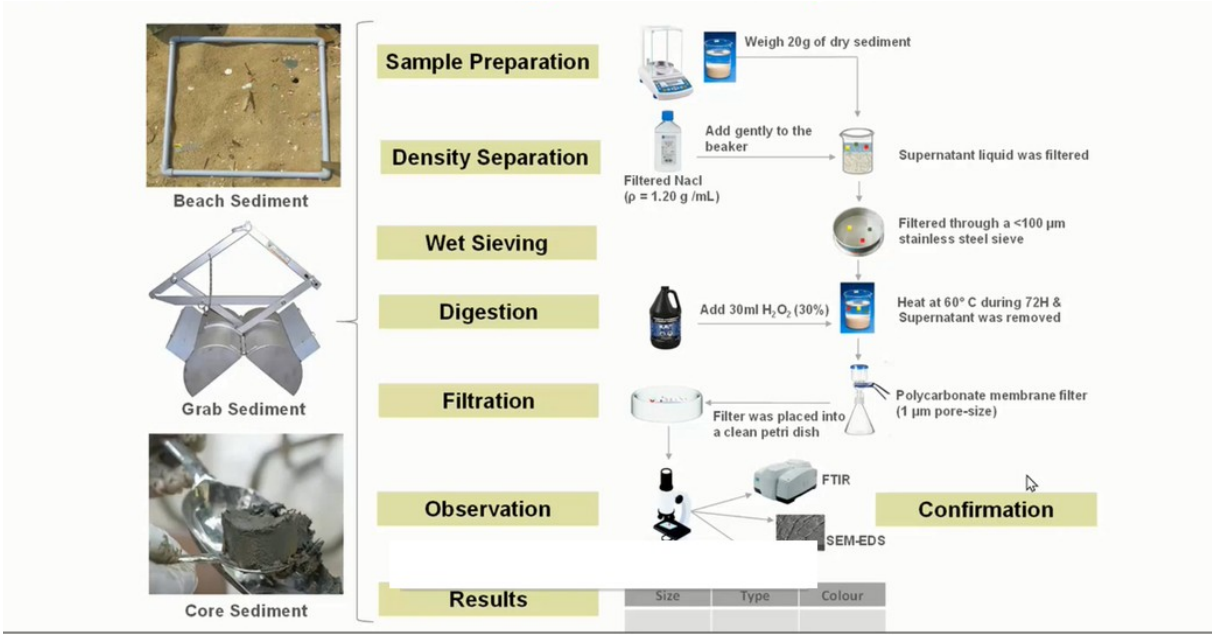
- Quality Control (Running blank samples)
- Preparation of salt solution:
- Density Separation
- Wet Peroxide Oxidation
- Sieving
- Vacuum Filtration

(b) Qualitative analysis:

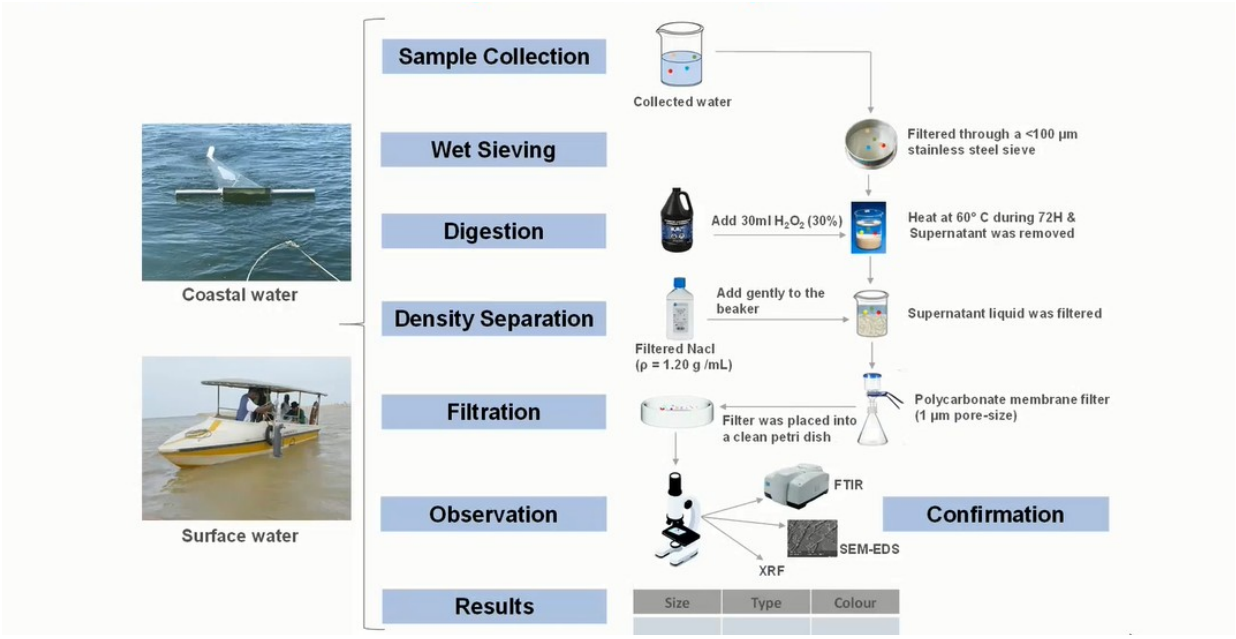
- Optical Microscope: The analysis is done through different magnification ranges i.e. 5x,10x and 20x to for various shape and sizes of microplastics.
- Micro-FTIR: In this technique, the spectra obtained by of targeted microplastics are analysed through the peaks obtained and analysing them through the functional group.
- Pyrolysis GC-MS: The thermal technique is used for the knowledge of degradation products of the microplastics found in the sample.
- Number of microplastic samples found in per litre of sample in each location was analysed along with various shapes and colours.

2.4.3 NCSCM

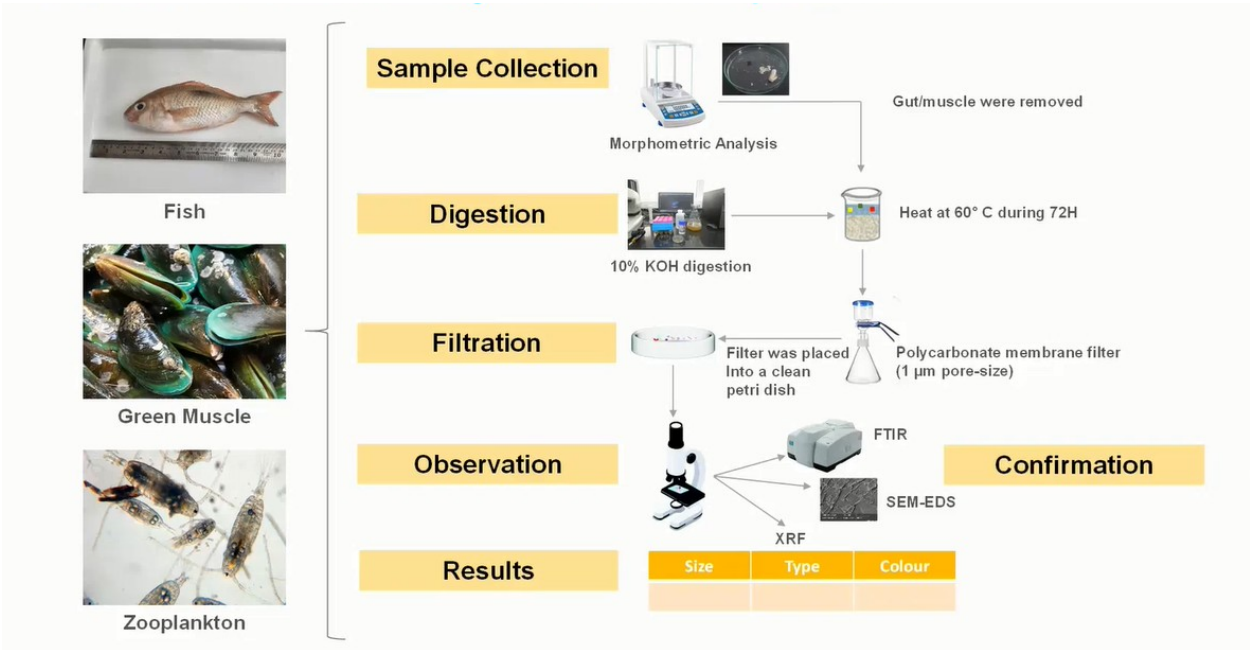
(a) Sample Extraction & analysis (Sediments)



(b) Microplastic Analysis in Water



a. Microplastics analysis in Biota



2.5 Observations

(a) Sampling and analytical methods adopted by different institutions in India are similar with minor variations

(b) Standard method for Sampling & Analysis developed by BIS/ISO is essential to formalize further action on monitoring reports.

3.0 Assessment of Microplastics

21

Microplastics (both primary and secondary) pollute drinking water sources primarily through discharge of sewage/wastewater treatment plant effluent and surface run-off. There are large numbers of industries that use (primary) microplastics for various applications, such as medicines, cosmetics etc. After their use, these primary microplastics get washed off and become a part of the domestic wastewater (Singh et al. 2021). As the sewage/wastewater treatment plants are not equipped for the complete removal of microplastics, the effluent released from these plants contains substantial quantity of microplastics (Amrutha and Warrier 2020). Upon mixing of this effluent with the freshwater sources, microplastics become part of the fresh/drinking water supply chain (Magnusson and Noren 2014; Novotna et al. 2019). It is also important to note that many components of water treatment plants and water distribution system are usually made up of plastic materials, such as high density polyethylene, polyvinyl chloride, polypropylene etc. (Mintenig et al. 2019) and hence, these further contribute towards microplastic generation in the water they carry.The treated bottled water is also reported to contain microplastics (Mason et al. 2018;Pivokonsky et al. 2018). Nevertheless, the smallest microplastic particle reported in case of drinking water is 1 µm (WHO 2019). Evidence suggests that it is the bottling process and/or packaging of the plastic bottles/caps that largely contributes to the generation of microplastics.

In the air, suspended microplastic particles have been isolated from various places, such as, urbanized city centres, indoor households, and remote outdoor regions. As there is wide range of microplastics' size, it is highly likely that these particles are inhaled by the humans (Jenner et al. 2022).

Soil can get affected from plastics through various means such as plastic mulch films, municipal so waste, sewage sludge, fertilizers coated with plastics etc. (McCormick et al.2014; Blasing and Amelung 2018; Liu et al. 2018). A significant positive correlation has been seen between the rate of sludge applied onto the soil and concentration of microplastic particles in the soil (Zhang et al. 2020).

Various organizations including CIPET, NCSCM, NCCR (MoES), NPC & CPCB have conducted microplsatic monitoring. Further international organization including UNEP, WHO and OECD have worked extensively on Microplastics and published comprehensive Reports. Based on aforementioned Sources of generation of microplastics, transfer media and end use areas have been identified. Further details of microplastics(concentration, type etc) for these areas have been compiled. Details are given in Table 3.1

Table 3.1 : Sources of Generation &Analysis& of Microplastics

S.N.	**Class**	**Category**	**Subcategory**	**Description**	**Analysis data**	**Reference**
1.	**Generation**					

22

S.N.	Class of Microplastics	Category	Subcategory	Description	Analysis data	Reference
a	Industry	(i)During production	Toothpaste		NA	UNEP
			Cosmetics	Microbeads in skin care	NA	UNEP
			Printer , ink, spray, injection moulding		NA	UNEP
			Plastic production	Emissions/ spillages	NA	UNEP
			Ship breaking		NA	UNEP
			Cigarette filters		NA	UNEP
		(ii)During Usage	Synthetic textiles	Use & washing	100 microfibers/L	UNEP,OECD
			Horticulture	Plastic Sheeting / Tube	NA	UNEP
			Road Transport	Tyre & Road wear particles	NA	OECD, WHO
			Paint from Building & Ships		NA	OECD
			Bottled Water	Caps & bottle	Section 3.1	WHO
			Synthetic Soles of Shoes		NA	WHO
b	Improper waste management	(i) Land Litter		Degradation under specific temp & UV rays	NA	UNEP, WHO
		(ii)Dumpsites		Degradation under specific temp & UV rays	NA	UNEP, WHO

23

S.N.	**Class**	**Category**	**Subcategory**	**Description**	**Analysis data**	**Reference**
		(iii)Marine litter		Degradation under specific temp & UV rays	NA	UNEP
c	Ocean Activities			Fishing Nets, Boxes, Rope, galley waste;	NA	UNEP, MoES
				Aquacuture - nets, floating	NA	UNEP
				Coastal Tourism	NA	UNEP NCSCM
				Offshore Oil & Gas Platform	NA	UNEP
d	Outflow from sewage treatment plant			Waste water treatment plant can effectively remove microplastics , but in most area adequate sewage treatment systems not provided	NA	WHO
e	Agricultural Runoff			When waste water sludge is used as compost	NA	WHO
f	Stormwater drains			Carrying Road dust	NA	WHO
g	Leachate			Leachate	Section 3.2	CPCB
2	**Transfer of Microplastics**					
a	Surface Water				Section 3.3	CPCB, NPC
b	Soil / Beach Sediment				Section 3.4	MoES, NCSCM
c	Sludge				NA	
d	Fish				Section 3.5	MoES **NCSCM**
e	Ocean				Section	MoES,

S.N.	Class	Category	Subcategory	Description	Analysis data	Reference
	water				3.6	NCSCM
3	**End use**					
a	Ground Water				Section 3.7	CPCB. WHO
b	Drinking Water			Microplastics have been identified in drinking-water as small as 1 µm, based on the smallest particle size detected by current methods. Large particles occur less frequently than small particles. The predominant particle shapes are fragments and fibres. The predominant plastic types are PET and PP	Table 3.1	WHO
c	Ambient Air			Tyre & Road wear dust	Section 3.8	WHO, CPCB

3.1: Drinking Water & Bottled Water

(a) WHO

Table 3.2 : MP comncentration in Tap Water / Bottled Water

Author	Water type	Lower size bound (µm)	Particles/L in sample (average)	Particles/L in blanks (average)
Oßmann et al.	Bottles (mineral water)	1	3074-6292	384

	•Glass •Single use PET •Reusable PET		2649 4889	
Pivokonsky et al. (2018)	DWTP from surface water sources (3 sites	1	628 338 369	<5% of counts in samples
Schymanski et al. (2018)	Bottles •Single use •Returnable •Glass •Beverage carton	5-20	 14 118 50 11	14±13
Mason, Welch and Neratko (2018)	Bottled	6.5-100 Lower bound based on microscope and software	315	23.5
Strand et al. (2018)	Tap from ground-water sources	10-100	0.2, 0.8 and 0.0 (LoD = 0.3)[4]	Unknown
Mintenig et al. (2019)	Tap from ground-water sources.	20	0.0007	0.67 particles/ L 0.3 fibres/L
Uhl, Eftekhardadkhah, and Svendsen (2018)	Tap from 24 sources	60	Average not reported since only a single result above LoQ (that result was 5.5)	0.5 (LoQ = 4.1 LoD= 0.9)
Mason, Welch and Neratko (2018)	Bottled	>100	10.4	4.15
Strand et al. (2018)	Tap from ground-water sources	>100 (10 µm sieve size)	0.312 (LoD = 0.58)	0.26
Kosuth, Mason and Wattenberg (2018)	Tap from unspecified sources	100 lowest reported	5.45	0.33 (based on 5 particles in 30 blanks (ea. 500mL))

26

3.2 Leachate from Dumpsite

Table 3.3. : Leachate (CPCB)

Location	Type of water	Microplastics concentration (particles/ L)	Reference
South China	Leachate	3 to 25 particles/L	Wan et al. 2022
Suzhou, China	Leachate	235.4 ± 17.1 particles /L	Sun et al. 2021
China	Leachate	0.42 to 24.58 particles/L	He et al. 2019
Shanghai, China	Leachate	4 ± 13 particles/L	Su et al. 2019
Lahti, Finland	Leachate	1.97 particles/L	Praaghet al. 2018
Alfsnes, Iceland	Leachate	4.51 particles/L	Praaghet al. 2018
Kodungaiyur, India	Leachate	0.75 to 16.2 particles/L	CPCB
Perungudi, India	Leachate	0.8 to 32 particles/L	CPCB

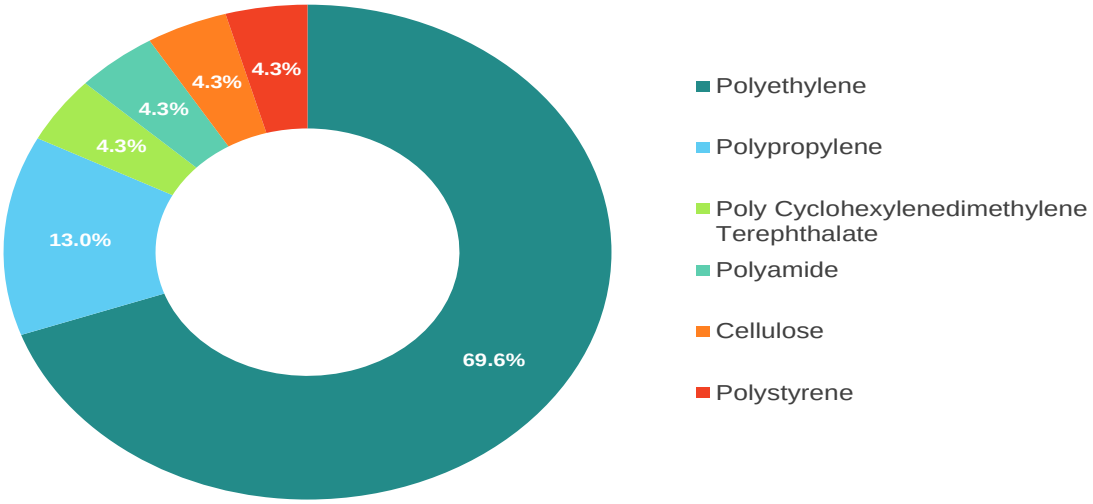


Figure 3.1 : Percentage composition of different types of plastics found in Leachate (CPCB)

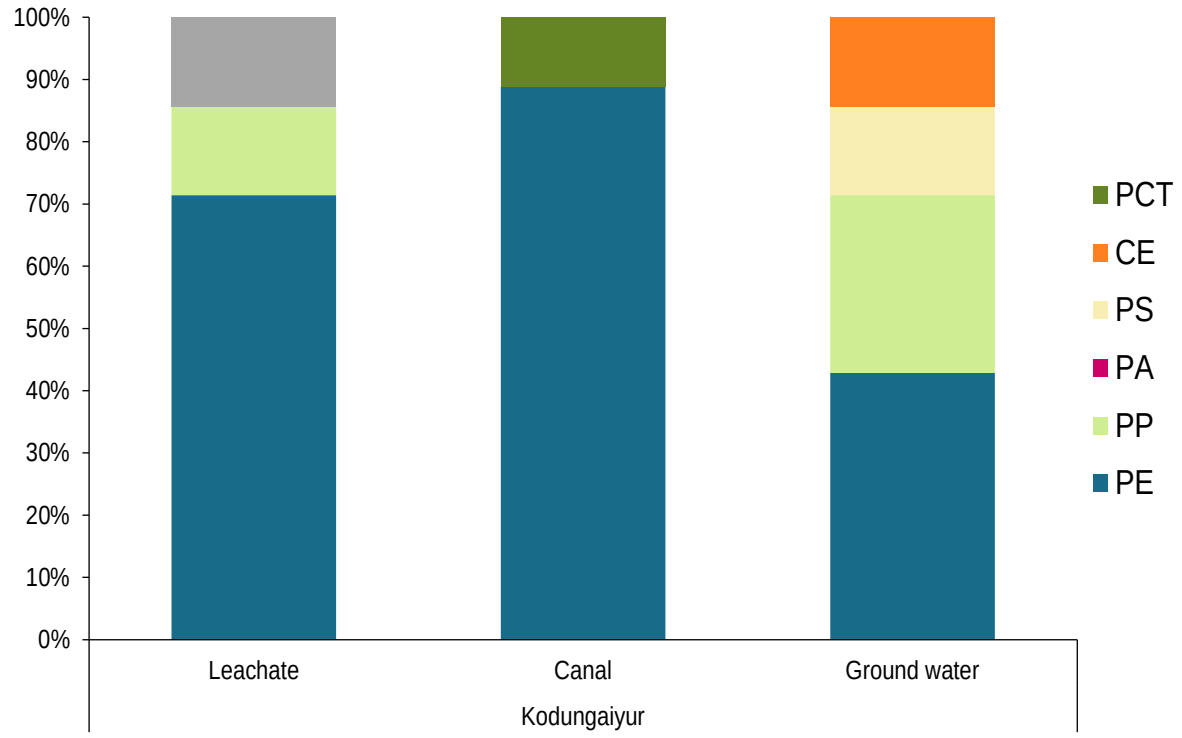


Figure 3.2: Percentage composition of microplastics in leachate, canal and groundwater samples around in dumpsite (CPCB)

3.3 Surface water

Table 3.4 Microplastics in Surface Water (WHO)

Location	Results reported (particles/L)	Sieve size (µm)	Study
Groundwater, Germany	Average:[b]0.7×10^{-3} Range:[b]$0\text{-}7\times10^{-3}$	3	Minteniget al. 2019
Three Gorges Reservoir, China	Average: 4.7 Range: 1.6 – 12.6	48	Di and Wang, 2018
Dongting Lake and Hong Lake, China	Averages: 1.2 and 2.3 Ranges: 0.9-2.8 and 1.3-4.7	50	Wang et al. 2018
Wuhan, China	Range: 1.6-8.9	50	Wang et al. 2017
Rhine river, Switzerland, France, Germany, Netherlands	Average: 0.0056	300	Mani et al. 2015
Western Lake Superior, USA	Average: 0.00026	333	Hendrickson, Minor, and Schreiner, 2018

28

Figure 3.3 Microplastics identified in the River
(Sizes of Plastic like Particles in Water Samples in percentage in four cities)(NPC)

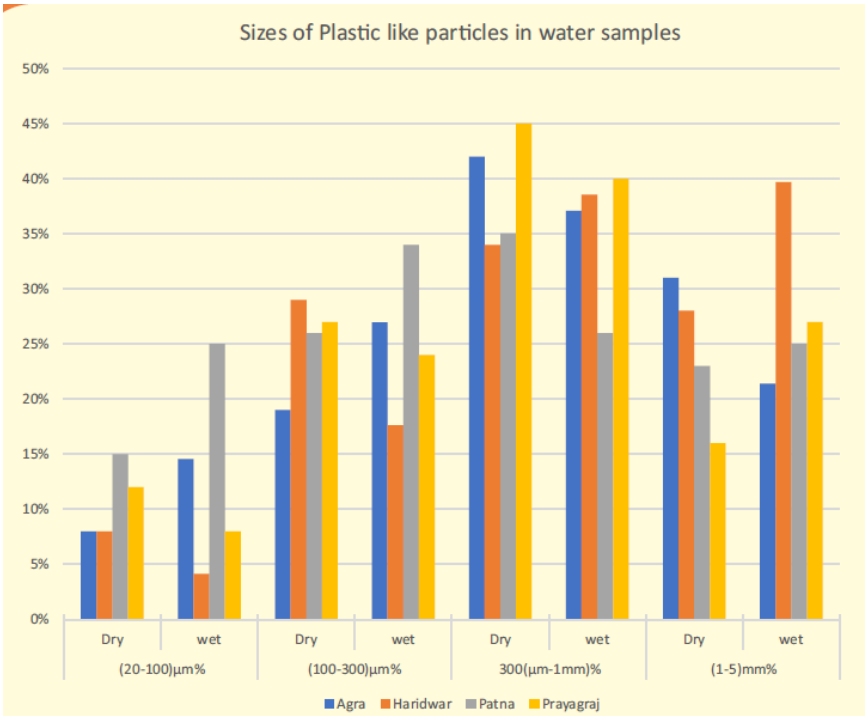
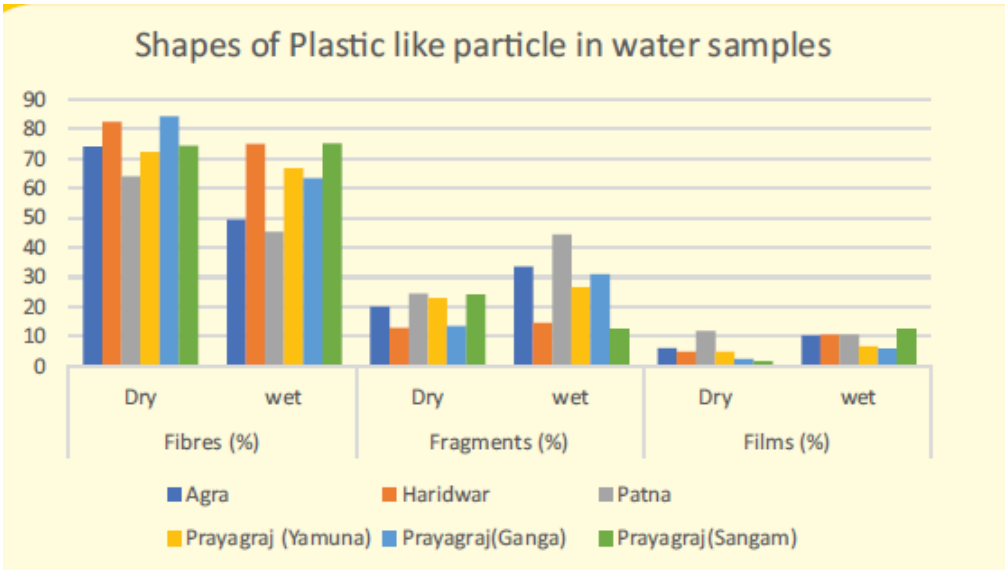
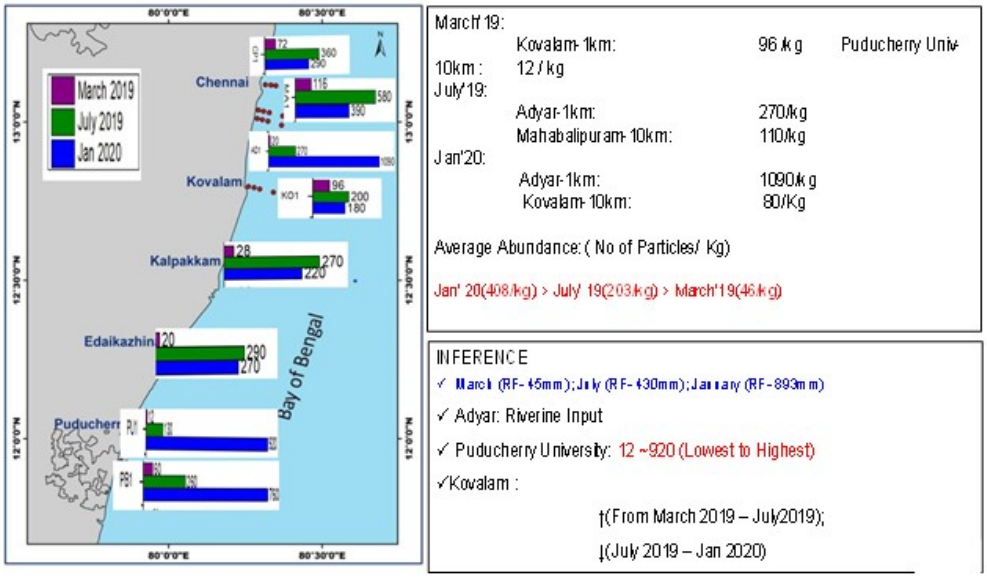


Figure 3.4 Microplastics identified in the River
(Shapes of Plastic like Particles in Water Samples amongst Fibres/Fragments/Films in percentage in four cities) (NPC)

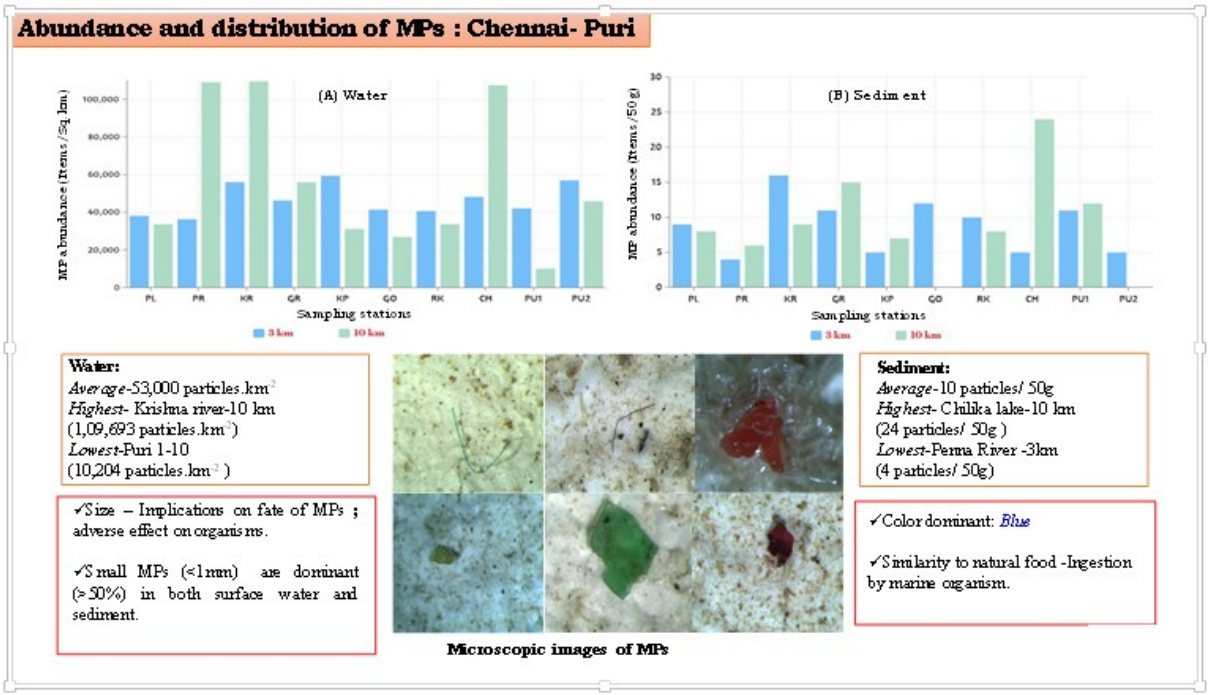


Section 3.4 :Beach Sediment/ Deep Sea Sediments
(a) Figure3.5 Microplastics (MoES- NCCR)
(Microplastic sediments –Chennai-Puducherry)

29



(b) Figure3.6Microplastics (MoES- NCCR)
(Microplastic sediments –Chennai-Puri)



(c) Beach sediments (NCSCM)

Abundance of microplastics in terms of numbers of particles and their range, in the beach sample reported from different parts of the world and long the Tamil Nadu coast () Table 3.5

30

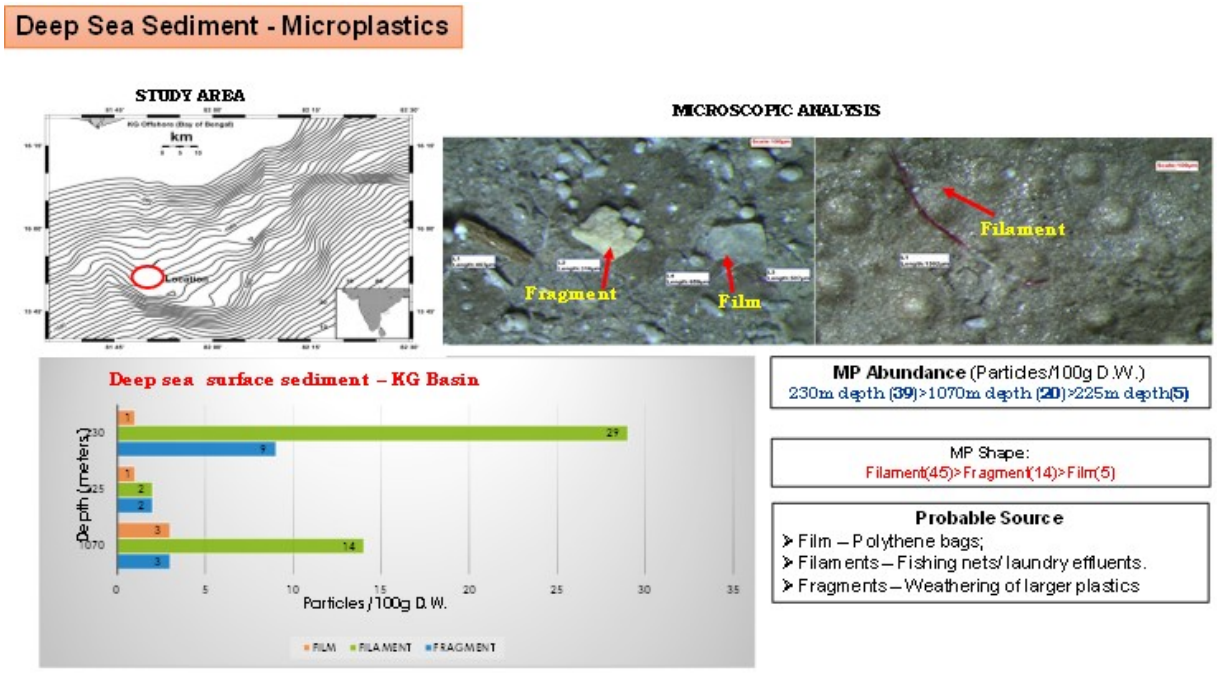
S.No.	Location	Range	Mean ±	Reference

31

1.	Charleston, Harbor, USA	42 to 1196/m^2	413.8 ± 76.7/ m^2	Grayet al. 2018
2.	Winyah Bay, USA	51 to 441/m^2	221.0 ± 25.6/ m^2	Grayet al. 2018
3.	Guanbara Bay, Brazil	12 to 1300/m^2	-	Carvalho and BaptistaNeto , 2016
4.	Bostanu, Persian Gulf	-	1258 ± 291/kg	Najiet al. 2016
5.	Gorsozan, Persian Gulf	-	122 ± 23/kg	Najiet al. 2016
6.	Norther Gulf on Mexico	-	50.6 ± 9.96/ m^2	Wessel et al.2016
7.	South Korea	2 to 92,217/m^2	8205/m^2	Lee et al. 2013
8.	Chile	1 to 169/m^2	30 ± 2.6/m^2	Hidalgo-Ruz and Thiel, 2013
9.	Easter Island	-	800 ± 320/m^2	Hidalgo-Ruz and Thiel, 2013
10.	South Korea	-	976 ± 405/m^2	Heoet al. 2013
11.	Mumbai, India	12 to 960/m^2	68.8/m^2	Jayasiriet al. 2013
12.	Otzias beach, Eastern Mediterranean	20 to 1218/m^2	575/m^2	Kaberiet al. 2013
13.	Portugal coast	1 to 137/m^2	26.6 ± 32.5/m^2	Martins and Sobral, 2011
14.	Malta, Central Mediterranean	0 to 1462/m^2	33.3/m^2	Martins and Sobral, 2011
15.	Belgium	-	91.9/kg	Claessenset al. 2011
16.	Hawaiian Archipelago	4 to 17,645/m^2	-	McDermid and McMullen, 2004
17.	Tamil Nadu Coast, India	2 to 178/m^2	46.6 ± 37.2/m^2	R. Karthik et al.

32

Figure 3.7 Deep Sea MicroplasticConcentration (MoES)



Section 3.5 Microplastics in Fish

Figure 3.8Microplastics in Biota (MoES)

33

MPs in biota - Chennai coast

- 7- Finfish & 3- Shellfish
- Average ingestion of MPs was higher in Shellfish (28.2±10.9 Nos./Ind.) than finfish (1.3±1.1 Nos./Ind.)
- Shape - Dominant - Fibres.
- Dominant size range - 1-1000 µm
- Red MPs (finfish), black MPs(Shellfish) are predominant
- Major polymers - Polyamide (PA), Polyethylene (PE), and Polypropylene (PP)

Section 3.6 Coastal Water

Abundance ranged between 0.22 and 3.58 particles/m3 with an average of 1.25 ± 0.88 particles/m3 (n = 14) (NCSCM).

Figure 3.9Microplastics in Coastal Water (Global distribution of mean microplastic particles (particles/m') in the coastal waters and comparison)

1. Western Portion Guanabara Bay, Brazil (Olivatto et al., 2019)
2. Kingston Harbour, Jamaica (Rose and Webber, 2019)
3. South China Sea (Cai et al., 2018)
4. Southern Sri Lanka (Koongolla et al., 2018)
5. Balearic Islands, Spain (Ruiz-Orejon et al., 2018)
6. Small Island of Bintan, Indonesia (Syakti et al., 2018)
7. Sea of Marmara (Tunçer et al., 2018)
8. Guanabara Bay-Brazil (Figueiredo and Vianna, 2018)
9. Italian minor Islands - Lucia et al., 2018
10. Tuscany coastal waters, Italy (Baini et al., 2018)
11. Aegean-Levantine Sea (Van der Hal et al., 2017)
12. Bay of Brest, France (Frere et al., 2017)
13. Southern Ocean (Isobe et al., 2017)
14. Bohai Sea, China (Zhang et al., 2017)
15. Rose Sea, Antarctica (Cincinelli et al., 2017)
16. North-eastern section of Qatar (Castillo et al., 2016)
17. Adriatic Sea (Suaria et al., 2016)
18. East Asia Sea, Japan (Isobe et al., 2015)
19. Arctic Polar water (Lusher et al., 2015)
20. Kyeonggi coast, South Korea (Chae et al., 2015)
21. Southeast Korea, coast (Kang et al., 2015)
22. Costa Vicentina, Portuguese coast (Frias et al., 2014)
23. Northeast Atlantic, Ireland (Lusher et al., 2014)
24. East China Sea (Zhao et al., 2014)
25. Northeast Pacific, California (Doyle et al., 2011)
26. Southwest coast, India (**Present study**)

Section 3.7 Microplastics in Groundwater

Table 3.6:Microplastics in Groundwater (CPCB)

Location	**Type of water**	**Microplastics concentration (particles/ L)**	**Reference**
South China	Leachate	3 to 25 particles/L	Wan et al. 2022
Suzhou, China	Leachate	235.4 ± 17.1 particles /L	Sun et al. 2021
China	Leachate	0.42 to 24.58 particles/L	He et al. 2019
Shanghai, China	Leachate	4 ± 13 particles/L	Su et al. 2019
Lahti, Finland	Leachate	1.97 particles/L	Praaghet al. 2018
Alfsnes, Iceland	Leachate	4.51 particles/L	Praaghet al. 2018
Kodungaiyur, India	Leachate	0.75 to 16.2 particles/L	CPCB study 2022
Perungudi, India	Leachate	0.8 to 32 particles/L	CPCB study 2022
South China	Groundwater	11 to 17 particles/L	Wan et al. 2022
Australia	Groundwater	16 to 97 particles/L	Samandraet al. 2022
Karst, US	Groundwater	15.2 particles/L	Pannoet al. 2019
Kodungaiyur, India	Groundwater	0.87 particles/L	CPCB study 2022
Perungudi, India	Groundwater	2.1 particles/L	CPCB study 2022

Section 3.8 Microplastics in Ambient Air

Table 3.7: Microplastics concentrations detected in the air at Dumpsites in India vsMicroplastics measured at different locations across the globe(CPCB)

Location	Samples Type	Method	Microplastics conc. (particles/m^3)	Reference
Shanghai, China	Urban megacity	KB-120F type intelligent middle flow total suspended particulate sampler	0–4.18	Liu et al. 2019a
Paris, France	Indoor and outdoor of Residential area of Paris city	Simple vacuum filtration array	0.3–1.5	Driset al. 2017
Asaluyeh County, Iran	Industrial area	ECHO PM ambient filter sampler	0.3–1.1	Abbasiet al. 2019
West Pacific Ocean	Coastal area	KB-120F type intelligent middle flow total suspended particulate sampler	0.13 ± 0.24	Liu et al. 2019a
Cal State University, USA	Across 100 km of coastal Southern California, Semi-urbanized landscape	Simple vacuum filtration array	0.7–19.6	Gaston et al. 2020
Kodungaiyur, Chennai, India	Urban area,landfill site	High Volume Air Sampler	0.37–0.92 (PM10) 0.50–0.97 (PM2.5)	CPCB study 2022
Perungudi, Chennai, India	Urban area, landfill site	High Volume Air Sampler	0.22–0.72 (PM10) 0.50–3.88 (PM2.5)	CPCB study 2022

3.9 Observations

- Quantification of Microplastic generation at source has not been done for most of the Sources
- Variation in Microplastic concentrations units reported by different organizations observed
- Most of the monitoring has been done in Coastal Areas

4.0 Risk Assessment

Microplastics can present several unique challenges for traditional human health risk assessment approaches. Findings of World Health Organization and ICMR are highlighted in this section

4.1 WHO

WHO in its report on Microplastics in Drinking water: WHO Report 2019" has highlighted the following issues

- Microplastics can present several unique challenges for traditional human health risk assessment approaches. Plastic polymers are generally considered to be of low toxicity. Being insoluble, they are unlikely to be absorbed from the gastrointestinal (GI) tract and generally do not interact with biological matrices, although particle size may influence absorption and toxicity (i.e. smaller particles may represent a greater hazard). However, plastics can contain additives and unbound monomers, which may leach out either into the surrounding water environment prior to human consumption or potentially, into the GI tract to become bioavailable under some circumstances. Further, plastic particles can sorb chemicals from the environment, some of which are of toxicological concern.
- Investigation of potential risks related to particles indicate that it is possible that some smaller plastic particles may be able to pass through the gut wall and translocate to tissues remote from the mucosa, although this may not necessarily translate to a health risk. Humans have always ingested particles and have ingested plastic particles for decades with no related indication of adverse health effects. In addition, a good deal of evidence suggests that microplastics pass through the GI tract into the faeces.
- There is currently a paucity of information to quantitatively assess any potential risk associated with exposure to microplastic particles Most toxicological tests of microplastics have focused on aquatic organisms or ecotoxicology. No epidemiological or human studies on ingested microplastics

have been identified. Data from studies on laboratory animals are scant and inadequate to confirm human health risk assessment of microplastics ingestion. **There are no studies on the impacts of ingested microplastics on human health and there are only a limited number of animal studies of questionable reliability and relevance**

- There is currently no evidence to suggest a human health risk from microplastic associated biofilms in drinking-water**.** The risks from pathogens in microplastic-associated biofilms is considered far lower than the well-established risk posed by the high concentrations and diversity of pathogens present in human and livestock waste, which often make their way into drinking-water sources with inadequate treatment
- **Routine monitoring of microplastics in drinking-water is not recommended at this time, as there is no evidence to indicate a human health concern**

4.2 **ICMR**

ICMR has informed that they have not carried out any study on impact of microplastics on human health so far. However, as per the study carried out so far, Microplastics have been reported in human saliva, blood, placenta , colon, stool and lungs. Overview of the findings of the study carried out on impact of Microplastics on human health , as reported by ICMR, is given below:

	No. of Studies	No. of Human Samples	MP Reported	Impact on Human Health
Blood	1	22	1.6 microgm/mL	Not reported
Placenta	1	6	12 particles in 4 out of 6 samples tested	Not reported
Lungs	2	13 (First Study)	0.69±0.85 gm/L of Lung tissue; 39 particles in 11/13 samples tested	Not reported
		20 (Second study)	37 particles in 13 out of 20 samples tested	Not reported
Stool	2	8 (First Study)	2 particles per gm of Stool	Not reported
		24 (Second study)	1-36 particles per gm of stool	Not reported
Saliva	1	2000	No. of sample in which MP reported: 650;	Not reported

			Avg. concentration: -0.33 MP/individual	
Genotoxic& cytotoxic effects of MP in Human blood	In-vitro	2	Size studied: 10-45 microm; Concentration – 25,50, 100, 250, 500 microg/L; Type:PE	Genomic instabilities were reported
Cytotoxic effect of MP with metal nano particles in human celebral& epithelial cells	In-vitro		Size studied: 3-16 microm; Concentration – 50 microg/L-10 mg/L; Type:PE&PS	Oxidative stress was reported

It was further informed by ICMR that studies are only about the presence of microplastics in human body and not about their physiological or psychological impact. Studies showing genotoxic& cytotoxic impacts are invitro studies conducted on only two individuals. Health impact of emerging contaminants are chronic and long term studies are required to establish Cause effect relationship. It would not be appropriate to set standards for drinking water for microplastics without establishing the cause-effect relationship

4.3 Observations

- Further studies are required understand the uptake and impact of microplastics on human health
- Influence of particle size, shape and chemical composition of microplastics to be studied in detail
  Studies are also required to assess the impact of associated chemicals & biofilm on human health

5. Remediation techniques:

5.1 Available technology for Microplastic removal

Microplastic treatment technologies are in the nascent stage. Removal methods in case of air and soil matrices have not been reported yet. Treatment technology options for microplastics in water include the

- Conventional Water treatment system: In the conventional water treatment technology, primary and secondary treatment processes help in the removal of microplastics 50 – 98% of microplastics could be removed during primary treatment and 0.2 – 14% during secondary treatment (Sun et al. 2019). Microplastic concentration can be significantly reduced by ultrafiltration and reverse osmosis (Ziajahromi et al. 2017). Combination of secondary and tertiary treatment processes has also been useful in the removal of microplastics.

- Microbial Degradation (Biodegradation): Environmental friendliness, cheap cost and low energy input, as well as a reduced carbon footprint, are all advantages of biodegradation. Plastics can be used by microorganisms as carbon and nitrogen sources, allowing them to survive and reproduce.

- Photodegradation/ Photocatalytic degradation: Photocatalytic degradation of typical microplastics can be carried out by UV light radiation and degradation for various sizes of microplastics will be studied.

5.2 Observations

- Available technologies for removal of microplastics need to be studied in detail to assess their efficacy
- Research studies to be conducted for removal of microplastics from air & soil

6.0 Initiatives taken to reduce Microplastics

- The Microbead-Free Waters Act has been notified inUS which prohibits the manufacture and distribution of nonprescription drugs that are also cosmetics and that contain plastic microbeads for the purposes of exfoliating or cleansing any part of the human body. Common examples of rinse-off nonprescription drugs that are also cosmetics include, but are not limited to, anti-cavity (fluoride) toothpastes, acne scrubs, anti-bacterial soaps, and anti-dandruff shampoos
- **BIS 2017 :** Plastic microbeads of diameter 5 mm or less, that are insoluble in water, and solid plastic particles used to exfoliate or cleanse in personal care products have been listed in the banned list
- **Plastic Waste Management (Second Amendment) Rules, 2022:**
  a. Banned all single-use plastics from 1st July 2022.
  b. mandate to increase the thickness of plastic carry bags to over 120 microns from December 31.
  c. Banned imports of solid plastic waste from March 2019

40

C. Conclusions

1. Independent studies regarding microplastics have been conducted by various organizations in the country including CPCB, MoES-NCCR, NCSCM, NPC and CIPET . Further international studies have been conducted by WHO, UNEP , OECD and others.
2. The studies have primarily focussed on monitoring microplastics (concentration, polymer type, colour, shape) in various environmental matrices.
3. Occurrence of microplastics has been reported in oceans, sediments, surface water, ground water, wastewater, tap water, bottled water, air, food products, aquatic organisms, and human beings
4. There is currently no standard method for sampling and analysis of microplastics in the environment. ISO is currently working on the subject
5. Sampling and analytical methods adopted by different institutions in India are similar with minor variations.Variation in Microplastic concentrations units reported by different organizations has been observed
6. Uniform procedure for sampling & analysis may be developed by organizations involved in microplastic analysis (CIPET, NCSCM, MoES-NCCR) which can be adopted uniformily across the country till the time ISO standard is finalized.
7. Source of generation of microplastics including industries, waste management , waste water treatment, ocean activities etc. have been identified. However, exact quantum of microplastics generated from the identified source has not been determined.
8. Microplastic concentration in transfer media is available for soil/beach sediment, surface water bodies, biota and ocean water. Microplastic concentration for sludge , specifically when it is converted to compost for land application is not available
9. Microplastic concentration in end use areas including ambient air, drinking water and ground water is available.
10. Source monitoring, transfer end use of all possible sources listed in Table 3.1 to be covered. Emphasis to be laid on such areas for which no information is available.
11. Regular monitoring of various water quality parameters to be conducted to provide insight into the presence and concentration of microplastics in environmental matrices(water, sediments, biota)
12. Microplastic leakages and pathways may be monitored in order to identify further sources and hotspots of microplastics.
13. Uniform procedure for sampling & analysis as finalized by this Committee may be adopted for such studies till the time ISO Standards are finalized

14. Studies conducted on the matter have reported about the presence of microplastics in human body. Physiological or psychological impact has not been reported in these studies.
15. Health impact of emerging contaminants and long term studies are required to establish Cause effect relationship of microplastics on human health
16. The aforementioned studies should cover different type, concentration and shapes of microplastics. Impact of chemicals /biofilms associated with Microplastics on human health to be covered. The studies may include the following:
    - Estimation of the duration and frequency of human exposure to microplastics. Microplastic monitoring as required may be conducted for the same
    - Once the exposure assessment is done precisely, dose-response assessment may be carried out, where the minimum concentration (of microplastics) responsible for any observable effect (on human) shall be assessed..

17. **Bioassays** may be conducetd to assess the Eco-toxicological impact of microplastics on animal life.
18. Standards development (Source & ambient) for microplastics may be taken up following establishment of the cause-effect relationship of microplastics on human health
19. Available technologies to be assessed for their efficacy for removal of microplastics.
20. Technologies to be developed for removal of microplastics from Air & Soil
21. **Source-directed interventions,**
    - Sustainable design and manufacturing of textiles, tyres, and complementary products (, laundry detergents, road surfaces, and vehicles), to minimise the tendency of products to contribute to microplastics generation;
    - Restrictions on microplastics in the manufacture and sale of certain personal care and cosmetic products containing microplastics.
    - Product requirements for household, commercial, or industrial washing machines. For instance, Australia and France have introduced measures to phase in microfibre filters on new washing machines

9. **End-of-life interventions,** effective solid & plastic waste management practices, to prevent waste leaking into the environment and potentially contributing to microplastics generation including the following;

    (a) Reducing the amount of plastic waste that enters landfills and dumpsites through the implementation of waste reduction policies and

initiatives, such as waste-to-energy programs and increased recycling.Microplastics can also be reduced by supporting the development and use of biodegradable plastic alternatives

10. **End-of-pipe interventions,** wastewater, stormwater, and road runoff management and treatment, to retain the emitted microplastics before these reach water bodies.
11. Maximizing clean drinking water supply to all citizens in the country
12. Other Best practices as listed below for minimizing microplastics in environment may be followed:
    - **(a)** Install physical barriers such as screens and filters on STP/WWTP systems to help reduce the amount of microplastics that enter rivers, lakes, and oceans.
    - **(b)** Support sustainable fishing practices to reduce the amount of microplastic entering rivers from fishing equipment.
    - (c) Implementation of Clean-up efforts for beaches and rivers

13. Training and capacity building including microplastic monitoring, analysis , health impact studies may be taken up for effective implementation of aforementioned points

Figure 6.1 : Best practices for litter management in marine

43

Minutes of Meeting on "Committee Meeting in compliance of Hon'ble NGT order in the matter of O.A. No. 251 of 2022" with CIPET/ICMR /NCSCM held on April 19th , 2022

A Committee meeting was held virtually via video conferencing on April 19, 2022 in compliance of Hon'ble NGT order in the matter of O.A. No. 251 of 2022 for study of microplastics impact on environment and human health. The meeting was coordinated by UPC-II division, CPCB, Delhi. Various stakeholders including representative of CIPET, ICMR, and NCSCM participated in the meeting (List of participants is placed as **Annexure-I**).

DH UPC-II briefly explained directions of NGT for the study to be conducted which covers standards for safe environment, remedial steps to reduce menace of micro plastic and addressing other incidental issues.

She also explained the steps taken by CPCB with regards to microplastics which mainly include assessment of microplastic with NCSCM in Ground Water & Ambient Air in compliance of NGT's order O.A. no. 99 of 2021. She also informed about the study undertaken by National Productivity Council on assessment of microplastics in river Ganga. It was further informed that Ministry of Science and Technology has constituted a committee and working on methods for removal of micro-plastics from water. It was proposed that the as the objective of the two Committees are interlinked, this committee may include representation from NEERI and DST.

The report submitted in O.A. No. 99 of 2021 was shared by CPCB with committee members and it was emphasized that study to should focus on identification of source of micro-plastic in water bodies, standardisation of monitoring techniques, risk assessment or health impact of micro plastics, methods of remediation and mitigation measures.

Dr. Mohanty from CIPET informed about the various studies being conducted regarding micro plastics are given below:

- Estimation of micro plastics in Tapi and Damanganga under Indo-Norway joint project(INOPOL) in Gujarat region in which it was observed t that land based resources are main contributor for the micro plastics.

- Standards for micro plastics determination being developed by ISO are at draft stage.
- Study for estimation of Micro plastic due to Compostable plastic is under way.

She also said that the CIPET can undertake study related to analysis of microplastic in water, soil, oceans etc part can be taken care by CIPET. Effect of microplastics on water content can be correlated with the releavant ISO Standards.

Dr Raj Narayan Tiwari from ICMR, Bhopal informed that they have taken up the studies for identification of micro plastic in different matrices in Bhopal. He further informed that articles published in Journals which highlight genotoxicity and cytotoxicity due to Microplastica. However health related studies due to microplastics in India have not been carried out so far.

Mr. Mrinal K. Biswas, RD Kolkata, CPCB discussed that the study shall be conclusive and it should include source, quality, quantity, impact on environment & human health and finally development of the standards for micro plastics. He also pointed out that the current available studies as well as journals are required to be considered for framing of action plan for the study to be carried out. Apart from that, study is required to be done in short term and long term manner to propose standards for microplastics.

Mr Robin form NCSCM, informed that they are working in coastline riverine system of India for characterisation, quantification and ecotoxical aspects of microplastics. He said leakage study i.e. quantity of micro plastic from leachate, landfills and sewage entering into nearby water body and ground water are required to be conducted in this field.

Further Ms. Divya Sinha -DH, UPC-II concluded the discussions and informed that the study shall cover inventorization, method of analysis, risk assessment or health impact of micro plastics, standards for treated sewage, drinking & ground water and methods of remediation and mitigation measures. She also informed that the standard for micro plastics in air is being developed by Air Quality Division CPCB.It was also important to identify which type plastics contribute maximum to the

45

generation of micro plastics

All the group members were requested to share the information and studies carried out in field of micro plastics with the Committee as well as provide any further inputs on the subject . Mr Mrinal K Biswas RD Kolkata was requested to to prepare draft Action Plan covering the Action Points discussed during the meeting as identifying the roles to be assigned to different organization. The same shall be circulated to the Committee members for finalization

The meeting ended with vote of thanks to the chair.

46

Annexure-I

List of Participants

S.N.	Name and Designation
1.	Dr. Raj Narayan Tiwari, Director, ICMR-NIREH, Bhopal
2.	Dr.R.S.Dhaliwal, Scientist G & Head, NCD, ICMR Hqrs
3.	Dr. Smita Mohanty, Director & Head (Principal Scientist) CIPET Bhuwneshwar
4.	Dr Robin , NCSCM Chennai
5.	Ms. Divya sinha Additional Director & I/c UPC-II, CPCB
6.	Mr. Mrinal Kanti Biswas Scientist "E" & Regional Director, CPCB
7.	Ms. Yogesh Chandra Scientist- B, CPCB

47

Sl.No	Action Point Description			Responsible Organization	Timeline (tentative)
1	Compilation of existing information on Microplastics	a	Committee members shall share information available with them	CPCB CIPET ICMR NCSCM	30.4.22
		b	Compilation of information	CPCB- RD Kolkata	7.5.22
		c	Identification of Gap Areas	CPCB – RD Kolkata	7.5.22
2	Standardization of methodology for monitoring, characterization & analysis of microplastics. Parameters for characterization to include size, type of plastic etc. Instruments required for monitoring / analysis and testing protocols to be delineated			CIPET/ NCSCM	15.5.22
3	Assessment of microplastics covering source, transfer media & end use. Available information as per Section 1 above shall be compiled and emphasis shall be on areas not covered as well as at the end use points. Number of samples to be collected shall be limited by the available infrastructure for monitoring as well as time			Assessment to be carried out by CIPET/ NCSCM – depending upon the available infrastructure. CPCB/Concerned SPCB/PCC to provide requisite support for the monitoring. Assessment to be coordinated & Report to be prepared by CPCB – RD Kolkata	15.6.22
	Source Monitoring	a	Source emissions from industries /activities - Identification of specific industrial sectors contributing to microplastics through literature survey and monitoring microplastics at source		
		b	Leachate from		

			dumpsite/ landfill site		
		c	Sewage treatment plant inlet / outlet		
	Transfer media	c	Surface Water bodies		
		e	Soil		
		f	Marine water		
		g	Fish		
	End- use	f	Water Supply plants (Inlet & Outlet)		
		g	Ground water		
		h	Ambient Air		
4	Source identification of microplastics based on Assessment report			CPCB	
5	Risk Assessment : To be carried out based on the Assessment report specifically w.r.t microplastic concentration at end use point .Parallelly reports in media on adverse impact of microplastics may be reviewed and study taken up as per requirement. Recommendation of safe level of microplastics in drinking water based on literature survey/ experimental studies			ICMR / BIS	15.6.22
6	Development of treatment methods for remediation of microplastics from water / wastewater.			NEERI/ DST/ CPCB	15.6.22
7	Recommendation of measures for reduction of microplastics in environment based on Assessment report including the following: • Measures for Control of coastal zone/ deep sea pollution due to marine litter • Developing regulatory & market based instruments for preserving riverine and marine ecosystems			CPCB	15.7.22
8	Identification of areas were standards have to be notified (drinking water standards, effluent discharge standards & ambient air quality standards)			CPCB	31.7.22
9	Training of SPCBs/PCC/CPCB staff on monitoring and analysis of microplastics &			CIPET / NCSMS	31.7.22

	including identification of measures/ for strengthening of laboratory infrastructure (Parallel activity)		
10	Submission of report to MoEF&CC	CPCB	15.8.22

50

Minutes of Meeting on "Second Committee Meeting in compliance of Hon'ble NGT order in the matter of O.A. No. 251 of 2022" with CIPET/ICMR /NCSCM held on July 27th , 2022

Second Committee meeting was held virtually via video conferencing on July 27, 2022 for study of micro plastics impact on environment and human health. Various stakeholders including representative of CIPET, ICMR, and NCSCM participated in the meeting (List of participants is placed as **Annexure-I**).

RD Kolkata, CPCB made brief presentation on research gap in Indian scenario based on the research document shared by CIPET, ICMR, and NCSCM. Gaps in Standardization of Qualitative and Quantitative techniques, gaps in Matrices covered under the published literature from various Geographical regions, were highlighted during the presentation. Presentation made is enclosed as **Annexure-II.**

Further discussions regarding need for future research was held by the members and DH UPC-II requested to all the group members to make brief presentation in next meeting as per details given below:

- RD Kolkata, CPCB
  - Methodology for development of standards covering sample requirement
  - Source of micro plastic
  - Areas of monitoring
  - Requirement for sampling methods and analysis
  - Capacity building
  - Availability and Gaps
- CIPET and NCSM
  - Available resources of monitoring sampling and analysis
  - Possible coverage for monitoring with existing resources
  - Institutional mechanism to fulfill additional sampling/analysis requirements, if any.
- ICMR
  - Existing studies on impact of micro plastic on human health
  - Identification of areas for further intervention to assess impact of micro plastic on human health.

51

The meeting ended with vote of thanks to the chair.

Annexure-I

List of Participants

S.N.	Name and Designation
1.	Dr. Raj Narayan Tiwari, Director, ICMR-NIREH, Bhopal
2.	Dr. Surya Singh ICMR-NIREH, Bhopal
3.	Dr.R.S.Dhaliwal, Scientist G & Head, NCD, ICMR Hqrs
4.	Dr. Smita Mohanty, Director & Head (Principal Scientist) CIPET Bhuwneshwar
5.	Dr Robin , NCSCM Chennai
6.	Ms. Divya sinha Additional Director & I/c UPC-II, CPCB
7.	Mr. Mrinal Kanti Biswas Scientist "E" & Regional Director, CPCB
8.	Ms. Yogesh Chandra Scientist- B, CPCB

52

Minutes of Meeting on "Third Committee Meeting in compliance of Hon'ble NGT order in the matter of O.A. No. 251 of 2022" with CIPET/ICMR /NCSCM held on August 5th, 2022.

Third Committee meeting was held virtually via video conferencing on August 5th, 2022 in compliance of Hon'ble NGT order in the matter of O.A. No. 251 of 2022 for study of micro plastics impact on environment and human health. Various stakeholders including representative of RD Kolkata, CIPET, ICMR, and NCSCM participated in the meeting (List of participants is attached as ***Annexure-I***).

Mr Mrinal K Biswas, RD Kolkata, CPCB, described the action plan for development of standards for microplastics. He provided examples from other countries which already have their own practices for managing microplastics. RD Kolkata ended their presentation with the proposed execution plan and the roles to be assigned to different organizations, for developing environmental standards. (The presentation is here attached as ***Annexure-II***)

The meeting progressed with the second presentation by NCSCM, where the information about protocol for analysis of microplastic in sediment, water & biota was briefly explained by them. They also explained the importance of surrounding environment from which sample has been taken, for analysis of microplastic.

Last presentation of the meeting was given by ICMR-NIREH Bhopal, where the results from the studies which have already been done on the presence of microplastic and their possible effects on human body, were discussed. Instruments which may be used for estimating the concentration of microplastics were also discussed during the presentation. (The presentation is here attached as ***Annexure-III***)

Ms. Divya Sinha -DH, UPC-II concluded the discussions with request to provide detailed information as annexed below, latest by **22/08/2022**, regarding the efficient methodologies adopted by CIPET & NCSCM for analysis of samples for microplastics in the environment.

The meeting ended with vote of thanks to the chair.

53

CIPET and **NCSCM** are required to provide the following information, latest by 22/08/2022, on testing and analysis of microplastics for drinking water, groundwater, compost/leachate samples:

Heads	Drinking water Sample	Groundwater Sample	Compost/leachate Sample
Methodology for testing and analysis			
Instruments Required			
Time period required for analysis			
Cost incurred per sample			
Presence/Coverage area of Organization			
Studies available			

Annexure I

List of Participants	
S. No.	**Name and Designation**
1.	Mr. Mrinal Kanti Biswas Scientist “E”; Regional Director, CPCB
2.	Dr. Raj Narayan Tiwari, Director, ICMR-NIREH, Bhopal
3.	Dr. Surya Singh, ICMR-NIREH, Bhopal
4.	Dr. Smita Mohanty, Director & Head (Principal Scientist), CIPET Bhuwaneshwar
5.	Mr. Himalaya Vardikar, CIPET LARPM, Bhuwaneshwar
6.	Ms. Divya sinha, Additional Director & I/c UPC-II, CPCB
7.	Ms. Yogesh Chandra, Scientist- B, CPCB
8.	Mr. Madnesh Kumar Dubey, Scientist- B, CPCB
9.	Mr. Mayank Raj Purbey, Scientist- B, CPCB

3rd Meeting of the 55 expert committee on "Development of standards for Microplastics"

-By-

Central Pollution Control Board
Regional Directorate, Kolkata

NGT order

- As per the Hon'ble NGT order dated 05.04.2022 pertaining to OA no. 251/2022 of 2022, where it has been directed that:

  *"There is need for **further studies**, considering the studies already conducted, to be steered by the Committee comprising of CPCB, ICMR, Central Institute of Petrochemicals Engineering & Technology (CIPET), NCSCM, and any other expert institutions as required, under the Nodal coordination of CPCB. Such studies and recommendations/ suggestions **may cover standards for safe environment**, **remedial steps** to **reduce menace of micro plastic** and **addressing other incidental issues**. CPCB may incur expenditure on studies and other incidents out of Environmental Compensation funds."*

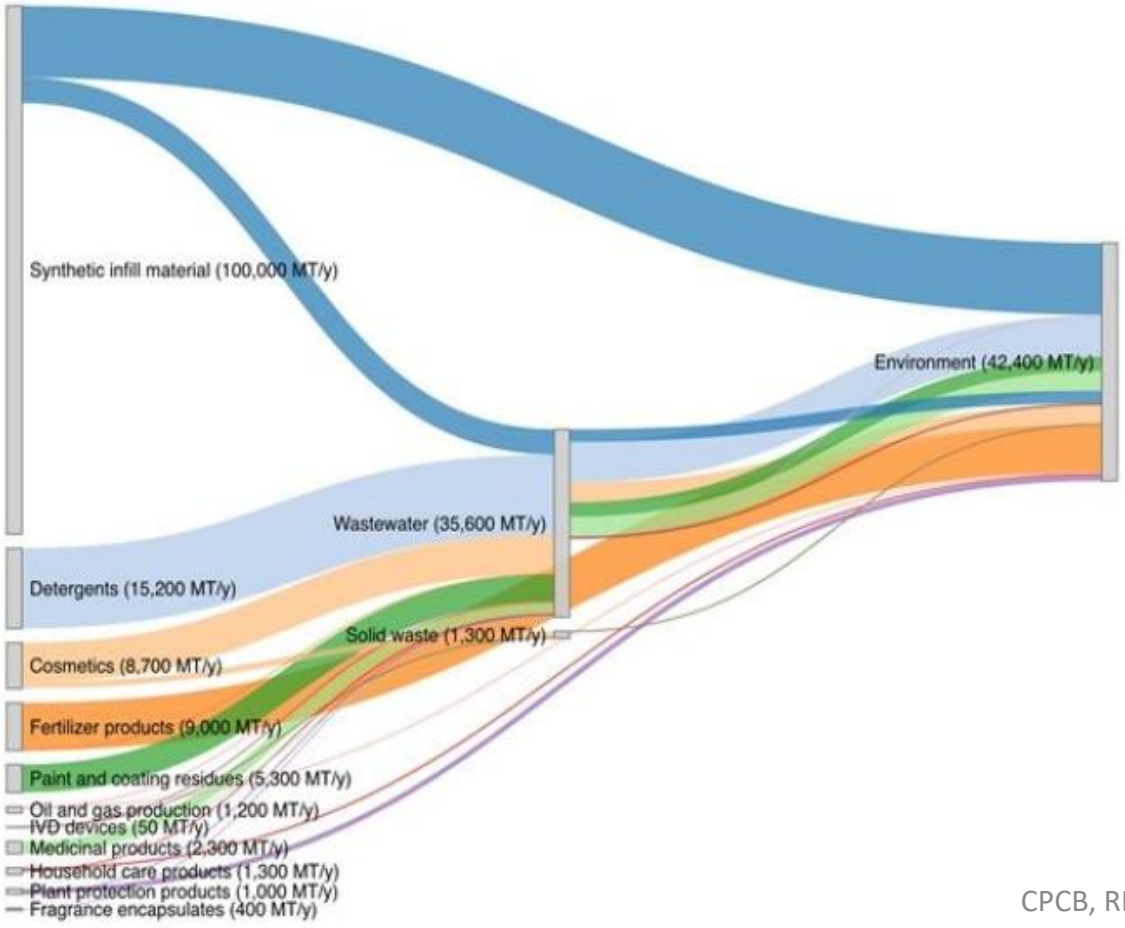
  &

- " *Having regard to the media report that violation of environmental norms in handling of plastics is resulting in serious adverse health effect on human beings, it appears to be necessary to **ensure strict compliance of environmental norms** and to undertake **further study** to consider **whether the existing policies of enforcement of environmental norms need to be revisited in any manner in the interest of human health**."*

International initiatives - EU

Regulations to control the pollution:

- Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)
- Committee for Socio-Economic Analysis (SEAC)



- Sankey plot showing major sources and sinks of primary microplastic emissions in the EU. Emissions to the environment include those to both the aquatic and terrestrial compartment. (Rheinberger et al., 2021)

.....International initiatives till date – Europe

- In 2018, Commission adopted European Strategy for Plastics – a Circular Economy, about €100 million (for 2 yrs) has been allocated for implementation of plastics strategy and R&D projects.
- In January 2019, ECHA(European Chemical Agency) proposed a wide-ranging restriction on microplastics expecting to **prevent** the release of **5,00,000 tonnes of microplastics over 20 years.**
- **Development in 2022…..**

Specific laws with partial objectives	Directives for unintentional formation of microplastics	Production & release into the environment, both directly and indirectly
1. Marine Strategy Framework 2. Fertilising Products Regulation 3. REACH restriction proposal	1. Plastics Waste Framework strategy 2. Waste Framework Directive 3. Marine Strategy Framework Directive	1. Eco-design Directive 2. Waste Framework 3. Urban Waste Water Treatment Sewage Sludge 4. Directive on air quality 5. Industrial Emissions 6. Regulation on tyre labelling 7. Regulation on motor vehicle type approval

…….International initiatives till date – USA

- December 18, 2015, Congress amended the Federal Food, Drug and Cosmetic Act (FD&C Act) by passing the **Microbead-Free Waters Act of 2015**.
  - ❖Prohibits manufacturing, packaging, and distribution of rinse-off cosmetics containing plastic microbeads.
  - ❖This new law also applies to products that are both cosmetics and non-prescription (also called “over-the-counter" or "OTC") drugs, such as toothpastes.

Indian scenario

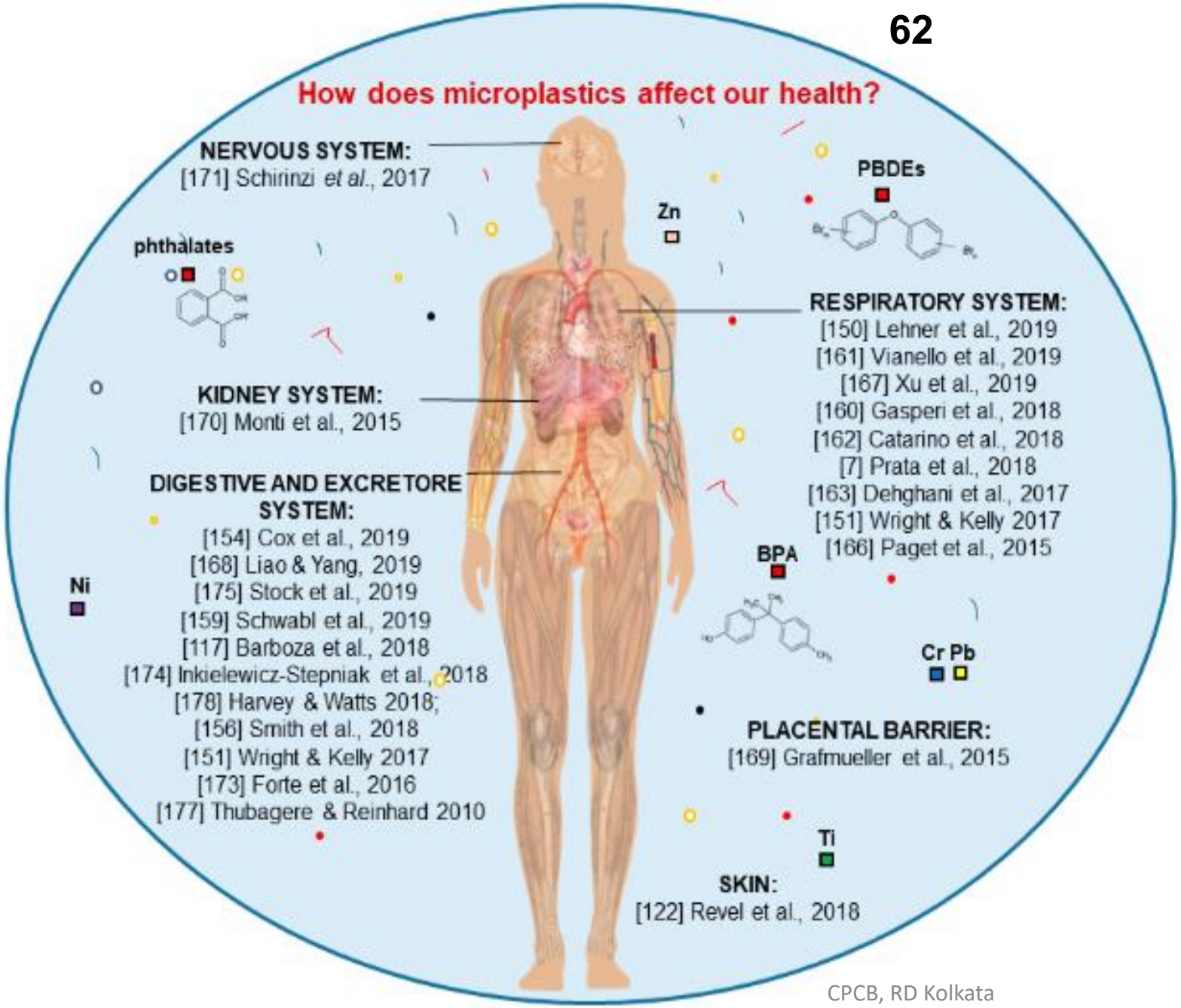
BIS 2017 : Plastic microbeads of diameter 5 mm or less, that are insoluble in water, and solid plastic particles used to exfoliate or cleanse in personal care products are banned

Plastic Waste Management (Second Amendment) Rules, 2022:

a. Banned all single-use plastics from 1st July 2022.
b. mandate to increase the thickness of plastic carry bags to over 120 microns from December 31.
c. Banned imports of solid plastic waste from March 2019

Why do we need a standard?

62



Overview of scientific studies focused on the effects of micro and nanoplastics on human health.

Colored squares represent pollutants (organic and inorganic) that could be present in environmental matrices (free or associated with micro and nanoplastics) and that could enter into the human body through different entry routes.

Campanale et al., 2021

Pollutants being carried by MP

Organism exposed to MP

How to develop a standard?

1. Scientific stages

(a) Knowledge of the hazard: involves identification and characterization of microplastic.

(b) Evaluation of the risk: establishes the probability and severity of potential adverse effects of microplastic on health and safety.

(c) Assessment of hazard: determination routes of microplastic exposure and estimation of the number of people exposed.

2. Political and administrative stage

(a) Acceptance to the tolerable risk

(b) Determination to safeguard the public

(c) Consideration of human ecology

(d) Choice of control technology requires both formulations of strategy and selection

(e) Legislation standards consider the existing national legal framework and identify necessary legal strategies.

(f) Economics

Segments for Developing Environmental standard

Segment	Execution plan
1. Identification of priority pollution issue	❑ **Standard methodology for Sampling, processing and analysis** ❑ **Finalization of the matrix: Assessment of Quality & Quantity** A. Water (River, Lakes, Dams, Marine, Leachates & Ground Water B. Solid (Sediments, Sludge, Soil) C. Air (Rural, Urban & fugitive industrial emission) D. Biota (Fishes, Micro invertebrates) E. Packaged foods/drinks F. Existing water and waste water treatment facilities
2. Information on health effects	**ICMR-NIREH**
3. Assessment of exposure	Through Outcome of 1 & 2: A. Major Sources & budgeting B. Quality & Quantity C. Impact (includes risk) on Environment & Human D. Removal efficiencies of existing facilities
4. Strategies for prevention and control	A. Identification & Banning of selective additives usage and processes B. Technological intervention for removal MP and reuse of Plastic C. Issuance of directives restricting production and release D. Source control by legislation and awareness programs E. Promoting alternatives

……Segments for Developing Environmental standard

Segment	Execution plan
5. Legal framework	1. Nature of the decision 2. Scope and development of environmental legislation 3. Content and structure of regulation 4. Institutional consideration 5. Geographical dimension of environmental problems 6. Supporting measures for regulatory strategy
6. Consequences of different approaches to environmental health protection	1. Optimisation of Preventive methods and socio-economic impacts
7. Decision-making process	1. Interaction between science and policy 2. Constraints affecting development of the country 3. Finalization of the standards for **a) Discharge into** i. Inland surface water, ii. Public Sewers, iii. Land for irrigation and iv. Marine coastal areas b) **Acceptable limits** for drinking water supply

Work Distribution for identification & exposure study

❑ Distribution to cover the Matrices, Locations to address the gap

Sl no	Segment	Institutional Distribution
1	Spatial Analysis of Water, Soil & biota STPs/WTP, Solid waste Dump sites	Eastern Zone: CPCB – RD Kolkata Western Zone: CPCB – RD Vadodara Central Zone: ICMR – NIREH, Bhopal Northern Zone: CPCB Delhi Southern Zone: NCSCM, Chennai
2.	Air pollution	CPCB Delhi
3.	Coastal & Marine pollution	NCSCM, Chennai
4.	Health effect study	ICMR – NIREH, Bhopal
5.	Cosmetics, Packaged food & drinks	CIPET

CIPET having adequate infrastructure and network, may initiate sampling and analysis in all the 4 zones (except south), till capacity building is done in other participatory institutes

Matrix and Location wise work plan: River

Sl. no.	Matrix	Segment	Existing study (Approx.) by independent researcher		Proposed representative study area (Water, Sediment & Biota)			
					Control group		Polluted stretch	
			Number	Name	Number	Name	Number	Name
1.	Water, Sediment & Biota, Water intake points	River	9	1. Ganga* 2. Brahmaputra* 3. Meghna 4. Adyar 5. Kosasthalaiyar 6. Multhirappuzhayar 7. Netravati 8. Alakananda 9. Indus * Few locations covered only	1	Umngot /Dawki	17	1.Ganga 2. Damodar 3. Bidyadhari 4. Yamuna 5. Cauvery 6. Mahanadi 7. Godavari 8.Krishna 9. Narmada 10. Tapi 11. Mandovi & Zuari 12. Netravati & Sharavathi 13. Kochi Backwaters 14. Neendakara 15. Perumadhura

Sl no	Matrix	Segment	Existing study (Approx) by independent researcher		Proposed representative study area (Water, Sediment & Biota)			
					Control group		Polluted stretch	
			Number	Name	Number	Name	Number	Name
2.	Water, Sediment, Biota Water intake points	Lakes	5	1. Veeranam lake, TN 2. Red hills Lake, TN 3.Vembanad lake, Kerala 4. Renuka lake, HP 5. Anchar lake, Northwest Himalaya	2	Kankaria lake, Gujrat Gurudongmer, Sikkim	15	1. Mirik lake, WB 2. Santragachi, WB 3. Ambazari Lake, Maharashtra 4. Puskar Lake, Rajasthan 5. Naraina Lake, Gujarat 6. Dal lake, J&K 7. Bellandur Lake, Bangalore 8. Naini lake, UK 9. Hussain Sagar, Telangana 10. Chilika Lake, Odisha 11. Vembanad lake, Kerala 12. Pulicat Lake, AP 13. Kolleru Lake, AP 14. Upper lake, MP 15. Lower lake, MP

Sl no	Matrix	Segment	Proposed representative study area (Water, Sediment & Biota)	
			Polluted stretch	
			Number	Name
3.	Water, Sediment & Biota, Water intake points	Dams	10	1. Panchet, WB 2. Mythan, Jharkhand 3. Hirakund, Odisha 4. Nizam Sagar Dam, Telangana 5. Sardar sarovar, Gujarat 6. Tehri, UK 7. Tungavadra, Karnataka 8. Uri Hydroelectric Dam, J& K 9. Gandhi Sagar Dam, MP 10. Kolar Dam, MP 11. Idukki Dam, Kerala 12. Govind Ballabh Pant Sagar Dam , UP 13. Jayakwadi Dam, Maharashtra

Ground water & Marine water

Sl no	Matrix	Segment	Existing study (Approx) by independent researcher		Proposed representative study area (Water, Sediment & Biota)
			Number	Name	Polluted stretch
4.	Water, Sediment & Biota	Ground Water (water extraction point)	2	Chennai, TN Punakayal, TN	State wise, representative data collection considering both urban and rural areas.
	Water, Sediment & Biota	Marine water & Coastal Pollution	41	Karnataka Kerala Tamilnadu Andaman Nicober Lakshyadweep	Sampling point: 1. Transect at every 200km interval along the coastal line of West Bengal, Odisha, AP, Goa, Maharashtra, Gujarat 2. Upto 200m depth contour (continental shelf)

Sl no	Matrix	Segment	Existing study (Approx) by independent researcher		Proposed study area	
					Polluted location	
			Number	Name	Number	Name
5.	Soil, Leachate & affected GW	Solid waste Dumpsite	0	none		State wise 1 or 2 major dumpsite
6.	Air	Urban	4	Chennai, TN Patna , Bihar Nagpur, Maharashtra Varanasi, UP	**As per the ongoing study by CPCB**	
7.	Health effect	Animal study Clinical study Human study	11	Arthropod and fishes	**Plan to be developed by ICMR NIREH**	

Evaluation of existing treatment technologies

74

Sl. No.	Treatment	Matrix	Technology wise evaluation (State wise evaluation)	
			Conventional	Advanced
1	Sewage treatment plants	Water & sludge	AL OP ASP TF	SBR MBBR FBAS MBR & others
2	Water treatment plants		State-wise evaluation	State-wise evaluation

Immediate action

Preparation and submission of interim report to Hon'ble NGT:

1. Distribution of microplastics in the environment – based on LIMITED studies in Indian context.
2. Impact on Environment – based on international studies
3. Impact on Human Health – based on international studies
4. Gap analysis & proposed methodology for the study indicating requirement for establishing a strong database, budgeting, impact, prevention and control.

76

106

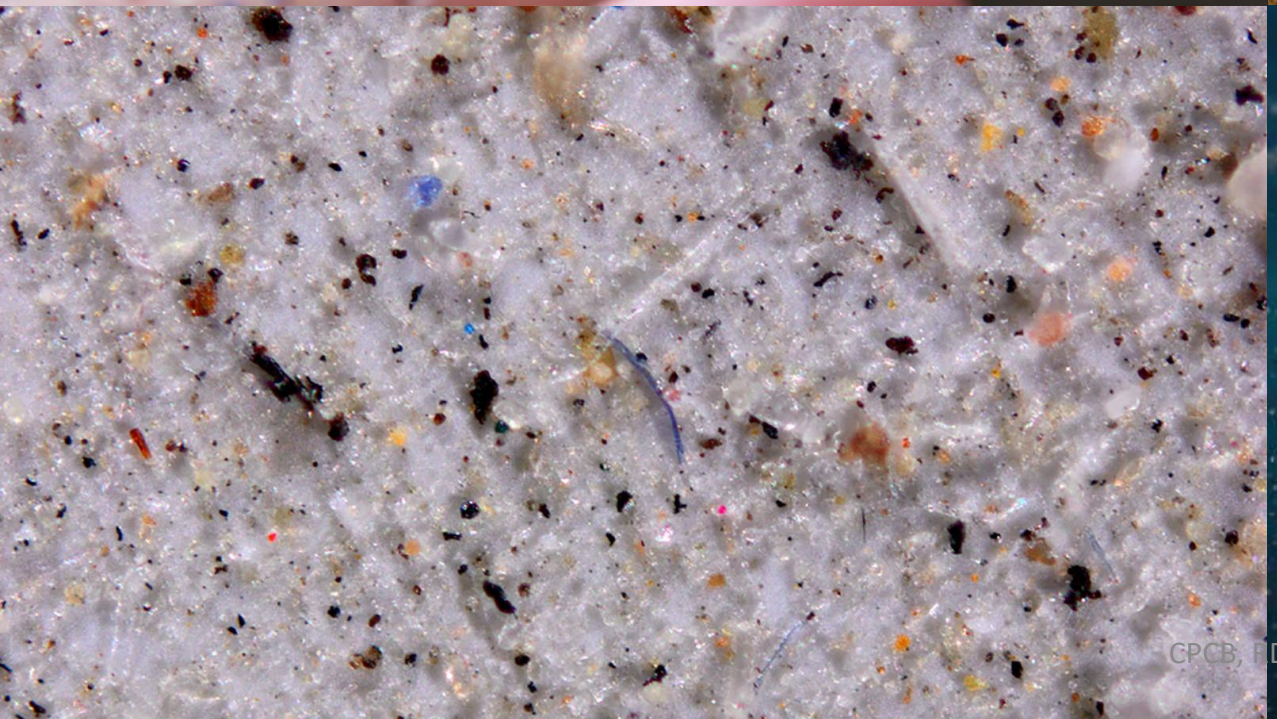


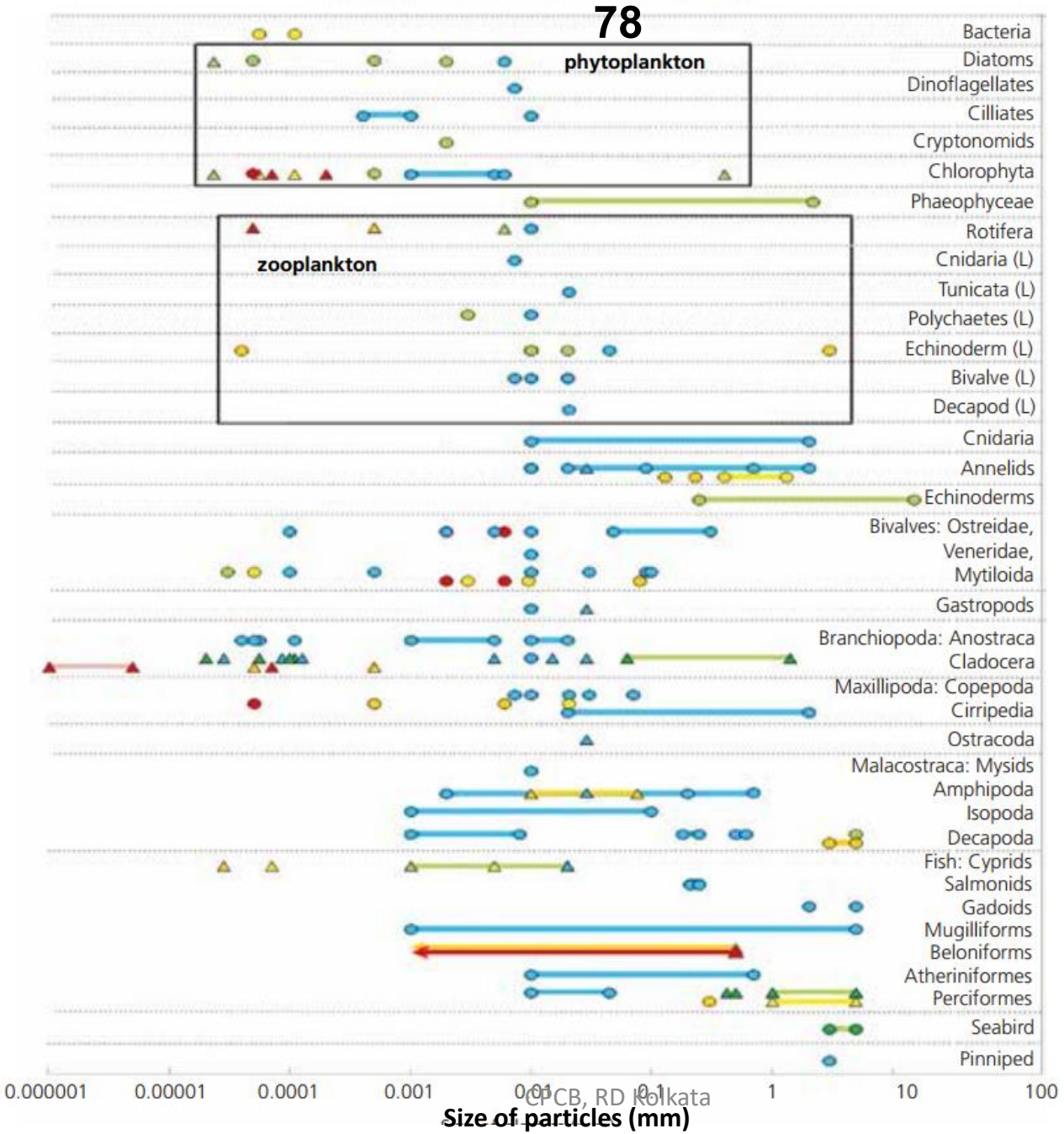
Table 2 Types of pollutants carried by different types of microplastics

77

Microplastic	Pollutant	Reference
PA	Benzene derivative	Rehse et al. (2018)
PBAT	Heavy metals	Kedzierski et al. (2018)
PE	Lubrication oil	Haghi and Banaee (2017)
	PAH	Oliveira et al. (2013)
	Paraquat	Rochman et al. (2013b)
	PBDE	Llorca et al. (2018)
	PCB	Wang et al. (2015)
	Per- and polyfluoroalkyl substances	Fisner et al. (2017)
	PFOSA	Zhan et al. (2016)
	PPCP	Hu et al. (2017)
	Triclosan	Frydkjær et al. (2017)
PET	Heavy metals	Rochman et al. (2013a)
PP	Heavy metals	Rochman et al. (2013b)
	PAH	Fisner et al. (2017)
PS	Antibiotic	Wen et al. (2018)
	Cadmium	Zhang et al. (2019b)
	Lubrication oil	Llorca et al. (2018)
	PCB	Wang et al. (2015)
	Per- and polyfluoroalkyl substances	Guo et al. (2018)
	PFOSA	Zhan et al. (2016)
	Roxithromycin	Hu et al. (2017)
PVC	17α-Ethinylestradiol	Qu et al. (2018)
	Antibiotic	Sleight et al. (2017)
	Benzene derivatives	Kedzierski et al. (2018)
	Heavy metals	Rochman et al. (2013a)
	Odesmethylvelafaxine	Pascall et al. (2005)
	PCB	Wu et al. (2016)
	PFOSA	Guo et al. (2018)
	Phenanthrene	
	Venlafaxine	
LDPE	Heavy metals	Rochman et al. (2013a)
HDPE	Heavy metals	Holmes et al. (2014)

PBAT polybutylene adipate terephthalate, *HDPE* high-density polyethylene, *PFOSA* perfluorooctanesulfonamide, *PPCP* pharmaceuticals personal care product

Summary of laboratory experiments (published up to the end of December 2016), in which organisms were exposed to micro- and nanoplastics



3RD MEETING OF THE EXPERT COMMITTEE ON MICROPLASTICS

(*w.r.t.* Hon'ble NGT OA No. 251/2022 of 2022)

Convened by

Central Pollution Control Board, Delhi

Presented by

ICMR – National Institute for Research in Environmental Health (NIREH), Bhopal

Human Health Research Scenario

Microplastics have been reported and estimated in:

- Human saliva
- Human blood
- Human placenta
- Human colon
- Human stool
- Human lungs

Human Saliva 81

Total number of studies till date: 1

No. of human samples: 2000

Instrument: µRaman Spectroscopy

Total number of particles reported: 650

Concentration of MP reported: 0.33 particles / individual

Impact on health: Not reported

Ref. Abbasi et al. 2021, Human exposure to microplastics: A study in Iran

Human Blood 82

Total number of studies till date: 1

No. of human samples: 22

Instrument: Pyr GC – MS (limitation 700 nm)

Concentration of MP reported: 1.6 µg / mL

Impact on health: Not reported

Ref. Leslie et al. 2022, Discovery and quantification of plastic particle pollution in human blood

Human Placenta [83]

Total number of studies till date: 1

No. of human samples: 6

Instrument: µRaman Spectroscopy (limitation 5 µm)

No. of MP particles reported: 12 particles in 4 samples out of 6 tested

Impact on health: Not reported

Ref. Rasuga et al. 2021, Plasticenta: First evidence of microplastics in human placenta

Human Colon 84

No. of human samples: 11

Instrument: FTIR Microscope

Concentration of MP reported: 28 ± 15.4 particles / g colon tissue

No. of MP particles reported: 331 particles / individual specimen

Impact on health: Not reported

Ref. Ibrahim et al. 2020, Detection of microplastics in human colectomy specimens

Human Stool 85

First Study

No. of human samples: 8

Instrument: FTIR microspectroscopy (limitation 50 µm)

Concentration of MP reported: 2 particles / g of stool

Impact on health: Not reported

Second Study

No. of human samples: 24

Instrument: FTIR microspectroscopy

No. of MP particles reported: 1 particle / g - 36 particles / g of stool

Impact on health: Not reported

Ref. Schwabl et al. 2019, Detection of various microplastics in human stool
Zhang et al. 2021, You are what you eat: Microplastics in feces of young men living in Beijing

Human Lungs 86

First Study

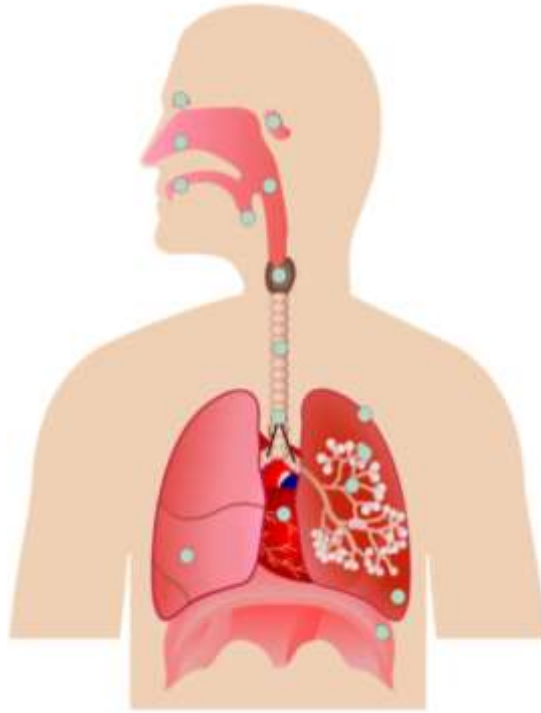
No. of human samples: 13

Instrument: µFTIR Spectroscopy (limitation 3 µm)

Concentration of MP reported: 0.69 ± 0.84 particles / g lung tissue

No. of MP particles reported: 39 particles in 11 samples out of 13 tested

Impact on health: Not reported



Second Study

No. of human samples: 20

Instrument: Raman Spectroscopy (limitation 20 µm)

No. of MP particles reported: 37 particles in 13 samples out of 20 tested

Impact on health: Not reported

Ref. Jenner et al. 2022, Detection of microplastics in human lung tissue using µFTIR spectroscopy
Amato-Lourenco et al. 2021, Presence of airborne microplastics in human lung tissue

Human Health Research Scenario in the Area of Microplastics

Genotoxic and cytotoxic effects of microplastics in human blood lymphocytes

No. of human samples: 2

Size of microplastic particle studied: 10 – 45 µm

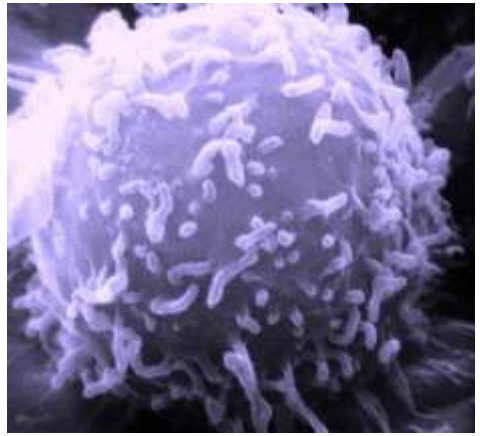
Type of microplastic particle studied: Polyethylene

Concentrations of MP studied: 25, 50, 100, 250, 500 µg/mL of blood

Type of study: *in-vitro*

Result: Genomic instabilities were reported

Mechanism: Unknown



Ref. Cobanoglu et al. 2021, Genotoxic and cytotoxic effects of polyethylene microplastics on human peripheral blood lymphocytes

Human Health Research Scenario in the Area of Microplastics

Cytotoxic effects of microplastics *accompanied by* metal nanoparticles in human cerebral and epithelial cells

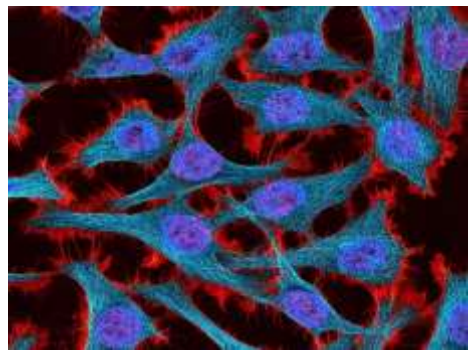
Size of microplastic particle studied: 3 – 16 µm

Type of microplastic particle studied: Polyethylene & polystyrene

Concentrations of MP studied: 50 µg/L to 10 mg/L

Type of study: *in-vitro*

Result: Oxidative stress was reported



Ref. Schirinzi et al. 2017, Cytotoxic effects of commonly used nanomaterials and microplastics in cerebral and epithelial human cells

Key Takeaways..89

Studies are only about the presence of microplastics in human body, NOT about their physiological / psychological impact

Studies showing the genotoxic and cytotoxic impacts of the microplastics are in-vitro studies, conducted over ONLY two individuals

Health impacts of emerging contaminants (e.g. MPs) are chronic. So, long-term studies are required to establish CAUSE-EFFECT RELATIONSHIP

Without establishing cause-effect relationship, it would not be appropriate to set STANDARDS for drinking water having microplastics

90

Annexure-2

Item No. 06 (Court No. 1)

BEFORE THE NATIONAL GREEN TRIBUNAL
PRINCIPAL BENCH, NEW DELHI

(By Video Conferencing)

Original Application No. 251/2022

In re: News item published in The Hindu dated 29.03.2022 titled **"Detecting microplastics in human blood"**

Date of hearing: 05.04.2022

CORAM: HON'BLE MR. JUSTICE ADARSH KUMAR GOEL, CHAIRPERSON
HON'BLE MR. JUSTICE SUDHIR AGARWAL, JUDICIAL MEMBER
HON'BLE MS. JUSTICE PUSHPA SATHYANARAYANA, JUDICIAL MEMBER
HON'BLE PROF. A. SENTHIL VEL, EXPERT MEMBER

ORDER

1. Proceedings have been initiated in light of captioned media report to the effect that in absence of enforcement of environmental norms on the subject, small particles of plastics enter the blood cells of human being through food, having adverse health impact.

2. Having regard to the media report that violation of environmental norms in handling of plastics is resulting in serious adverse health effect on human beings, it appears to be necessary to ensure strict compliance of environmental norms and to undertake further study to consider whether the existing policies of enforcement of environmental norms need to be revisited in any manner in the interest of human health.

3. It appears from the record that the Southern Bench of NGT has taken up Suo Moto based on similar media reports in OA No. 99/2021(SZ), *Tribunal on its own motion Suo Motu based on the news*

item in The Times of India Newspaper, Chennai Edition dt. 05.04.2021, "Chennai, you are breathing micro plastic" vs. The Chief Secretary to Government of Tamil Nadu Chennai and Ors. and OA No. 174/2021(SZ), *Tribunal on its own motion Suo Motu based on the news item in The Times of India Newspaper, Chennai Edition dt. 27.07.2021, "High level of metals PM 2.5 found in city's air you're breathing" vs. The Chief Secretary to Government of Tamil Nadu Chennai and Ors.,* wherein CPCB carried out study on analysing micro plastic in ground water in context of landfills leachate and analysis through National Centre for Sustainable Coastal Management (NCSCM), Chennai. To avoid conflicting orders, the said matters stand transferred to the Principal Bench of this Tribunal for being dealt alongwith the present matter. Counsel appearing in the said matters be informed by e-mail. If they have any objection, they are at liberty to move this Tribunal. Record of the said matters be called for in the form of scanned documents. It is not necessary for the time being to call for the original record which may be retained at Chennai Bench. The date fixed in the said matters will stand deferred to 19.10.2022 on which the present matter will now be listed. The titles of the said matters be now modified as *In re: News Item published in The Times of India, Chennai dated 05.04.2021 titled* ***"Chennai, you are breathing micro plastic"*** in OA No. 99/2021(SZ) and *In re: News Item published in The Times of India, Chennai dated 27.07.2021 titled* ***"High level of metals PM $_{2.5}$ found in city's air you're breathing"*** *in* OA No. 174/2021(SZ).

4. There is need for further studies, considering the studies already conducted, to be steered by the Committee comprising of CPCB, ICMR, Central Institute of Petrochemicals Engineering & Technology (CIPET), NCSCM, and any other expert institutions as required, under the Nodal coordination of CPCB. Such studies and recommendations/ suggestions

may cover standards for safe environment, remedial steps to reduce menace of micro plastic and addressing other incidental issues. CPCB may incur expenditure on studies and other incidents out of Environmental Compensation funds.

5. The report of the study with suggestions for remedial action may be filed before this Tribunal by e-mail by August 31, 2022 with a copy to the Secretary, MoEF&CC as input for consideration of policy on the subject. MoEF&CC may file its action taken report in the matter before the next date by e-mail at judicial-ngt@gov.in preferably in the form of searchable PDF/ OCR Support PDF and not in the form of Image PDF.

List for further consideration on 19.10.2022.

A copy of this order along with the media report be forwarded to CPCB, ICMR, CIPET, NCSCM, Chennai and MoEF&CC by e-mail for compliance.

Adarsh Kumar Goel, CP

Sudhir Agarwal, JM

Pushpa Sathyanarayana, JM

Prof. A. Senthil Vel, EM

April 05, 2022
Original Application No. 251/2022
SN

Annexure-III

Action Plan

S.No.	Conclusions of the Report prepared by CPCB, ICMR,CIPET and NCSCM	Concerned Ministries/Department/ Body	Action plan with time line
1.	Uniform procedure for sampling & analysis may be developed by organizations involved in micropl astic analysis (CIPET, NCSCM, MoES-NCCR) which can be adopted uniformily across the country till the time ISO standard is finalized.	CPCB to develop uniform procedure for sampling and analysis along with Central Institute of Petrochemicals, Engineering & Technology (CIPET), National Centre for Sustainable Coastal Management (NCSCM) and National Centre for Coastel Research (NCCR), CSIR- IITR and CSIR-NEERI	i. First meeting for finalization of uniform methodology for sampling and analysis of micro plastics conducted on November 09, 2023(Minutes placed at Annexure I) ii. Second meeting proposed to be during November 2023 to finalize Uniform procedure for sampling & analysis
2.	Source of generation of microplastics including industries, waste management, waste water treatment, ocean activities etc. have been identified. However, exact quantum of microplastics generated from the identified source has not been determined.	CPCB, CIPET/DCPC, NCSCM/MoEFCC, NCCR/MoES, CSIR- IITR and CSIR-NEERI	Point 2-6, 13,14, 26 i. Preliminary listing of all points to be monitored. ii. Proposed SOP for monitoring. iii. Compilation of technologies for Micro plastic removal. iv. Meeting with Stake holders v. Awarding of work vi. Execution of work
3.	Microplastic concentration in transfer media is available for soil/beach sediment, surface water bodies, biota and ocean water. Microplastic concentration for sludge, specifically when it is converted to compost for land application is not available	CPCB, CIPET/DCPC, NCSCM/MoEFCC, NCCR/MoES CSIR- IITR and CSIR-NEERI	
4.	Source monitoring, transfer end use of all possible sources listed in Table 3.1 of the report to be covered. Emphasis to be laid on such areas for which no information is available.	CPCB, NCSCM/MoEFCC, NCCR/MoES, CSIR- IITR and CSIR-NEERI	

5.	Regular monitoring of various water quality parameters to be conducted to provide insight into the presence and concentration of microplastics in environmental matrices (water, sediments, biota)	CPCB, NCSCM/MoEFCC, NCCR/MoES, CSIR- IITR and CSIR-NEERI	
6.	Microplastic leakages and pathways may be monitored in order to identify further sources and hotspots of microplastics.	CPCB, NCSCM/MoEFCC, NCCR/MoES, CSIR- IITR and CSIR-NEERI	
7.	Uniform procedure for sampling & analysis as finalized by this Committee may be adopted for such studies till the time ISO Standards are finalized.	CPCB, CIPET/DCPC, NCSCM/MoEFCC, NCCR/MoES, CSIR- IITR and CSIR-NEERI	Covered in 1
8.	Health impact of emerging contaminants and long term studies are required to establish Cause effect relationship of microplastics on human health	Indian Council of Medical Research/DHR, CPCB, CIPET/DCPC, NCSCM/MoEFCC, NCCR/MoES	Nodal Agency - ICMR
9.	Studies conducted on the matter have reported about the presence of microplastics in human body. Physiological or psychological impact has not been reported in these studies.	ICMR/DHR	Nodal Agency - ICMR
10.	The aforementioned studies should cover different type, concentration and shapes of microplastics. Impact of chemicals/biofilms associated with Microplastics on human health to be covered. The studies may include the following: Estimation of the duration and frequency of human exposure to microplastics. Microplastic monitoring as required may be conducted for the same.	Indian Council of Medical Research/DHR, CPCB, CIPET/DCPC, NCSCM/MoEFCC, NCCR/MoES	Nodal Agency – ICMR

	Once the exposure assessment is done precisely , dose- response assessment may be carried out , where the minimum concentration(of microplastics) responsible for any observable effect (on human) shall be assessed..		
11.	Bioassays may becondu cted to assess the Eco- toxicological impact of micro plastics on animal life.	CPCB, CSIR-IITR, CSIR-NEERI	Nodal Agency – ICMR
12.	Standards development (Source & ambient) for microplastics may be taken up following establishment of the cause-effect relationship of micro plastics on human health	CPCB, ICMR/DHR	Post completion of Activities listed at 2-11
13.	Available technologies to be assessed for theirefficacy for removal of microplastic	CPCB, DCPC/CIPET, MoEFCC/NCSCM, MoES/NCCR, CSIR- IITR and CSIR-NEERI	
14.	Technologies to be developed for removal of micro plastics from Air & Soil	CPCB, DCPC/CIPET, MoEFCC/NCSCM, MoES/NCCR, CSIR-NEERI, CSIR- IITR and CSIR-NEERI	
15.	Source-directed interventions, Sustainable design and manufacturing of textiles , tyres, and complementary products (laundry detergents, road surfaces, and vehicles), to minimize the tendency ofproducts to contribute to microplastics generation; Restrictions on microplastics in the manufacture and sale of certain personal care and cosmetic pr	Ministry of Textiles, Department of Promotion and Industry and Internal Trade, Ministry of Heavy Industries, Ministry of Road Transport and Highways, Department of Chemicals and Petro-Chemicals CDSCO/Department of Health a	

	oducts containing micro plastics. Product requirements for household, commercial, or industrial washing ma chines. For instance, Au stralia and France have i ntroduced measures to p hase in micro fibre filters on new washing machin es	nd Family Welfar e, Department of P harmaceuticals Department of Pr omotion and Ind ustry and Interna l Trade	
16.	End-of-life interventions, effective solid & plastic w aste management practi ces, to prevent waste leaking into the environm ent and potentially contri buting to microplastics g eneration including the f ollowing; Reducing the amount of plastic waste that enters landfills and dumpsites t hrough the implementati on of waste reduction po licies and initiatives, suc h as waste-to-energy pro grams and increased rec ycling. Microplastics can also b e reduced by supporting the developm ent and use of biodegrad able plastic alternatives	Department of Dr inking Water and Sanitation, Ministry of Housing and Urb an Affairs,	
17.	End-of-pipe intervention s, wastewater, stormwat er, and road runoff mana gement and treatment, t o retain the emitted micr oplastics before these re ach water bodies.	Department of W ater Resources, River developme nt and Ganga Re juvenation, Department of Dr inking Water and Sanitation, Ministry of Housing and Urb an Affairs	

18.	Maximizing clean drinking water supply to all citizens inthe country	Department of Drinking Water and Sanitation	
19.	Other Best practices as listed below for minimizing microplastics in environment may be followed: Install physical barriers such as screens and filters on STP/WWTP systems to help reduce the amount of microplastics that enter rivers, lakes, and oceans. Support sustainable fishing practices to reduce the amount of microplastic entering rivers from fishing equipment. Implementation of Clean-up efforts for beaches and rivers	Department of Drinking Water and Sanitation, Ministry of Housing and Urban Affairs. Department of Water Resources, River development and Ganga Rejuvenation, Department of Fisheries Ministry of Earth Science	
	Training and capacity building including microplastic monitoring, analysis, health impact studies may be taken up for effective implementation of aforementioned points.”	CPCB, DCPC/CIPET, MoEFCC/NCSCM, MoES/NCCR, CSIR- IITR and CSIR-NERI	
	Other conclusions given in the report		
20.	Independent studies regarding microplasticshave been conducted by various organizations in the country including CPCB, MoES- NCCR, NCSCM, NPC and CIPET .Further international studies have been conducted by WHO, UNEP , OECD and others.		

21.	The studies have primarily focused on monitoring microplastics (concentration, polymer type, colour, shape) in various environmental matrices.		
22.	Occurrence of microplastics has been reported in oceans, sediments, surface water, ground water, wastewater, tap water, bottled water, air, food products, aquatic organisms, and humanbeings		
23.	There is currently no standard method for sampling and analysis of microplastics in the environment. ISO is currently working on the subject		
24.	Sampling and analytical methods adopted by different institutions in India are similar with minor variations.Variation in Microplastic concentrations units reported by different organizations has been observed		
26.	Microplastic concentration in end use areas including ambient air, drinking water and ground water is available.		

रजिस्ट्री सं० डी० एल०-33004/99

REGD. NO. D. L.-33004/99

Annexure - IV

भारत का राजपत्र
The Gazette of India

असाधारण
EXTRAORDINARY
भाग II—खण्ड 3—उप-खण्ड (i)
PART II—Section 3—Sub-section (i)
प्राधिकार से प्रकाशित
PUBLISHED BY AUTHORITY

सं. 494] नई दिल्ली, सोमवार, सितम्बर 25, 2000/आश्विन 3, 1922
No. 494] NEW DELHI, MONDAY, SEPTEMBER 25, 2000/ASVINA 3, 1922

पर्यावरण और वन मंत्रालय

अधिसूचना

नई दिल्ली, 25 सितम्बर, 2000

सा. का. नि. 742(अ).—केन्द्रीय सरकार, पर्यावरण (संरक्षण) अधिनियम, 1996 (1996 का 29) की धारा 6 और धारा 25 द्वारा प्रदत्त शक्तियों का प्रयोग करते हुए, पर्यावरण (संरक्षण) नियम, 1996 का और संशोधन करने के लिए निम्नलिखित नियम बनाती है, अर्थात् :—

1. (1) इन नियमों का संक्षिप्त नाम पर्यावरण (संरक्षण) संशोधन नियम, 2000 है।

(2) इस अधिसूचना में अन्यथा जैसा उपबंधित है उसके सिवाय, वे राजपत्र में प्रकाशन की तारीख को प्रवृत्त होंगे।

2. पर्यावरण (संरक्षण) नियम, 1986 में,—

(1) अनुसूची 1 में पटाखों के लिए शोर मानकों से संबंधित क्रम संख्याक 89 और उससे संबंधित प्रविष्टियों के पश्चात् निम्नलिखित क्रम संख्यांक और उनसे संबंधित प्रविष्टियां अन्त:स्थापित की जाएंगी, अर्थात् :—

"90. कोयला खानों के लिए मानक

1. वायु क्वालिटी मानक

निम्नलिखित धूल उत्पादक स्रोतों से 500 मीटर की दूरी पर प्रबल हवा की दशा पर विचार करते हुए नीचे की ओर हवा की दिशा में निलंबित कणिकीय पदार्थ (एस. पी. एम.), अन्त: श्वसनीय कणिकीय पदार्थ (आर. पी. एम.), सल्फर डाईआक्साइड (एस ओ$_2$) और नाइट्राजन आक्साइड (एन ओ$_2$) का संकेन्द्रण नीचे दी गई सारणी-I, और II, और III में विनिर्दिष्ट मानकों से अधिक नहीं होगा।

धूल उत्पादन के स्रोत

लदाई या उतराई, कर्षण सड़क, कोयला परिवहन सड़क, कोयला हथालने का संयंत्र (सी. एच. वी.) रेल सरकवां, विस्फोट, छेदन, अधिक ऊंचे ढेर या कोई अन्य धूल उत्पादन के बाहरी स्रोत जैसे कोक भट्टी (कठोर तथा मुलायम), इष्टिका उद्योग, पास की सड़क आदि।

टिप्पण :—1. जहां उपचारित बहिस्राव ऐसे नगर सीवर में डाला जाता है जो अंतिम उपचार संयंत्र में जाता है, वहां जैव-रसायन आक्सीजन मांग (बी ओ डी) की 100 मि.ग्रा./लि. तक और रसायन आक्सीजन मांग (सी ओ डी) की 400 मि.ग्रा./लि. तक छूट दी जा सकेगी।

2. बहिस्राव की क्वालिटी (एक लिटर प्रति किलोग्राम उत्पाद) संयुक्त सूती वस्त्र उद्योग संयुक्त ऊनी वस्त्र उद्योग और टैक्सटाइल प्रसंस्करण उद्योग में क्रमश: 100, 250 और 80 होगी।

93. **स्नान-जल के लिए प्राथमिक जल क्वालिटी मानदंड**

जलाशय या उसके भाग में के जल का कई प्रकार से उपयोग किया जाता है। जल के उपयोगों और क्रियाकलापों के प्रकार पर निर्भर रहते हुए जल क्वालिटी की कसौटी किसी विशिष्ट प्रयोजन के लिए उसकी उपयुक्तता अवधारित करने के लिए विनिर्दिष्ट कर दी गई है। विभिन्न प्रकार के उपयोगों में एक उपयोग यह भी है जो जल के उच्चतर स्तर की क्वालिटी या शुद्धता की मांग करता है और उस जलाशय के विस्तार में उसे "अभिहित सर्वोत्तम उपयोग" के रूप में जाना जाता है। इस पर आधारित प्राथमिक जल क्वालिटी की कसौटी के निबंधनों के अनुसार विभिन्न उपयोगों के लिए जल क्वालिटी अपेक्षाएं विनिर्दिष्ट की गई हैं। सारणी 1 में स्नान-जल के लिए प्राथमिक जल क्वालिटी की तर्कयुक्त कसौटी विनिर्दिष्ट की गई है।

सारणी 1

स्नान-जल के लिए प्राथमिक जल क्वालिटी मानदंड

(संगठित बाह्य स्नान के लिए प्रयुक्त जल)

मानदंड		तर्कआधार
1. फिकल	500 (वांछनीय)	निम्न मल जल संदूषण सुनिश्चित करने के लिए,
कोली फॉर्म	2500 (अधिकतम अनुज्ञेय)	फिकल कोलीफार्म और फिकल स्ट्रेप्टोकोक्की के
एम. पी. एन./100 मि.लि.		बारे में यह माना गया है कि वे जीवाणु रोगोत्पादकता
2. फिकल स्ट्रेप्टोकोक्की	100 (वांछनीय)	को दर्शित करते हैं। वांछनीय और अनुज्ञेय सीमाएं पर्यावर्णिय दशाओं में उतार-चढ़ाव
एम. पी. एन./100 मि.लि.	500 (अधिकतम अनुज्ञेय)	को अनुज्ञात करने के लिए सुझाव देती हैं जैसे कि मौसमी परिवर्तन, बहाव की दशाओं में परिवर्तन आदि।
2. पी. एस.	6.5 से 8.5 के बीच	यह रेंज त्वचा और आँख, नाक, कान आदि जैसे कोमल अंगों को संरक्षण प्रदान करती है जो बाह्य स्नान के दौरान सीधे प्रभावित होते हैं।
3. घुली हुई आक्सीजन		5 मि.ग्रा./लि. के न्यूनतम घुली हुई आक्सीजन संकेन्द्रण ठीक ऊपरीधारा में आर्गनिक प्रदूषण युक्त आक्सीजन लेने से युक्तियुक्त मुक्ति सुनिश्चित करते हैं जो तलछट से अनाइरोबिक गैसों (आबनोक्सीयस गैसों) के उत्पादन को निवारित करने के लिए आवश्यक है।
4. जैव-रसायन आक्सीजन मांग (बी ओ डी) (27^{o} से. पर 3 दिन)		3 मि.ग्रा./लि. या इससे कम जल की जैव रसायन आक्सीजन मांग आक्सीजन डिमांडिग प्रदूषकों से युक्तियुक्त मुक्ति सुनिश्चित करती है और आबनाक्सीयस गैसों के उत्पादन को रोकती है।"

(2) अनुसूची 6 के शोर मान दंडों से संबंधित भाग ङ में, मोटरगाड़ियों के लिए शोर सीमा से संबंधित भाग क के पश्चात् निम्नलिखित अन्त: स्थापित किया जाएगा :—

"कक. 1 जनवरी, 2003 से मोटर यानों के लिए शोर सीमा

मोटर यानों के लिए निम्नलिखित शोर सीमा 1 जनवरी, 2003 से लागू होगी। अनुसरण किए जाने वाली परीक्षण पद्धति भा मा.

MINISTRY OF ENVIRONMENT AND FORESTS

NOTIFICATION

New Delhi, the 25th September, 2000

G.S.R. 742(E).— In exercise of the powers conferred by sections 6 and 25 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government hereby makes the following rules further to amend the Environment (Protection) Rules, 1986, namely.

1. (1) These rules may be called the Environment (Protection) Amendment Rules, 2000.

(2) Save as otherwise provided in this notification, they shall come into force on the date of their publication in the Official Gazette.

2. In the Environment (Protection) Rules, 1986,—

(1) In Schedule I, after serial number 89 relating to Noise standards for fire crackers and the entries relating thereto, the following serial numbers and entries shall be inserted, namely:—

"90. Standards for coal mines

1. Air Quality Standards

The Suspended Particulate Matter (SPM), Respirable Particulate Matter (RPM), Sulphur dioxide (SO_2) and Oxides of Nitrogen (NOx) concentration in downwind direction considering predominant wind direction, at a distance of 500 metres from the following dust generating sources shall not exceed the standards specified in the Tables I, II and III given below:

Dust Generating Sources

Loading or unloading, Haul road, coal transportation road, Coal handling plant (CHP), Railway sliding, Blasting, Drilling, Overburden dumps, or any other dust generating external sources like coke ovens (hard as well as soft), briquette industry, nearby road etc.

93. Primary Water Quality Criteria for Bathing Waters.

In a water body or its part, water is subjected to several types of uses. Depending on the types of uses and activities, water quality criteria have been specified to determine its suitability for a particular purpose. Among the various types of uses there is one use that demands highest level of water quality or purity and that is termed as "Designated Best Use" in that stretch of water body. Based on this, water quality requirements have been specified for different uses in terms of primary water quality criteria. The primary water quality criteria for bathing water are specified along with the rationale in table 1.

Table 1.

PRIMARY WATER QUALITY CRITERIA FOR BATHING WATER
(Water used for organised outdoor bathing)

CRITERIA		RATIONALE
1. Fecal Coliform MPN/100 ml:	500 (desirable) 2500 (Maximum Permissible)	To ensure low sewage contamination. Fecal coliform and fecal streptococci are considered as they reflect the bacterial pathogenicity.
2. Fecal Streptococci MPN/100 ml:	100 (desirable) 500 (Maximum Permissible)	The desirable and permissible limits are suggested to allow for fluctuation in environmental conditions such as seasonal change, changes in flow conditions etc.
2. pH:	Between 6.5 -8.5	The range provides protection to the skin and delicate organs like eyes, nose, ears etc. which are directly exposed during outdoor bathing.
3. Dissolved Oxygen:	5 mg/l or more	The minimum dissolved oxygen concentration of 5 mg/l ensures reasonable freedom from oxygen consuming organic pollution immediately upstream which is necessary for preventing production of anaerobic gases (obnoxious gases) from sediment.
4. Biochemical Oxygen demand 3 day,27°C:	3 mg/l or less	The Biochemical Oxygen Demand of 3 mg/l or less of the water ensures reasonable freedom from oxygen demanding pollutants and prevent production of obnoxious gases";

Annexure -V

By Speed Post/Email

F. No. A-14011 /1/2024 WQM-I 412-428

01.05.2024

To,

The Member Secretary,
SPCBs/PCC: - (Andhra Pradesh, Assam, Bihar, Goa, Gujarat, Himachal Pradesh, Haryana, Jammu & Kashmir, Kerala, Madhya Pradesh, Maharashtra, Manipur, Mizoram, Odisha, Rajasthan & Uttar Pradesh)

Sub: Non-complying status of data monitored under National Water Quality Monitoring at Ramsar locations from Jan to Dec 2023 reg.

CPCB periodically reviews water quality data received under NWMP. Water quality data for the period Jan to Dec 2023 for Ramsar sites in your State has been reviewed. It has been observed that ___ number of locations are non-complying w.r.t Primary Water Quality Criteria for Outdoor Bathing notified under the E(P) Rules, 1986(**details enclosed**).

In view of the above, it is requested to identify the sources of pollution specially at the non-complying locations and may take concerted efforts for improvement of water quality of Ramsar Sites. The action taken report on subject matter shall also be submitted to this office.

Yours faithfully,

O/C

(Vishal Gandhi)
Scientist -E, WQM – I

Encl: As above

Copy to:

1. The Regional Director, (RD Lucknow, RD Kolkata, RD Pune, RD Shillong, RD Chennai, RD Vadodara, RD Bengaluru, RD Bhopal, RD Chennai) : For kind information & follow up with concerned SPCBs, Please.
2. PS to MS, CPCB : For kind information of 'MS' Please.

केन्द्रीय प्रदूषण नियंत्रण बोर्ड
निर्गत..N.Singh
दिनांक 06/5/2024

O/C

(Vishal Gandhi)