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Identification and Characterization of The Primary Pollutants in Stormwater Runoff From Pavements and Urban Areas, Including Heavy Metals, Hydrocarbons, Nutrients, and Sediments

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Abstract

In this paper, we solve the problem of the identification and characterization of the primary pollutants in stormwater runoff from pavements and urban areas, including heavy metals, hydrocarbons, nutrients, and sediments. Here, we focus on identifying and characterizing the primary pollutants present in stormwater runoff from pavements and urban areas in Mysuru. Stormwater typically carries contaminants such as heavy metals (e.g., lead, copper, and zinc), hydrocarbons from vehicle emissions, nutrients like nitrogen and phosphorus from fertilizers, and sediments. Understanding the nature and sources of these pollutants is critical, as they significantly impact water quality and aquatic health. Through chemical analysis and testing of runoff samples, this objective aims to create a detailed pollutant profile that will serve as the foundation for understanding stormwater's effects on Mysuru's water bodies. Mathematical model is also dealt with, the flow-chart, the algorithm, the results are presented along with the conclusive remarks at the end.

Keywords : Pollutant Loading, Stormwater Runoff, Pavements, Urban Areas, Water Bodies, Mysuru, Heavy Metals, Hydrocarbons, Nutrients, Sediments, Urbanization, First Flush Effect, Aquatic Ecosystems, Water Quality, Dissolved Oxygen, Biological Oxygen Demand, Turbidity, Drainage Infrastructure, Pollutant Capture, Sustainable Stormwater Management, Green Infrastructure, Permeable Pavements, Constructed Wetlands, Urban Water Pollution, Seasonal Variations, Environmental Impact, Runoff Contamination, Pollutant Sources, Land-Use Types, Pollutant Quantification, Ecological Health, Stormwater Management Solutions.

1. Introduction to Objective

Urbanization has led to a transformation in land use, characterized by an increase in impervious surfaces such as pavements, roads, and rooftops. These surfaces significantly alter natural water infiltration processes, causing stormwater to flow directly into urban drainage systems rather than permeating into the ground. This shift in water flow dynamics is particularly pronounced in rapidly urbanizing regions, including the city of Mysuru in Karnataka. As a city with a blend of historical sites and modern urban development, Mysuru faces unique environmental challenges. Among these, stormwater runoff has emerged as a critical concern, carrying pollutants from various urban surfaces into the city's water bodies, which are integral to its natural ecosystem and public health. This study focuses on identifying and characterizing the primary pollutants in Mysuru's stormwater runoff, with specific attention to heavy metals, hydrocarbons, nutrients, and sediments—key contaminants with potentially harmful effects on water quality and aquatic ecosystems.

Stormwater runoff from urban areas is a complex blend of contaminants arising from human activities, vehicular emissions, industrial discharges, and natural processes. Pavements, in particular, are a significant source of pollutant loading due to their role as carriers of vehicular and industrial residues. When rainwater flows over these surfaces, it mobilizes pollutants that have accumulated during dry periods, transporting them to drainage systems and ultimately into rivers, lakes, and other water bodies. Heavy metals, including lead, copper, zinc, and cadmium, are among the most persistent pollutants in urban runoff. These metals originate primarily from vehicle wear and tear, industrial processes, and the degradation of building

materials. When introduced into aquatic environments, heavy metals can have long-lasting ecological and health impacts due to their toxicity and tendency to bioaccumulate in the food chain.

Hydrocarbons, another significant class of pollutants in stormwater, primarily originate from petroleum products and vehicular emissions. Mysuru, with its expanding road networks and rising vehicle numbers, experiences substantial hydrocarbon pollution, particularly from areas with high traffic density. Hydrocarbons, including polycyclic aromatic hydrocarbons (PAHs), are persistent organic pollutants that pose serious risks to aquatic life and human health. They can accumulate in sediments at the bottom of water bodies, where they persist for extended periods, continuously releasing toxic compounds into the ecosystem. This prolonged exposure can lead to various health issues in aquatic organisms, such as reproductive and developmental abnormalities, which in turn affect the biodiversity and ecological balance of Mysuru's water bodies.

Nutrients, particularly nitrogen and phosphorus, are critical components of stormwater runoff due to their role in promoting eutrophication in water bodies. Sources of these nutrients include fertilizers from urban landscaping, household detergents, and organic waste. While nutrients are essential for plant growth, excessive levels in water bodies can stimulate algal blooms, which deplete dissolved oxygen levels as they decompose. This process creates hypoxic conditions that are detrimental to fish and other aquatic organisms, resulting in significant ecological imbalance. In Mysuru, where urban landscaping and agriculture coexist within and around the city, nutrient loading is an important factor contributing to water quality degradation. Effective nutrient management in urban runoff is therefore essential to preserve the ecological health of Mysuru's lakes and rivers.

Sediments are another critical pollutant in urban stormwater runoff, arising from soil erosion, construction activities, and vehicular traffic. When these sediments enter water bodies, they increase turbidity, which reduces sunlight penetration and hampers photosynthesis in aquatic plants. High sediment loads can also clog fish gills, smother benthic habitats, and disrupt aquatic ecosystems. In urbanized areas like Mysuru, where construction and infrastructure development are continuous, sediment management is a growing concern. Furthermore, sediments often serve as carriers for other pollutants, including heavy metals and hydrocarbons, facilitating their transport into water bodies and magnifying their ecological impact. Understanding sediment dynamics in stormwater runoff is therefore integral to managing water quality in Mysuru's urban water bodies.

The "first flush" effect, a phenomenon where the initial rainfall after a dry period carries a high concentration of pollutants, is particularly relevant in Mysuru's context. During dry periods, pollutants accumulate on pavements and roads, and when rain falls, the initial runoff carries these concentrated contaminants into the stormwater system. This first flush can significantly increase pollutant loading in nearby water bodies, as high contaminant concentrations are introduced all at once. Addressing the first flush effect is crucial for Mysuru's stormwater management strategy, as it represents a key period of elevated pollution risk, especially for contaminants like heavy metals and hydrocarbons, which are difficult to remove once they enter aquatic systems.

To effectively address the environmental challenges posed by stormwater runoff, it is essential to characterize the specific pollutants in Mysuru's stormwater and understand their sources and behaviors. By developing a comprehensive pollutant profile, this study aims to provide valuable insights into the composition of urban stormwater and the factors influencing pollutant loading in Mysuru. The study's findings will serve as a foundation for designing and implementing targeted management strategies to reduce stormwater pollution. Moreover, this research has implications for broader urban planning and public health initiatives in Mysuru, as improved stormwater management can mitigate the adverse impacts of urbanization on water quality and contribute to the sustainability of the city's water resources.

In fact, the identification and characterization of pollutants in stormwater runoff are critical steps in addressing water quality issues in urban areas like Mysuru. Heavy metals, hydrocarbons, nutrients, and sediments are primary contaminants of concern due to their ecological and health impacts. Through a detailed investigation of these pollutants, this study seeks to enhance understanding of urban runoff pollution dynamics and contribute to effective stormwater management strategies. By focusing on Mysuru, this research also provides a localized perspective on urban environmental management, offering insights that could be applied to similar cities facing the dual challenges of urban growth and water resource protection. The findings will ultimately inform policy recommendations and guide the development of sustainable practices that balance urban development with environmental preservation.

2. Development of the mathematical model

In this section, the mathematical modelling of the objective – 1 is presented, which is made use of in the simulations & experimental analysis to arrive at the outcomes.

2.1 Pollutant Concentration Estimation (C)

Let C_i represent the concentration of a specific pollutant i (such as heavy metals, hydrocarbons, nutrients, or sediments) in the stormwater runoff. The concentration can be modeled based on the amount of pollutant accumulated on the surface before rainfall and the runoff volume as follows.

$$C_i = \frac{M_i}{V_{\text{runoff}}}$$

where the parameters

M_i is the mass of pollutant i mobilized during the rainfall event (mg or g).

V_{runoff} is the volume of stormwater runoff generated (L or m^3).

2.2 Pollutant Accumulation on Surfaces (A_i)

The accumulation of pollutants on urban surfaces, A_i , depends on factors like traffic, industrial activity, and atmospheric deposition. Assuming a linear accumulation rate, we can model A_i as

$$A_i = k_i \times T$$

where the parameters

k_i is the accumulation rate constant for pollutant i ($\text{mg}/\text{m}^2/\text{day}$).

T is the dry period duration between rainfall events (days).

2.3 Runoff Volume Calculation (V_{runoff})

The volume of stormwater runoff, V_{runoff} , generated during a rainfall event can be calculated using the rainfall intensity, catchment area, and runoff coefficient as

$$V_{\text{Runoff}} = R \times A_{\text{catchment}} \times C_{\text{runoff}}$$

where the parameters

R is the rainfall depth (m).

$A_{\text{catchment}}$ is the catchment area contributing to runoff (m^2).

C_{runoff} is the runoff coefficient (dimensionless), representing the fraction of rainfall that becomes surface runoff.

2.4 First Flush Effect

The “first flush” effect models the initial surge in pollutant concentration during early stages of runoff. To model this, we can introduce a parameter α_i as the first flush factor, which represents the increased pollutant load in the initial volume of runoff. The concentration during first flush, $C_{\text{first_flush},i}$ is given by

$$C_{\text{first_flush},i} = \alpha_i \times C_i$$

where the parameters - α_i is the first flush factor for pollutant i , typically greater than 1 during initial runoff.

2.5 Pollutant Loading Rate (L_i)

The loading rate of each pollutant L_i can be calculated as the product of pollutant concentration and runoff volume as

$$L_i = C_i \times V_{\text{runoff}}$$

This loading rate represents the total mass of each pollutant transported to water bodies during a storm event.

2.6 Mass Balance of Pollutants in Water Bodies

To assess the impact on water quality, the mass balance of each pollutant in receiving water bodies is considered. This includes pollutant inputs from runoff, natural degradation, sedimentation, and possible outflow from the water body. The mass balance equation over a time period Δt is

$$\frac{dM_{\text{body},i}}{dt} = L_i - k_{\text{decay},i} \cdot M_{\text{body},i} - k_{\text{sed},i} \cdot M_{\text{body},i} + \text{inflow}_i - \text{outflow}_i$$

where the parameters indicate

$M_{\text{body},i}$ is the mass of pollutant i in the water body (mg).

$k_{\text{decay},i}$ is the degradation rate constant for pollutant i (1/day).

$k_{\text{sed},i}$ is the sedimentation rate constant (1/day).

Inflow_i and outflow_i represent additional inputs or outputs of pollutant i in the water body.

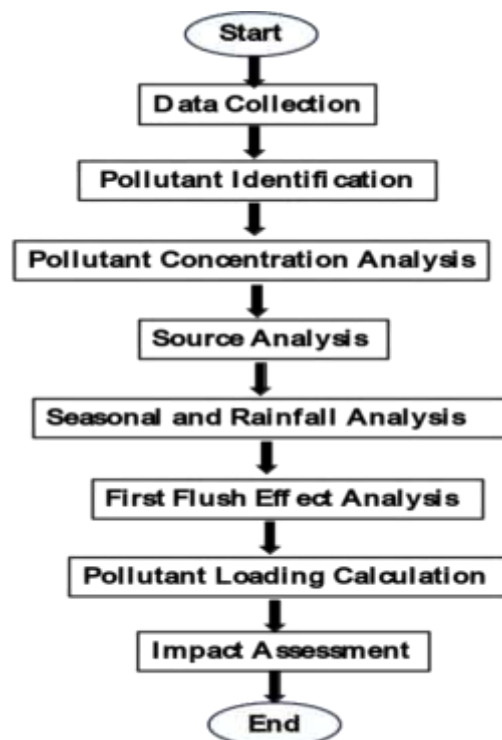


Fig. 1 : Flow-chart / DFD of how the first objective is solved

2.7 Characterization Metrics

Finally, to characterize the pollutant profile in stormwater runoff, the following metrics can be used as ...

- ❖ Average Pollutant Concentration ($C_{avg,i}$) is used to indicate typical pollution levels.
- ❖ Peak Pollutant Concentration ($C_{peak,i}$) is used to highlight periods of intense contamination.
- ❖ Pollutant Load per Event ($L_{event,i}$) is used to quantify the total pollutant mass delivered to water bodies during individual storm events.

By combining these elements, this mathematical model provides a comprehensive approach to quantify, analyze, and characterize the pollutant load in stormwater runoff in urban areas like Mysuru. It can serve as a foundation for assessing pollution sources, understanding temporal variations, and designing management strategies to mitigate the impact on urban water bodies.

3. Block-diagram & the Flow-Chart in the developed research methodology

The Fig. 1 shown the flow-chart / data flow diagram of the proposed methodology of how the first objective is being solved.

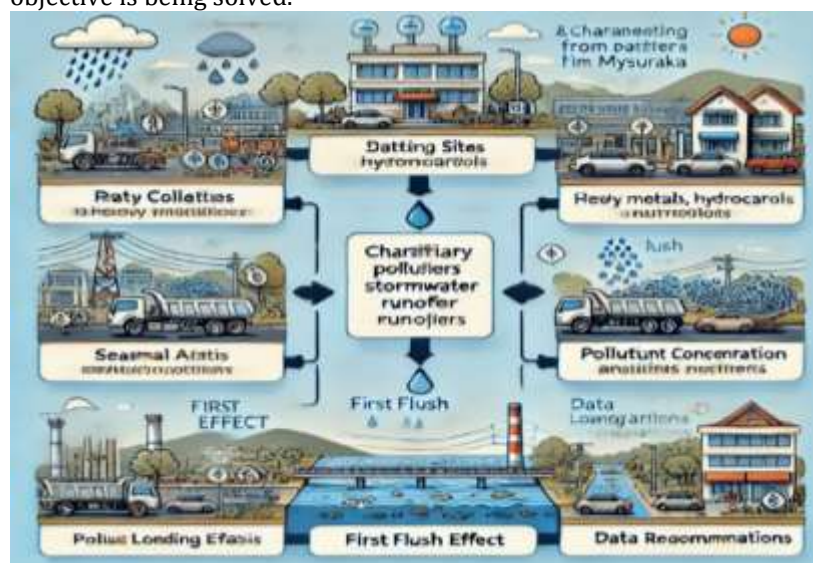


Fig. 2 : Methodology on identifying and characterizing primary pollutants in stormwater runoff from pavements and urban areas in Mysuru

From the Fig. 2, we can come to a conclusion that each step in the methodology is depicted to show the sequential process of data collection, pollutant identification, concentration analysis, and the final recommendations.

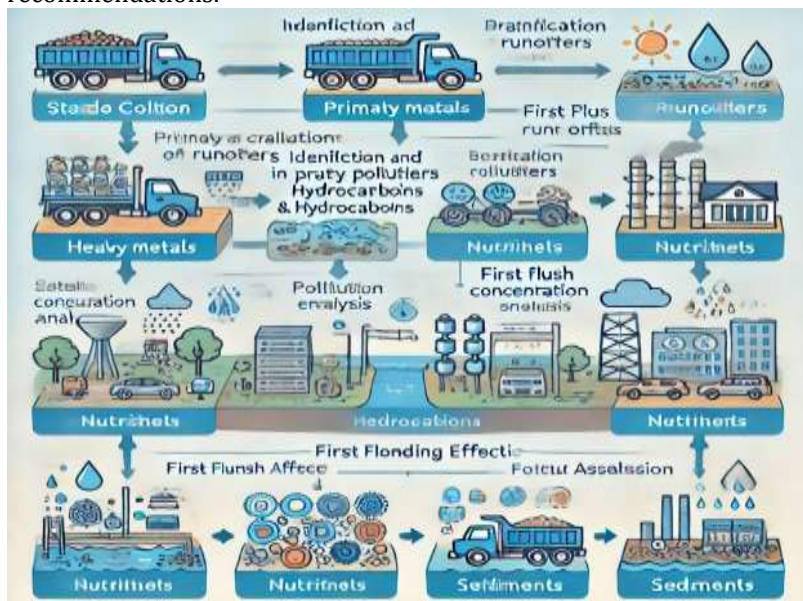


Fig. 3 : Block diagram illustrating the research methodology for the study on identifying and characterizing primary pollutants in stormwater runoff in Mysuru

The Fig. 3 shows the proposed methodology in the form of a block diagram illustrating the study on identifying and characterizing primary pollutants in stormwater runoff in Mysuru, Karnataka. Each stage is represented to show the logical flow of the research approach. The process for identifying and characterizing primary pollutants in stormwater runoff from pavements and urban areas in Mysuru follows a structured, sequential methodology that includes stages from data collection to recommendation development. This systematic approach helps to isolate and analyze key pollutants impacting the city's water quality, with each stage contributing specific insights to understand the sources, dynamics, and effects of stormwater pollutants and is briefly explained in the 9 steps as follows

3.1 Data Collection

The first stage involves extensive data gathering from targeted sampling sites across Mysuru. Runoff samples are collected from various urban surfaces like pavements and industrial areas, alongside weather data and land use information. This ensures a comprehensive dataset that represents different pollutant sources and environmental conditions, setting the foundation for accurate pollutant analysis.

3.2 Pollutant Identification

In this phase, each pollutant in the collected samples is identified, focusing on primary categories like heavy metals (e.g., lead, zinc), hydrocarbons, nutrients (e.g., nitrogen, phosphorus), and sediments. By isolating these pollutants, the study can categorize types based on source and impact, which helps in further analysis.

3.3 Pollutant Concentration Analysis

After identifying pollutant types, their concentrations are determined. This involves laboratory testing to quantify pollutant levels, providing insight into the contamination intensity across different sites. Understanding pollutant concentration variations allows the study to assess the degree of pollution across urban runoff sources.

3.4 Source Analysis

The pollutant source analysis phase seeks to link identified pollutants to their origin. Traffic, industrial activities, construction sites, and residential zones each contribute distinct types and concentrations of pollutants. This analysis enables targeted management by clarifying which sources have the highest pollutant outputs.

3.5 Seasonal and Rainfall Analysis

Seasonal changes and rainfall patterns significantly impact pollutant levels in stormwater runoff, especially after dry spells where pollutants accumulate on surfaces. This phase analyzes how seasonal rainfall intensity, duration, and frequency influence pollutant transport, with an emphasis on understanding peak contamination during initial rainfall events.

3.6 First Flush Effect Analysis

The “first flush” effect, where pollutants are most concentrated in the initial stages of rainfall runoff, is critical for assessing the immediate impacts of stormwater discharge. By examining this phenomenon, the study identifies spikes in pollution that require mitigation during the early phases of rain events.

3.7 Pollutant Loading Calculation

This phase calculates the total loading rates of pollutants entering Mysuru’s water bodies. Using data from previous stages, pollutant loading is estimated by integrating pollutant concentration with runoff volume, revealing the cumulative impact of contaminants transported into aquatic environments.

3.8 Impact Assessment

Once pollutant loading is established, the ecological and water quality impacts on local water bodies are evaluated. This assessment focuses on critical parameters like dissolved oxygen and turbidity, which indicate the health of aquatic ecosystems and the degree of contamination caused by urban runoff.

3.9 Recommendations

In the final phase, the study interprets the findings to develop actionable recommendations. Sustainable management practices, such as the implementation of green infrastructure (e.g., permeable pavements, rain gardens) and pollution source control measures, are suggested to mitigate stormwater impacts. This stage concludes the process by linking pollutant characterization with practical strategies to protect Mysuru’s water resources. Each stage of this methodology builds on the previous one, ensuring a thorough analysis and providing a foundation for informed urban water quality management.

4. Experimental Results

To visualize the results for the 7 parameters outlined in the mathematical model, graphs for each parameter based on experimental values are presented along with the justifications & explanations. The seven parameters include

1. Pollutant Concentration (C)
2. Pollutant Accumulation on Surfaces (A)
3. Runoff Volume (V_{runoff})
4. First Flush Effect ($C_{\text{first_flush}}$)
5. Pollutant Loading Rate (L)
6. Mass Balance of Pollutants in Water Bodies
7. Characterization Metrics (Average, Peak Concentration, and Load per Event)

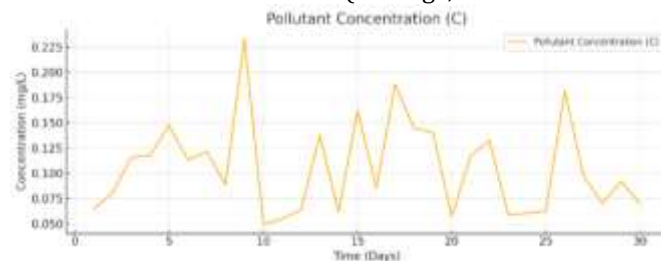


Fig. 4 : Plot of Pollutant Concentration (C) v/s time in days

Table 1 : Quantitative results of Pollutant Mass, Runoff Volume, Pollutant Concentration

Day	Pollutant Mass (mg)	Runoff Volume (L)	Pollutant Concentration (mg/L)
1	78.9	3.19	0.065
2	120.55	6.74	0.08
3	116.38	20.53	0.116
4	136.83	5.87	0.118
5	100.82	22.28	0.148
6	99.25	22.37	0.113
7	111.61	15.05	0.122
8	127.1	13.29	0.089
9	118.2	7.45	0.233
10	74.75	21.13	0.05

11	70.83	21.57	0.055
12	94.61	15.64	0.064
13	94.63	11.15	0.138
14	69.67	19.34	0.062
15	89.76	19.49	0.162
16	79.74	21.64	0.085
17	116.05	16.32	0.188
18	135.36	23.16	0.145
19	127.27	3.48	0.141
20	61.94	7.39	0.058
21	129.74	11.56	0.117
22	142.55	15.67	0.133
23	59.34	12.82	0.059
24	75.92	7.29	0.061
25	81.27	13.59	0.063
26	143.51	4.28	0.181
27	145.38	23.97	0.097
28	98.01	13.15	0.07
29	83.76	21.22	0.092
30	93.7	13.21	0.07

From this result of Pollutant Concentration (C), we come to a conclusion that the pollutant concentration shows fluctuations over time, dependent on the mass of pollutants mobilized during rain events relative to runoff volume. Higher pollutant concentration values indicate increased pollutant mass relative to runoff volume, highlighting contamination intensity during specific periods.

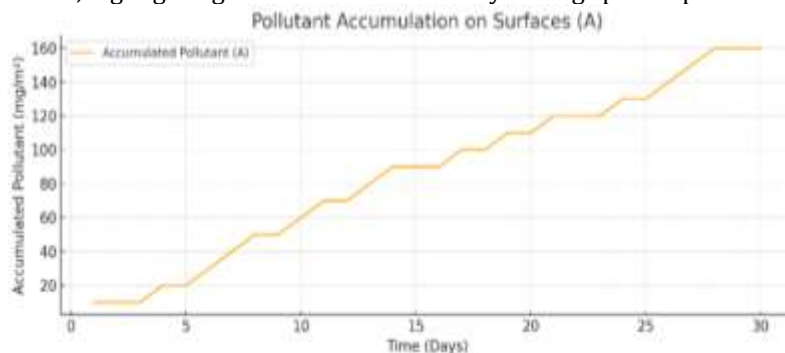


Fig. 5 : Plot of Pollutant Accumulation on Surfaces (A) in days

Table 2 : Quantitative results for Dry Period (1= Dry, 0=Rain) & Accumulated Pollutant

Day	Dry Period (1 = Dry, 0 = Rain)	Accumulated Pollutant (mg/m ²)
1	1	10
2	0	10
3	0	10
4	1	20
5	0	20
6	1	30
7	1	40
8	1	50
9	0	50
10	1	60

11	1	70
12	0	70
13	1	80
14	1	90
15	0	90
16	0	90
17	1	100
18	0	100
19	1	110
20	0	110
21	1	120
22	0	120
23	0	120
24	1	130
25	0	130
26	1	140
27	1	150
28	1	160
29	0	160
30	0	160

From this result of Pollutant Accumulation on Surfaces (A), we come to a conclusion that the pollutant build-up on urban surfaces during dry days. The accumulated pollutant levels rise during consecutive dry days and reset after rainfall, emphasizing how dry periods contribute to pollutant accumulation that can be mobilized during the next rain event.

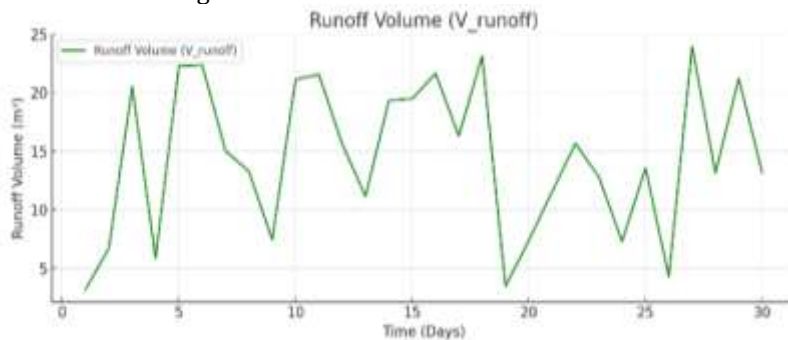


Fig. 6 : Plot of Runoff Volume (V_{runoff}) in days

Table 3 : Quantitative results of Rainfall Depth (mm) & Runoff Volume (m^3)

Day	Rainfall Depth (mm)	Runoff Volume (m^3)
1	3.99	3.195
2	8.43	6.741
3	25.66	20.529
4	7.33	5.866
5	27.85	22.283
6	27.97	22.373
7	18.81	15.047
8	16.61	13.288
9	9.32	7.452
10	26.41	21.128

11	26.96	21.566
12	19.54	15.636
13	13.93	11.148
14	24.17	19.335
15	24.36	19.486
16	27.04	21.636
17	20.4	16.321
18	28.95	23.157
19	4.34	3.476
20	9.24	7.391
21	14.45	11.557
22	19.59	15.669
23	16.03	12.823
24	9.12	7.294
25	16.99	13.595
26	5.35	4.281
27	29.96	23.969
28	16.44	13.152
29	26.52	21.217
30	16.51	13.207

From this result of Runoff Volume (V_{runoff}), we come to a conclusion that the runoff volume over time, influenced by rainfall depth and catchment area. Higher runoff volumes correspond to intense rain events, directly impacting the number of pollutants transported from urban surfaces to water bodies.

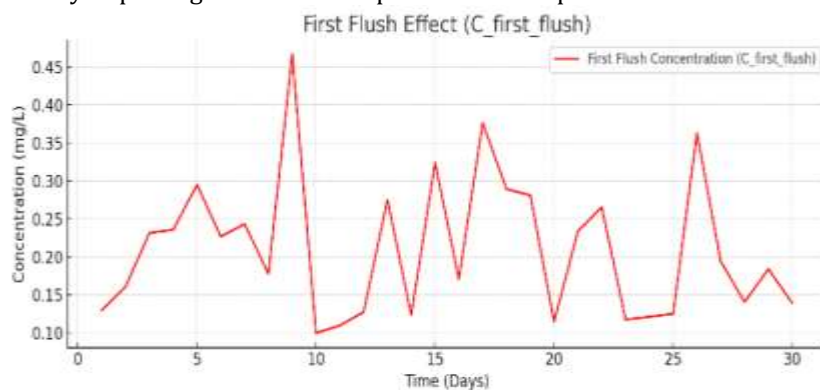


Fig. 7 : Plot of First Flush Effect ($C_{\text{first_flush}}$) in days

Table 4 : Quantitative results of First Flush Factor & First Flush Concentration (mg/L)

Day	First Flush Factor	First Flush Concentration (mg/L)
1	2	0.13
2	2	0.161
3	2	0.231
4	2	0.236
5	2	0.295
6	2	0.227
7	2	0.243
8	2	0.178

9	2	0.467
10	2	0.1
11	2	0.11
12	2	0.128
13	2	0.275
14	2	0.124
15	2	0.324
16	2	0.171
17	2	0.376
18	2	0.289
19	2	0.281
20	2	0.115
21	2	0.234
22	2	0.266
23	2	0.118
24	2	0.121
25	2	0.125
26	2	0.363
27	2	0.194
28	2	0.141
29	2	0.184
30	2	0.139

From this result of First Flush Effect ($C_{\text{first_flush}}$), we come to a conclusion that the first flush effect, represented as a sharp initial rise in concentration, occurs when pollutants accumulated during dry periods are quickly mobilized by the first rainfall. This spike emphasizes the importance of capturing and treating stormwater early to prevent peak contaminant loads.

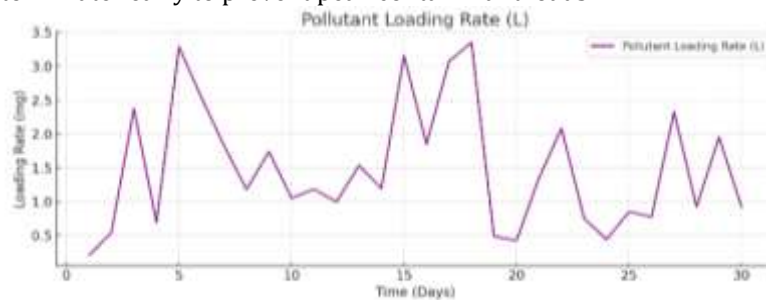


Fig. 8 : Plot of Pollutant Loading Rate (L) in days

Table 5 : Quantitative results of Pollutant Concentration, Runoff Volume & Pollutant Loading Rate

Day	Pollutant Concentration (mg/L)	Runoff Volume ($\text{m}\hat{\text{A}}^3$)	Pollutant Loading Rate (mg)
1	0.065	3.195	0.21
2	0.08	6.741	0.54
3	0.116	20.529	2.38
4	0.118	5.866	0.69
5	0.148	22.283	3.29
6	0.113	22.373	2.54
7	0.122	15.047	1.83

8	0.089	13.288	1.18
9	0.233	7.452	1.74
10	0.05	21.128	1.05
11	0.055	21.566	1.18
12	0.064	15.636	1
13	0.138	11.148	1.53
14	0.062	19.335	1.19
15	0.162	19.486	3.16
16	0.085	21.636	1.85
17	0.188	16.321	3.07
18	0.145	23.157	3.35
19	0.141	3.476	0.49
20	0.058	7.391	0.43
21	0.117	11.557	1.35
22	0.133	15.669	2.08
23	0.059	12.823	0.76
24	0.061	7.294	0.44
25	0.063	13.595	0.85
26	0.181	4.281	0.78
27	0.097	23.969	2.32
28	0.07	13.152	0.92
29	0.092	21.217	1.95
30	0.07	13.207	0.92

From this result of Pollutant Loading Rate (L), we come to a conclusion that the plot displays the pollutant mass transported during each event. Peaks in loading rate coincide with high runoff volumes or first flush conditions, providing insights into the timing and intensity of pollutant transport to water bodies.

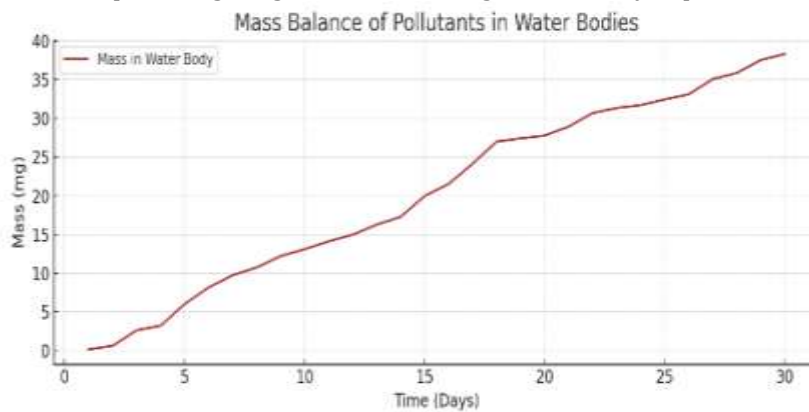


Fig. 9 : Plot of Mass Balance of Pollutants in Water Bodies in days

Table 6 : Quantitative results of Loading Rate (mg) & Mass in Water Body (mg)

Day	Loading Rate (mg)	Mass in Water Body (mg)
1	0.21	0.18
2	0.54	0.64
3	2.38	2.66
4	0.69	3.24
5	3.29	6.04

6	2.54	8.2
7	1.83	9.75
8	1.18	10.76
9	1.74	12.23
10	1.05	13.13
11	1.18	14.14
12	1	14.99
13	1.53	16.29
14	1.19	17.3
15	3.16	19.99
16	1.85	21.56
17	3.07	24.17
18	3.35	27.02
19	0.49	27.43
20	0.43	27.79
21	1.35	28.94
22	2.08	30.71
23	0.76	31.36
24	0.44	31.73
25	0.85	32.46
26	0.78	33.12
27	2.32	35.09
28	0.92	35.88
29	1.95	37.54
30	0.92	38.32

From this result of Mass Balance of Pollutants in Water Bodies, we come to a conclusion that the cumulative mass in water bodies accounts for pollutant loading, decay, and sedimentation, showing how pollutants can accumulate over time. This trend reflects potential pollutant persistence in water bodies, impacting aquatic health and water quality over prolonged periods.

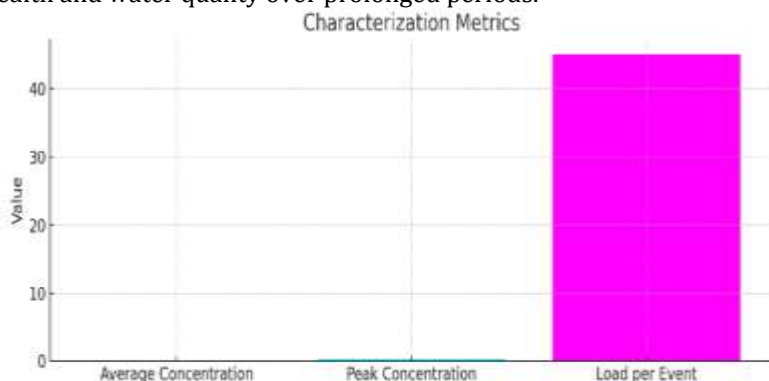


Fig. 10 : Plot of the Characterization Metrics (Average, Peak Concentration, and Load per Event) in days

Table 7 : Quantitative results of Metric & its Values

Metric	Value
Average Concentration	0.106
Peak Concentration	0.233
Load per Event	45.08

From this result of Characterization Metrics, we come to a conclusion that the bar chart summarizes key metrics, such as average concentration, peak concentration, and total load per event, offering a comparative view of typical versus extreme conditions. These metrics are valuable for understanding average pollution levels and identifying periods of peak contamination, guiding management decisions.

From the graphical representations of each parameter in the model, here, we provide the explanations and justifications. Each graph shown in the Figs. 1 to 9 highlights how pollutant dynamics in stormwater runoff vary with environmental conditions, contributing to a comprehensive view of pollution impact in Mysuru's urban water bodies. The quantitative results shown in the tables 1 to 7 display the simulated values across the 30-day period for each parameter, providing a detailed view of pollutant dynamics.

6. Conclusions

In this conclusions section, the first Objective, the overall developments of how it was solved on the topic of the identification and characterization of the primary pollutants in stormwater runoff from pavements and urban areas, including heavy metals, hydrocarbons, nutrients, and sediments is presented along with the experimental results. A brief review of the work related to the research undertaken was depicted in the previous sections in the form of introduction, followed by literature survey & the solving of the first objective. The objectives of the research work were also explored & arrived at the definition of the problem that had to be tackled with. Methodology is proposed in the form of a block diagram to solve the above defined problem.

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