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Supplementary Materials

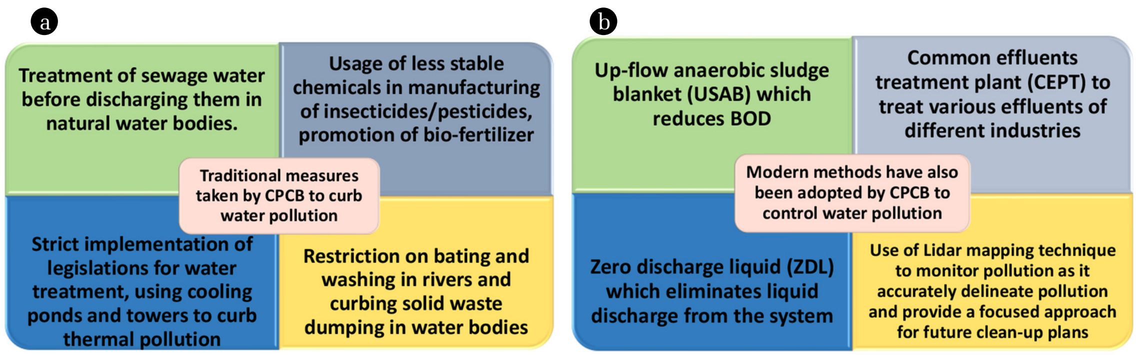

Fig. S1. a) Traditional and b) Modern methods adopted by CPCB to curb water pollution.

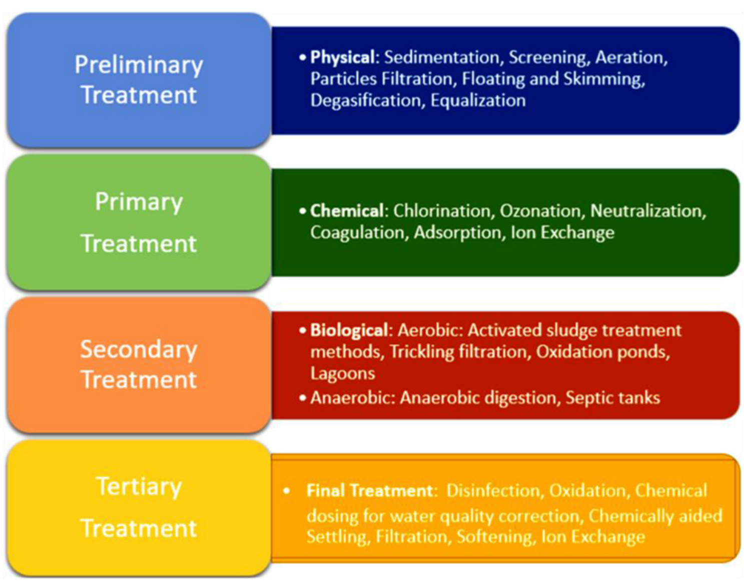

Fig. S2. Treatment and technologies used for wastewater remediation.

Fig. S3. Location map of river Ganga. Source: Internet.

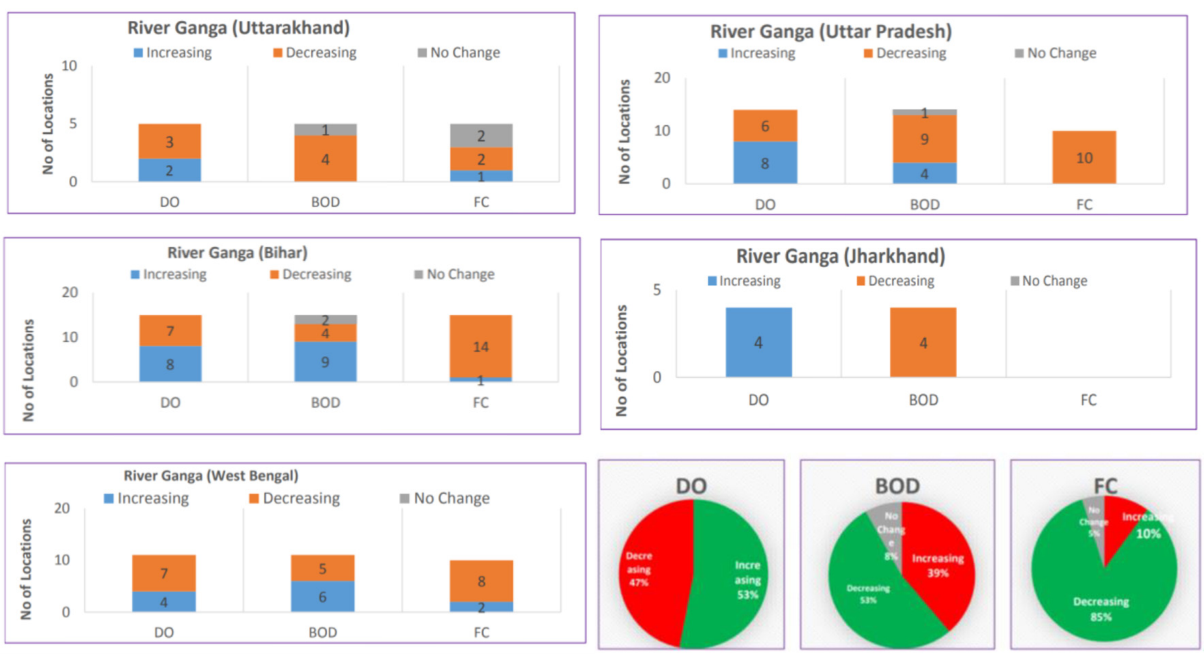

Fig. S4. Overall analysis on river Ganga before and during lockdown period. Reproduced with permission from ref [104].

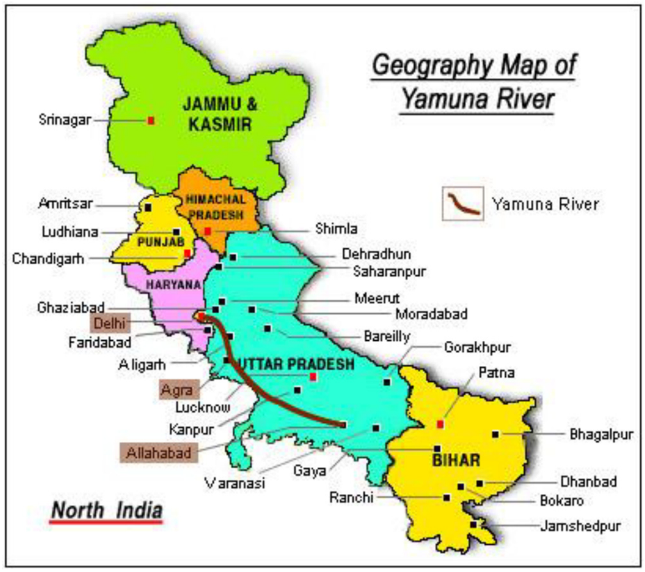

Fig. S5. Location map of river Yamuna. Source: Internet.

Fig. S6. Location map of river Godavari. Source: Internet.

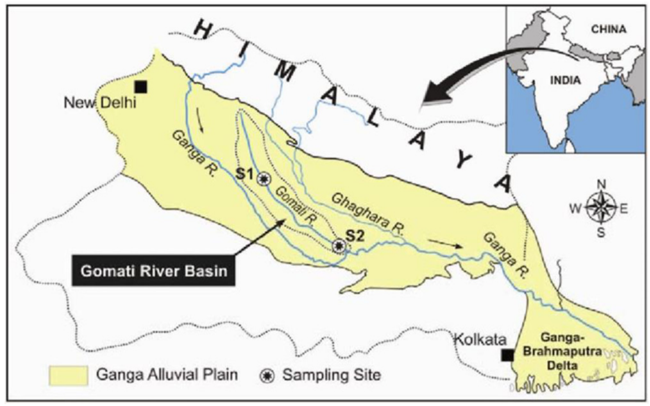

Fig. S7. Location map of river Gomati. Source: Internet.

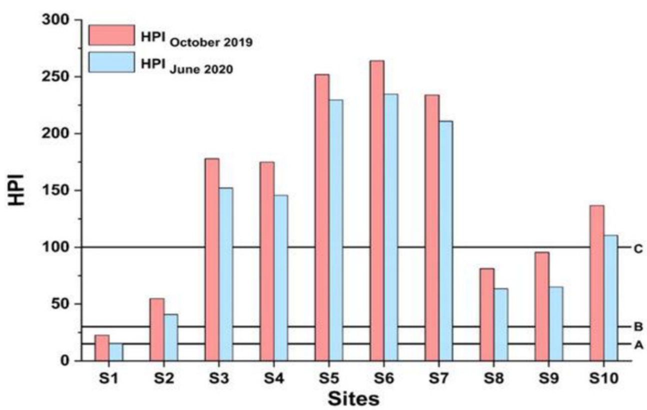

Fig. S8. Site-wise variation of HPI in October 2019 and June 2020. Reproduced with permission from ref [107].

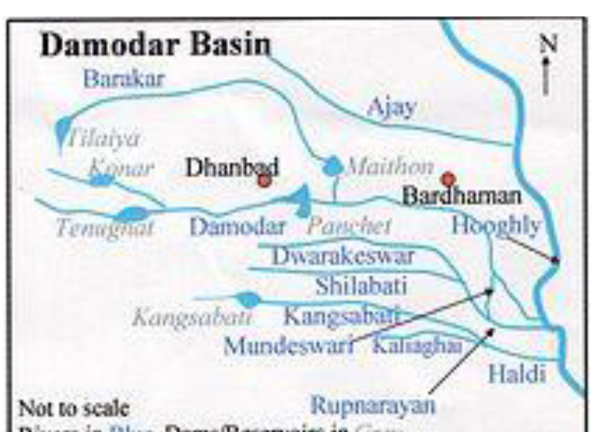

Fig. S9. Location map of river Damodar. Source: Internert.

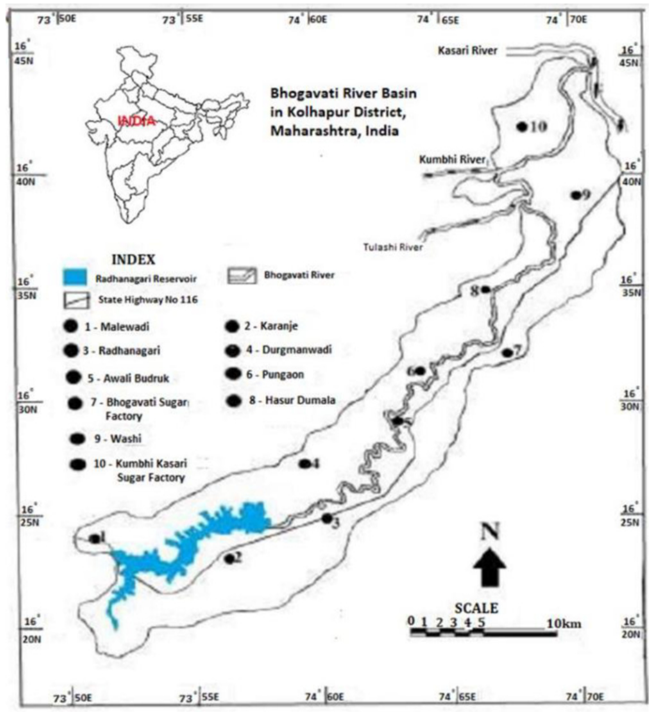

Fig. S10. Location map of river Bhogavati. Source: Internet.

Table S1. Industry Specific General Standards Described by CPCB for Discharge of Effluents [121].

S. No.	Parameter	Standards	
		Inland surface water	Marine coastal areas
1	Suspended solids	100 mg/L	i) For process wastewater-100 mg/L ii) For cooling water effluent 10% above total suspended matter of influent
2	pH Value	5.5 to 9.0	5.5 to 9.0
3	Temperature	should not exceed 5 ℃ above the receiving water temperature	should not exceed 5 ℃ above the receiving water temperature
4	Free ammonia (as NH_3)	5.0 mg/L	5.0 mg/L
5	BOD (3 days at 27℃)	30 mg/L	100 mg/L
6	COD	250 mg/L	250 mg/L

Table S2. Overview of Some Important Techniques Used for Wastewater Remediation [86, 102].

Technology	Principle	Related Materials	Merits	Demerits
Adsorption	Heavy metal absorption by the surface of a solid via weak intermolecular forces (van der Waals), chemical forces (covalent bonds), and electrostatic interactions.	Activated carbon, zeolites, nanomaterials (carbon nanotubes, graphene, nano metal oxides, and so on), and bio waste (agricultural waste, seafood waste, cellulose waste, etc.)	• Low-cost process • High efficiency • Adsorbent regeneration • Metal recovery possibility	• Low capacity • Low-capacity difficulty in large-scale applications • Adsorbent loss results in poor metal removal
Chemical Precipitation	Heavy metals are removed from wastewater by adding an appropriate reagent to generate metal precipitates, which may then be separated through filtering, flotation, or sedimentation.	Precipitating substances such as natrium sulphide, limewater, iron chloride, polyaluminium chloride, iron hydroxide, and others may be used.	• Technique that is both simple and effective. • It is possible to remove items selectively. • Other operations' waste products can function as precipitating agents.	• A large amount of reagent is required, which can be rather expensive at times. • Large amounts of sludge are produced, making disposal difficult. • Precipitation may perform poorly in the presence of undesirable complex formers such as EDTA, which forms well-soluble and strong complexes with the metals to be precipitated.
Membrane Processing	Metal ions are separated over a specifically engineered semi-permeable membrane based on their hydrated size and shape by establishing a pressure differential between the membrane's surfaces.	Ultrafiltration membranes having pore sizes ranging from 10 to 100 nm	• There is no need for any chemical additives or thermal inputs. • Environment-friendly • Fabrication, operation, and scaling-up protocols are all simple.	• Choose a middle ground between selectivity and permeability. • Large amounts of energy are used as a result of pressure-driven processes. • Extreme fouling • Processed water loss is high. • hefty upfront outlay
		Positively charged nanofiltration membranes having pore sizes ranging from 1 to 10 nm, such as poly(amidoamine) dendrimer-decorated polyamide membrane.		
		In reverse osmosis, a thin film composite polyamide membrane with pore size of 1 nm is used.		
		Polydopamine functionalized halloysite nanotube-polyetherimide membranes are examples of nanohybrid membranes.		
		Electrodialysis used in ion-exchange membranes		
Electrochemical Precipitation	Passing direct current through aqueous metal solution comprising a cathode and an anode causes heavy metal ions to precipitate onto the cathode in the form of a metal deposit that may be scraped off and recovered.	Usage of electric current	• Atmospheric temperature and pressure operation • Simple and beneficial to the environment • It necessitates less effort.	• pH sensitivity • Relatively high price • The effectiveness of removal is poor.

Table S2. Continue

Technology	Principle	Related Materials	Merits	Demerits
Solvent Extraction	Addition of an organic molecule that selectively extracts metal ions from aqueous solution by forming an organometallic complex in the organic layer that may then be destroyed by acid or base to transfer the metal into the aqueous phase and renew the extractant.	Organic compounds having molecular masses of 200-450 units that are insoluble in water; often utilised as a 20-50 percent solution in aromatic or aliphatic solvents. Di-(2-ethylhexyl) phosphoric acid (DEHPA) (acidic extractant), Adogen 364 (basic extractant), tri-n-butylphosphate (neutral extractant), and others are examples.	• Energy usage is minimal. • Complete extractant regeneration • Possibility of obtaining high purity individual metal compounds	• Difficulties concentrating metals during the extraction procedure • a low extraction efficiency
Ion Exchange	The separation of metal ions is accomplished by the reversible exchange of ions between those present in the solution and those present in the ion-exchange resin.	Montmorillonites, sulphonated coal, zeolites, sodium silicates, acrylic and metha-acrylic resins, and so on.	• Fast kinetics and high removal efficiency • a large treatment capacity • Low-cost maintenance • Resin regeneration that works • Energy usage is minimal.	• Expensive running costs • Because performance is strongly reliant on a certain ion, the approach is inappropriate for simultaneous metal removal. • Fouling caused by calcium sulphate and iron • Organic debris and microorganisms accumulating in resin beads
Chemical Reduction	Heavy metal reductive precipitation in a less hazardous form in the presence of a suitable reducing agent	Sodium borohydride, hydrazine hydrate (liquid), H2S (gas), sodium thiosulphate, ferrous sulphate, dithionite, formaldehyde, zero-valent colloidal iron (ZVI), and other reducing agents are used.	• To treat groundwater, it can be pumped into deep natural aquifers. • Human exposure should be minimised. • Regeneration (in the case of ZVI) is a possibility.	• Difficulty in dealing with the generation of hazardous intermediates