

# Embarking towards 'Swachh Bharat': *Ek Kadam Swachhata Ki Aur*

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Sitting on the sides of river Sessa (a tributary of river Brahmaputra) and enjoying the cool breeze, she wonders will the river water be transparent as before? She recollects the rendezvous of walking along the river banks when she was a kid to greet the water. She reminisces the tradition of worshipping river Brahmaputra and its tributaries by her forefathers as the lifeline to protect their civilization and socio-cultural aspects. Meanwhile glancing the pages of the newspaper, she finds the tragic tale of the river Sessa dominating the headlines over last fortnight. She continued reading and found a report by the Dibrugarh Fishery Co-operative Society stating an abrupt rise in the fish death in river Sessa leaving the rest of the fishes unhealthy for human consumption. The report advocated that the discharge of the untreated toxic wastes from the polymer factory nearby has resulted in sudden increase in the number of polluted stretches in this river, leaving the livelihood of the fishermen at stake. This problem of water pollution is of recent vintage with the heralding of the industrial revolution in the city. It is pretty apparent that the immediate aftermath of the polymer factory faced severe episodes of environmental change. As she completed reading the column of the newspaper, she felt the mute atrocities faced by the river water and a twilight seeking a raise in voice for the same. While the denizens of Assam were waking up with zeal to celebrate 'Namami Brahmaputra river festival', the trumpet of the gala kept playing in her dreams as if seeking a voice for the silent violence faced by the river. She speculated how 'Namami' symbolizing 'worship thee' be complete without paying heed to the agony behind silence of the river water. The

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\* Dr. Sujata Pramanik, Post Doctoral Fellow from Dibrugarh University, Dibrugarh, Assam, is pursuing her research on "Biomimetic Preparation of Iron Oxide based Bionanocatalyst using Marine Waste Biomass and its Catalytic Activity in Environmental Remediation and C-C Bond Functionalization." Her popular science story entitled "Embarking towards 'Swachh Bharat': Ek Kadam Swachhata Ki Aur" has been selected for AWSAR Award.

need of the hour is to grapple the problem with vigor. On this note, the obvious question of who hasn't dreamt of bringing forth the renaissance of the river with effective abatement of pollution looms over the mind. A hope against hope!

Additionally being a researcher, she had a different set of responsibilities starting from teaching, proposal writings to lab work. She worked in a lab where the group worked towards establishing 'catalyst bank' employing metals- the multitasking champions, which intended to provide the scientific community immeasurable application across domains. She pondered that she had the right tools at hand- the metals, in tackling the hurdle of wastewater problem. She felt as if the river water begged for alchemy for revival of its lost phoenix. Being a chemist, she knew that she could effectively modulate the chemistry of metals and search out a possible solution in this milieu. She discussed the matter with her mentor, Prof. Pankaj Das, and he suggested on unlocking the potentials of the metals and probe into multifunctional attributes in this vein. Armamentarium of the metals at her disposal, she decided to move forward with gleam in her eyes. Just as springtime heralds hope, the receipt of financial grant from DST SERB made her feel that her step towards her 'magic catalyst' won't remain a dream anymore.

Moving with a train of thoughts, she aimed to develop her 'magic catalyst' that would satisfy 3R approach namely recoverable, robust and recyclable. However, an uncertainty regarding the choice of metals kept revolving in her mind. Next day at morning meal, her mom questioned her younger brother- what does your breakfast cereal and steel spoon has in common? While her brother kept pondering the answer, she got inkling about her starting tool- that is iron, which would endow magnetic properties and assure the three distinct features of being robust, recoverable and recyclable. Another cue that she had drawn from the mom's question was that alloying of metals as in steel can activate and bestow multifunctional and superior performance as compared to the individual counterparts. But however the hunt for the second metal still marched on in her mind. The task to adorn the second metal with iron which would confer wastewater remediation properties seemed to be an arduous challenge. Suddenly she recollected her grandma's stories narrating the use of noble metals in water treatment and pharmaceuticals since ancient times. Before tinkering with her metals, she decided to opt for an in-depth study in this context. She found that the significance of the noble metals could be clearly seen from historical perspective and especially in the contemporary times. She finally felt as if her squeaky wheels have got the grease to move. She then decided to pull a second leaf out of her toolbox that is to go with palladium- the noble metal at her doorstep. She harnessed the powers of iron and palladium and weaved them into her 'magic catalyst'. The two metals rearranged their electrons to exhibit profoundly different properties. Seeking to stride a chord with the sustainability concept, she tamed the functionalities of the two metals using water as the solvent. Just as the doctors use 'vital signs' such as blood pressure to gauge the wellbeing of people, she as a chemist used different analytical tools to characterize her prepared catalyst. After she was ascertained about the preparation of her catalyst, she moved on to screen the toxic effluents present in the river water. She found 4-nitrophenol and chromium toxins top listed her search of effluents in the river water. She continued ahead to check the efficacy of the catalyst in removal of the same. Finally the vital findings of her study showed the removal

of the toxic effluents of the river water within 5 min of incubation of wastewater with the catalyst. To test the analysis, she repeated her experiment several times to check the reproducibility and recyclability of the catalyst. To her delight, she could spell magic and repeatedly recover her catalyst by using a magnet. She reported her findings to her mentor and he further suggested her to check the multifaceted potentiality of her catalyst. Surprisingly, the catalyst was found to show potency in bridging two carbon atoms by a bond in the synthesis of organic chemicals. She was enlightened to prepare a clean and environmentally benign 'magic catalyst' which was instrumental in destruction of the toxic effluents of the river water and construction of organic chemicals. She was delighted to share her work amidst the scientific society and finally published her findings in 'ChemistrySelect' journal.

Going back to the title question "will the river water be transparent as before?", the answer seems to be yes in part. Although the designing of her 'magic catalyst' irked her curiosity to extend some therapeutic ailment to the diseased river, she has many more extra miles to move on to return the lost glory of the river. The pursuit to achieve the complete vision for 'Swachh Bharat Mission' borders on the surreal and calls for a holistic approach. Hope this 'magic catalyst' raises some flags to imbibe inquisitiveness in young minds to blend science with innovation and make the ball to start rolling in the right direction.