

ENVIRONMENTAL CRIME SCENE INVESTIGATION - THE LAKE THAT SPEWS FROTH AND FIRE



Fig1: The foaming and fire breathing lake of
Bellandur (1)



Fig 2: Unfortunate and unsightly froths on
Yamuna- Murky history of Bellandur
repeats itself in Delhi (2)

No! this isn't one of those iconic swiss backdrops where SRK performed his ethereal Bolly numbers. This is 'The Bellandur Lake' in the sprawling city of Bangalore and there's absolutely nothing romantic about this 'foamy snow'.

It is a lake that regularly spews out slushes of foam that climbs up to heights of 10feet and eventually spills over the mesh barricade surrounding the lake onto the traffic. The obnoxiously smelly foam eerily greets 'Bon Jour' to its disgusted pedestrians. Bellandur foam at times breathes fire, choking the locality with soot and smoke. This intense case of environmental enigma requires hardcore academic 'detectivism' to prevent such an environmental 'crime' repeating itself in 35,000 other lakes in the South Indian state of Karnataka. This is not just the tragedy of Bangalore; large scale foaming has pestered many big cities in India. Yamuna is fuming in Delhi, Marina beach is lodging a silent protest against pollution in Chennai, Mithi River is chocking in Mumbai and the story goes on and on.

“Bellandur! The serene beauty was an abode of migratory birds when we were in College” said my Supervisor “Can’t believe! it’s such a nightmare now” he added; on our first discussion. Let me brief you about the site! Bellandur Lake is an 360hectare water body artificially designed to collect run-off from upstream catchments of about 160km². Bangalore city grew 12 times since 1970 to about 12million today, not to mention a whole lot of suburbs has also become a part of this sprouting process prompted by the IT and small-industry boom. The City could not keep up with the rising wastewater generation trends of its swelling population; currently only a third of its wastewater is treated. Bangalore discharges around 1500 million liters per day (MLD) as wastewater of which around 530MLD goes to Bellandur tank. The status quo of water bodies worsens when these untreated wastes are dumped into tank at rates which surpasses its natural assimilative/polishing capacity. The Lake is walled by over 500 towering apartments that are often suspected to ‘clandestinely’ release partially treated or untreated water right into this water body.

The manifestation of hidden pollution as ‘foam and fireworks’ in the waterbody have triggered public concern and garnered enough media attention. So much so, the Karnataka High Court, the Supreme Court and even the National Green Tribunal (NGT) have been flagged about this issue. Despite the NGT’s punitive confrontations and reprimands, the Bellandur still foams.

When I was in IIT Guwahati during my masters, I used to read how frothing Bellandur inadvertently turned into a selfie spot. The foam, fires and fights over sustainability was an enigma that always used to baffle me. It was a mere serendipity, that two years down the line I was in IISc, Bangalore for my PhD and I knew right away – I have to unravel this mystery.

Now, Bangalore’s never-ending tragedy, Bellandur lake is the protagonist of my PhD research. A horde of ‘instant experts’ generate unverified “Expert Opinions” that hover around in public information space without any scientific credibility. For example, the foam is branded toxic, but is it really? The irresponsible “doomsday” predictions, the presence of heavy metals and rouge phosphatic detergents in foam – How much truth lies in these claims? Why is the foam so miraculously stable that it doesn’t subside for days together? How can we stop such events from repeating itself? I am trying to answer these unsettled questions during my PhD tenure.

We all have seen bubbles! in science an aggregate of such bubbles is called foam. When we open the tap to fill a bucket - we do see bubbles at the water surface, but these bubbles pop out in no time. They don’t form foam! Let’s imagine another scenario – now we have a little detergent in the bucket. This time when we open the tap, bubbles will be stable and they’ll

combine to form foam. So, we need detergents (surface active agents i.e. surfactants) to form a stable foam.

For a long time, public media made us believe that 'phosphatic detergents' were the root cause directly responsible for the frothing waterbodies. But; Phosphorus itself being very expensive, most of the commercial detergent manufacturers voluntarily avoided their use as builders (enhance cleaning properties of detergents) and switched to non-phosphatic 'alternative' like Zeolite. Synthetic detergents were slowly but steadily taken out of market and replaced by biodegradable eco-friendly alternatives starting from 1970s. On the other hand, the levels of detergents in the Bellandur were found significantly high. Current studies in lab revealed that it has reached concentrations between 15-20mg/l in the sewage inflowing to the lake and when water leaves the lakes the levels of detergents have diminished, only slightly. Does that mean our detergents are not biodegradable?

To answer this question, we need to realize that the detergents are in fact biodegradable, i.e., under right conditions, microorganisms will eventually eat it up and break it down to its basic components and in due course blend it back in with the earth. So, why aren't they degrading in the lake itself? The answer is because they aren't getting the 'right' conditions. Let me explain it explicitly. Most biodegradable detergents need oxygen to degrade. Studying dissolved oxygen (DO) concentration in Bellandur water samples over a year we concluded DO was mostly below 1mg/l which is abysmally low - acceptable limit being above 4 mg/l. Moreover, we have in recent times, increased use of highly chlorinated anti-microbials like toilet and floor cleaners, sanitizers and handwash in daily life. Interesting observations in lab studies indicated presence of such disinfectants and antimicrobials in lake water. This kind of environment is hostile for bacteria to multiply and without bacteria - we can't imagine biodegradation.

Why does our lakes have such devastatingly low DO? Apartments along the Bellandur shoreline release untreated sewage to the lake and being so close to the lake it is too difficult to pin which of these establishments are carrying out such 'clandestine' discharges. Sewage constitutes Nitrogen and Phosphorus amongst other nutrients and thus it triggers growth of floating aquatic weeds (macrophytes) like water hyacinth. In Bellandur they grow invasively and cover the lake surface- therefore, there remains no open surface for oxygen transfer to take place from atmosphere into the water. Studies in lab indicated extreme high concentrations of such nutrients in water sample. Thus, the reason for such dreadfully low DO in Bellandur is now established!

So, does our detergents still have phosphate? During the early 2006 to 2016, the frothing was always attributed to use of ‘phosphatic’ detergents peddled by unscrupulous manufacturers. However, after my extensive analysis in our IISc lab - Phosphorus content in commercially successful Indian detergents were found minimal. So, the ‘Phosphatic detergent’ theory has now largely received a backseat. Even after analysing heavy metal concentrations in water samples thoroughly at all inlets and outlets, they were found at concentrations nowhere near alarming. Yet, media branded the foam to be toxic!

There are some non-technical issues that make the investigation difficult. The high value of estate at this spot makes it a hub of extensive illegal unauthorized activities. Complicating Environmental Crime Scene Investigation (ECSI) challenge is the case of sludge tankers from Sewage Treatment Plants and industries illegally letting off their waste loads into the lake at night. This is an environmental crime that frequently goes unnoticed. The second element of the ECSI is the vagueness of the idea as to who is the custodian of the lake or who is responsible party to the ECS? Who will remove the floating aquatic weeds largely responsible for low DO in water? Why is the government selling detergents which degrade only aerobically?

The reigning laws and policies dealing with this situation is nebulous enough to create a scenario of dignified non-action. There are numerous actors in this ECSI all with different motives, stakes and tactics. The extent of academic detectivism and government interference needs to be sorted out to bring about lucidity on how to deal with the situation. The ‘low hanging fruits’ method will defer the ECSI solution and thus needs a deeper analysis of the situation and possible solutions. When misreporting, fake news and pseudofacts are everywhere, reading newspapers can be a challenge. My point is, if its fake, it’s not news. I am on my research expedition, with lots of answered and unanswered questions – but I pledge to fightback misinformation regarding Bellandur, armed with science.

Photo reference:

1. <https://economictimes.indiatimes.com/news/politics-and-nation/two-rains-are-enough-for-bellandur-lake-to-froth/articleshow/65960032.cms?from=mdr>
2. <https://www.india.com/travel/articles/this-picture-of-the-yamuna-river-in-new-delhi-will-make-your-heart-sink-3231459/>