

# Collectively blind to pollution

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2023 was the hottest year on record, a year that broke many climate records. Canada's forests started to burn in March, and continued to burn until June. China experienced unprecedented flooding, with over a week of consecutive heavy rainfall. In India, the southwest monsoon arrived late, leaving many parched parts of the country reeling from heatwaves. In June, our neighbouring state of Andhra Pradesh broke another local record, with the highest number of successive days of heatwave ever documented.

As Canadian writer Margaret Atwood so eloquently pointed out, climate change is 'everything change'. Economy, society, ecology – they're all inter-connected and impacted by global environmental change. 2023 was also the year that a group of global scientists published a paper in the journal *Science Advances*, warning us that the earth had exceeded six of the nine planetary boundaries that maintain stable environmental conditions, enabling life on earth to continue, and human life to flourish.

Pollution is one of the planetary boundaries, perhaps the most visible one, that affects us directly and indirectly in a number of different ways. Air pollution is something we all see and experience daily, especially when stuck in Bengaluru traffic. Water pollution may be less visible to us, but still impacts us considerably. Tyres constitute an invisible link between air and water pollution, may have severe impacts on human health -- one that scientific research has recently begun to document in full earnest.

The rubber tyres on which we ride in traffic are prone to cracking due to oxidation. Thus, for many years now, stabilising agents have been added to tyres to prevent cracking. One of the more common chemicals added to tyres across the world for over six decades is called 6PPD (its full IUPAC name is N1-(4-Methylpentan-2-yl)-N4-phenylbenzene-1,4-diamine, so let's just call it 6PPD). Over time, 6PPD migrates out of the tyre towards the surface -- where it gets oxidised by ozone, becoming 6PPD-quinone or 6PPD-Q. Recent research has found that this compound is extremely toxic to fish, even in small amounts, leading to massive deaths in some commercially important species like coho salmon.

Worn away by friction, when tyres collide with the road, rubber particles containing 6PPD-Q find their way into the air as smog, or are deposited on the soil and road surface. Washed away by the rain, they enter urban water run-offs, making their way into lakes, rivers and eventually into the sea. A 2021 report by Pew Charitable Trusts, *Breaking the Plastic Wave*, found that dust from car tyre abrasion made up over three-fourths of the 3 million metric tons of microplastic that enters the ocean annually. In India, estimates indicate that passenger cars contribute 20% of the microplastics released through tyre dust, while trucks and buses contribute the main share (over half).

If 6PPD-quinone is acutely toxic to fish in urban streams, as a 2021 study by the US Environmental Protection Agency finds, what is its impact on human health? The toxicity of this dust on humans has not been well studied, and the absence of knowledge is not comforting. A recent study showed that the chemical was widespread in the rainwater run-off, soil and air across Hong Kong; and an even more alarming study from South China determined that 6PPD-Q was present in urine samples of pregnant women, children and adults.

Fortunately, this is also a problem that can be easily addressed, if this compound were to be phased out of tyre manufacturing – though that may be easier said than achieved. There are tens of thousands of such compounds and chemicals that we use daily though, and we do not know the impacts of most of these.

Climate change is 'everything change' -- but our collective blindness towards the planetary impacts of the Anthropocene is also a reflection of how little we know. Tyre dust is one example -- all around us, yet invisible to our eyes. What else are we collectively blind to?