

GUEST EDITORIAL

# Pharmaceutical horrors of the environment: An emerging concern

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*“Don’t join a queue if you don’t know what is at the end of it” - Challis*

There was a time we could enjoy a train ride in rural India, with its pristine countryside, mostly verdant and fresh with unpolluted air ...

But not any more...!!

Nothing ruins the landscape as permanently as the indestructible plastic garbage. India, despite its recent rise to a global power, has been notoriously callous towards the upkeep of the environment. Even educated people have no qualms about throwing an empty bottle of mineral water out of the train window.

Plastic waste is only the most visible of pollutants; we must not forget that there is much more to environmental pollution than plastic bags and P E T bottles. The hazard is more than what meets the eye, much more than what a person of average education can even guess. Not even the most well informed citizens are aware of the scale and magnitude of the horrors of environmental pollution. From drinking water to industrial emissions, everything we see around us has been devastated, paradoxically perhaps, by the hands of ‘industrial development’ and the ‘rising standards of living’.

Indian pharmaceutical industry has been among the most successful enterprises that emerged in Independent India. It is ‘a rags to riches’ story in which India has become a global leader, producing and exporting active pharmaceutical ingredients (APIs) and formulations that meet approximately 40% of the world’s API requirements and 90% of the domestic needs.

The current growth rate in pharmaceuticals is among the highest in the industrial sector. The burgeoning interest in pharmaceutical education appears to be the result of this phenomenal success story.

That pharmaceuticals pose a threat to the environment was not fully appreciated until early 1990s, when the near extinction of vultures (up to 95%) in the Indian subcontinent was traced to diclofenac-induced kidney failure in vultures that fed on abandoned carcasses of cattle dosed with diclofenac. A flurry of research that followed not only confirmed that drugs can be environmental hazards but also proved that the diclofenac episode is just the tip of the iceberg.

Every pill eventually ends up in the environment. Chemical properties that render medicinal value also make drugs the most persistent, lipophilic and non-biodegradable residues in the environment. Drugs also tend to accumulate in terrestrial and aquatic organisms. The presence of carbamazepine (up to 18mcg/L) in Kaveri is an indication of how these stubborn sewage residues end up in rivers. 95% of antibiotics are excreted unaltered. Studies in the West have shown that up to 54% of people throw medicines into trash or flush them in the toilet.

The general water treatment plants are ill-equipped to handle pharmaceuticals. Traces of prescription drugs have been detected in drinking water supplied to millions of American homes. Ethinyl estradiol in effluents has resulted in feminization of fish downstream of sewage plants. Propranolol, Diclofenac, Ibuprofen and Fluoxetine have been detected in environmentally relevant levels. Thus, “drugs pollute not only the bodies of patients who take them but also the environment where residues accumulate”. The Central Pollution Control Board has ranked pharmaceutical industry as one among the seventeen highly polluting industries of the nation.

Drugs are not only used to heal the sick, but also to run profitable commercial enterprises. Antibiotics are used against orchard pathogens and as feed supplements in poultry, shrimp and pig farms. Pig house dust accumulating from feed, bedding and faeces was found to contain five antibiotics in a combined concentration of 12.5mg/kg. The emergence of antibiotic-resistant bacteria has also been attributed to selection pressure created by multiple antibiotics in effluents. Thus, what might be interpreted as a local problem could soon become a recalcitrant global burden in the treatment of infectious diseases.

If the extinction of vultures was an eye opener to the potential hazards of drugs in Indian environment, the results of a relatively recent study on the effluents at Patancheru by Swedish scientists opened the Pandora’s Box of pharmaceutical pollution in India.

### **Mind-boggling Pollution!**

Patancheru Enviro Tech Ltd (PETL) near Hyderabad was built for treating the abundant industrial waste generated by 90 odd bulk drug manufacturers. The clarified effluent released from the plant has been shown to eventually merge with Godavari. Wastewater downstream showed 150 times the highest levels of pharmaceuticals detected in the United States. Out of the 59 APIs tested, 21 were detected at levels greater than 1mcg/L.

More than 11 drugs were detected at the highest level ever in the planet. Ciprofloxacin was detected at 31000 mcg/L which is much greater than the maximum therapeutic plasma level. Each day’s discharge from PETL had up to 45kg of ciprofloxacin, which is enough to meet the needs of the Swedish market for five days. The combined quantity of APIs in the effluent was estimated to be worth €100,000 in Sweden!

Swedish team went further. They subjected the Patancheru effluent to a variety of tests in which they observed up to 40% growth reduction in tadpoles, even at the lowest concentrations. Even when diluted 500 times, this notorious effluent increased global gene expression and cytochrome P450-1A activity in fish. Scientists have warned that antibiotics in the effluent could increase selection pressure and thus promote the transfer of resistance-genes from harmless environmental microbes into deadly pathogens, leading to the emergence of deadly drug-resistant microorganisms.

Even the farmers have not been spared: paddy output in the vicinity of Patancheru dropped from 40 bags per acre to 10 bags per acre. Probably inspired by the research carried out by the Swedish scientist in 2007, the Government of India, Ministry of Chemicals & Petrochemicals set up an Environment Cell in November, 2008. The timing of the event is unmistakably linked to the fact that the wake-up call must come from data generated abroad!

The recent FIP meeting at Hyderabad in September 2011 engaged a special session on the environmental hazards of pharmaceutical manufacture. A team of visitors, mostly from Scandinavian countries, expressed regret at the situation emerging in the third world. Sweden's Medical Products Agency Report to Swedish Government has recommended reduction in outsourcing manufacture of APIs to countries that neglect environmental pollution in addition to effecting suitable GMP revisions to control emissions.

The new EU regulations would have to specify and prioritize proven hazards. Would it mark the beginning of the end of pharmaceutical pollution in India? Or would it be the end of Indian advantage in the competitive pricing of APIs for the global market?

Let us hope for the best!

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