

## **Endemic Fluoride Toxicosis : WB Not Exempt Crippling Effects : Incurable, But Easily Preventable**

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### **A Visit to Nassipur**

Not very far from Rabindranath's Santiniketan, some 10 miles off Nalhati Railway Station, there is the small Nassipur village which appears like a deserted and haunted place. The terrain is somewhat rocky and near the Bengal-Jharkhand border. I heard at Santiniketan that a natural inorganic chemical pollutant there in drinking water cause havoc for over two decades as a result of which many people have died, young people of thirty looks like an old man of seventy, many people are crippled and many cannot walk without support. Children, some still can be seen, play but their teeth are mottled, which are stained yellow, red, brown, even black. In and around Nassipur the present writer saw the visible and invisible human agonies and pains.

The present writer was appalled to learn that the silent and invisible killer was one of his "subjects", a chemical element, Fluorine, from which is derived the anion, called Fluoride (symbol F<sup>-</sup>) which causes diverse ailments, that included degeneration and deformation of bones and muscles and nerves for which the name Fluoride Toxicosis (or simply Fluorosis) is used. The present writer felt stupid as he found that inspite of his nearly half a century of chemistry teaching and research, that also included fluorine and fluoride, he never knew that a daily intake of a few milligrams of fluoride from drinking water; food and atmospheric air, can have such devastating effects. His stupid feelings rose higher when he found that 'Bablu Master' (a fluorosis afflicted man of thirty to sixty with bow like spine and neck) knew much more about fluoride than the present writer, who earlier thought of himself a knowledgeable chemistry professor and a competent environmentalist. Sitting on a stool before Bablu Master what I learnt in an hour about

fluoride, what my other colleagues in Universities didn't know as yet. This is the village whence hailed Professor Dhananjay Nassipuri, a famous chemist and one of my teachers at Calcutta University in the 1950's, who bears in his title the name of this village.

It was learnt that the fluoride problem arose after digging tube wells some thirty years back to provide 'safe' water for the fields and the people. While the WHO's maximum permissible limit of fluoride in drinking water is 1.5 mg per litre, GOI's 0.8 to 1.0 mg per litre, Nassipur water contained upto 16.0 mg per litre, when 3 to 4 mg per litre is known to cause extensive fluorosis.

### **Historical :**

Back home I searched chemistry and medical text books and ransacked University libraries, but could not find much about the adverse health effects of fluorides. Some medical books contain only a brief mention, Goodman and Gilman's Pharmacology (1991) contains somewhat more. But chemistry books are notoriously indifferent to these matters as also our College and University Syllabi. Gradually I learnt from other sources that fluorosis was first discovered among grazing sheep who became rippled or dead by Muller and Gudson in 1932, who also coined the name of the disease as Fluorosis, for which the name Fluoride Toxicosis is a better one. The farmers of Nalgonda, a few miles off the Hyderabad city, in the Nellore district in Andhra Pradesh, independently discovered fluorosis among their cattle in the early 1930's. Cattle used for ploughing the land developed aches and pains in the joints and had to be abandoned even within six months after purchase. The cattle were unable to get up and walk and plough the land. Soon pains and agonies and crippling effects were observed among the villagers. The first medical report on fluorosis was published in 1937 in the Journal of Indian Medical Research under the leadership of an English Veterinarian. Now huge amount of information and knowledge has been accumulated in the International Science, and fluoride toxicosis is controlled in developed countries. But it is not only still a major environmental health problem in most of the developing countries including China,

India, the Middle East, North and East Africa, Mexico and some South American countries. In fact fluorosis is escalating because of indiscriminate withdrawal of ground water, without prior geological testings and increasing industrialization without adequate safeguards. Burning of fluoride rich coal, manufacture of superphosphate, aluminium, steel, lead, copper, nickel, bricks and tiles release substantial fluoride in the atmosphere. Black tea, some sea fish are also sources of fluoride exposure as also black and red rock salt. Fluoridated tooth paste and other fluorinated dentrifices as given by the dentists in the form of tablets, drops, rinses and gels have now come under fire from scientists and public health activists.

### **The Magnitude :**

At present some 70 to 80 million people in 17 Indian states suffer from fluorosis, as revealed by GOI's Rajib Gandhi National Safe Drinking Water Mission in 2004. 1975 Encyclopedia Britannica wrote that five lakh people in Punjab suffer from fluorosis. Severe fluorosis prevails in Rajasthan, Punjab, Haryana, Uttar Pradesh, Delhi, Gujarat, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu, Jharkhand. With more testings and surveys fluorosis endemic areas expands in the map. Recent examples are WB and NE Hill states, which only a few years ago were not shown among fluorosis endemic regions. But they are now occupying larger and larger areas in the map. In WB the districts of Dakshin Dinajpur, Birbhum, Bankura, Purulia, Bardhaman (Purbasthali), West Medinipur, South 24-Parganas have been found to be fluoride affected. The PHED of WB Government have made some studies (some 700 tubewells), but they are keeping the information a "secret", evidently on political considerations. Even a technician would be reprimanded if he makes fluoride measurements on tube well water without the sanction of the authorities. So it is not difficult to understand why the present writer, a senior academician and environmentalist, failed to have PHED's data, after written requests and a dozen visit to the New Secretariat Buildings' PHED Deptt.

### **Chronic Fluoride Toxicity :**

Now we should have a look at the effects of fluoride toxicity on Man and Animals and try to point out their modes of actions. The low-level of consciousness among the public and the medical people in general (including the dentists, who prescribe fluorides) is due to the low level of health education, lack of treatment facilities and information. Along with these the overwhelming Indian preoccupation with the as yet unsolved problems of traditional water and vector borne diseases like cholera, typhoid, enteric diseases, malaria, dengue etc. which have been eradicated in the developed countries a century ago enabling them to rise to higher rungs of civilization and development. The brilliant scientific triumphs of microbiology and chemotherapy in the late 19<sup>th</sup> century have so dazzled the eyes of the medical people, that bureaucrats and the elites that the arrival of newer environmental diseases from natural and industrial inorganic pollutants like fluoride, arsenic, mercury, lead etc. have not received proper attention. But their adverse impact on public health is increasing by leaps and bounds and none can afford to remain indifferent to them any longer.

To understand the toxic effects of fluorides in human and animal systems we should try to have even a superficial idea about the action mechanisms, which we would only just mention here and would not go into details. Fluoride is not an essential element and humans can have perfectly good health without fluoride, even with fine caries-free teeth. Three prominent chemical properties of fluoride are responsible for its adverse orthopedic and biochemical effects :

1. Electronic and size similarities between hydroxide (OH<sup>-</sup>) and fluoride (F<sup>-</sup>) facilitate exchange of hydroxide by fluoride in calcium hydroxy phosphate  $[\text{Ca}_{10}(\text{OH})_2(\text{PO}_4)_6]$  or apatite minerals in bones and teeth enamel. Conversion to fluorapatite  $[\text{Ca}_{10}\text{F}_2(\text{PO}_4)_6]$  imparts acid resistance to enamel and help prevent caries. Nearly 99% of fluoride intake is deposited in bones and teeth. Use of fluoride-free water causes some restoration of hydroxy apatite through replacement of fluoride by hydroxide ion.

2. The strong hydrogen bonding properties of fluoride cause many biological disruptions. Hydrogen bonding is very important in the structure and functioning of proteins, enzymes and DNA. The molecular architecture of a protein molecule is so finely tuned to perform a specific function exceedingly well that is rather delicately susceptible to any external factor which may disrupt that function. Fluoride through its hydrogen bonding effect disrupts the biosynthesis and functioning of proteins and enzymes and causes various deformation and disabilities. DNA hydrogen bonds may also be affected if the concentration is high.

Bone is basically a protein tissue, composed of a matrix of collagen protein fibres (a triple helical molecular structure) impregnated with calcium hydroxy phosphate and calcium carbonate. Bones not only form skeleton and give structural support for the mechanical action of soft tissues, protect soft parts and act as a mineral reservoir or sink. It also provides for a protective site for specialized tissues such as the blood forming system (bone marrow). Bones are relatively inelastic, but has a high tensile strength. Bones form and decay. Fluoride through its hydrogen bonding properties disrupts the structure and even formation of the collagen proteins and cause fluorosis. Aging and nutrition deficiency can cause more resorption or mineralization and can be seen in the decreasing of heights in the old and aged. Fluorosis is a slow progressive crippling malady and can be seen in the young and old, male or female, rich or poor. The usual complaints at the beginning are :

Pain in the neck, back joints, and rigidity begin in regions where cancellous bones predominate. Skeletal fluorosis is a slowly progressive degenerative disease which are often misdiagnosed variously as spondulitis, osteoporosis etc. and given wrong treatments. With progress of the disease, pain becomes associated with rigidity and restricted movements of cervical and lumber spine, knee and pelvic joints as well as shoulder joints.

3. The complexing ability of fluoride with some metals disrupts many normal biological processes and causes diseases. Complexation of magnesium ion by fluoride

disrupts the functioning of some enzymes, fluoride damage the selenium based glutathione enzyme and cause a rise in the toxic metals in the body. Fluorides complex with aluminium and has been linked to Alzheimer's disease.

Fluoride can also damage a fetus. Abortions, still births, and birth of deformed babies are common in endemic areas. Infant mortality due to calcification (deposition of calcium salts in the tissue) of blood vessels can also occur. Male infertility due to defective sperm morphology, oligo spermia (deficiency of spermatozoa in the semen), azoospermia (absence of spermatozoa in the semen) and low testosterone levels is quite common in males living in fluoride endemic areas. An useful short introduction to the subject can be had from the following :

A Treatise on Fluorosis by Professor (Dr.) A. K. Susheela, New Delhi, 2002, who has founded an NGO, Fluorosis Research and Rural Development Foundation.

#### **Back to Nassipur :**

There is no cure for fluoride toxicosis. But it is easily preventable. Some cures occur if detection is early and the patient is prevented from further fluoride exposure. But this is yet to be fully achieved. After long struggles, it is learnt, that in the mid 1990s tubewells were installed in a fluoride free zone in the nearby Tiripitaya river near Nassipur for supply of fluoride-free water through pipelines at selected hours of the day. But due to frequent load-shedding and disruption of power supplies which often persist for days, the "time taps" remain dry and people are forced to use polluted tank or seepage water as a consequence of which they suffer from enteric diseases. A few small reservoirs could have solved the problem, as the PHED people in the New Secretariat Building admitted. But could not be done despite my pleadings on the plea that Zilla Parishad have not asked for it and formally "they don't know it" and they have little funds. When I showed my recent report published in the Statesman (14 July, 2006) with the title "A crippling disease in Birbhum villages" they remained mute. This is our popular government.

#### **Rabindranath's fury :**

I am reminded of poet Rabindranath's outburst a few months before his death. This is quoted from "Baaishe Sravan", p.107-108, by Nirmal Kumari Mahalanobis, Mitra & Ghosh, Calcutta, 1367 (English translation mine).

"Reacting furiously to the open letter of Miss Elenor Rathbone, a British MP that castigated the Indians, Rabindranath gave a strong reply, which was widely published in all English newspapers on 5<sup>th</sup> June, 1941, that made every Indian happy. When a discussion was going on in the presence of the poet, Rabindranath burst out :

"They (the British) are a civilized nation! Even after two hundred years of civilized governance here there is no food, no clothes, no health, no education, nor even small availability of drinking water for quenching thirst. We have received only "Law and Order" and along with that impertinent words as those of Rathbone. It is like adding insult to injury. How can I tolerate this? You have not seen, but I have seen the tremendous hardship of people even for getting small amounts, of water. When I was in my estate I have seen women are coming even from a distance of five miles just to collect a pitcherful of water. I have seen with my own eyes people are digging in the mud and collecting water after straining the mud in a napkin. What we will do with "Law and Order" when in the cruel summer sun our breasts burst in thirst? Talk only after you arrange for safe drinking water for all?"

"They are not ashamed of calling theirs a civilized government. When such water scarcity comes in my mind, my blood boils. I feel like shooting out had I had a gun in my hand".

He could not continue any further, in excitement profuse tears rolled down from his eyes. I have never heard the poet speak so emotionally and furiously".

The present writer has seen such things in some regions even in the present day CPM's W.B. It is intriguing to conjecture what would have been the poet's reactions if I could take him to visit Nassipur. Me had feelings similar to Tagore when I was moving from house to house in Nassipur area witnessing the human deformities and agonies.