IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT)
e-ISSN: 2319-2402,p- ISSN: 2319-2399.Volume 10, Issue 5 Ver. I (May. 2016), PP 01-03
www.iosrjournals.org

Influence Of Temperature on Concentration of Thiocyanates in Air According To the Eötvös'rule

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Abstract: *Scope of my study is to attribute the right responsibility to thiocyanates which are present in this corrupted aerosol, that is the polluted atmosphere in our European industrialised countries, victims of Global Warming, have with regards to Human Health, depending on the heat and humidity, trying to explain the concern using the Eötvös' rule.*

Keywords: *Thiocyanates, Global Warming, Eötvös' rule.*

I. Background

Polluted air is nothing but an strange aerosol made of particulates, organic nanoparticles and other hydrocarbon constituents and this mix has an own vapour pressure when relative humidity is very high (especially in tropical industrialised countries like all the States overlooking the Mediterranean Basin) or an own peculiar surface pressure when relative humidity is low (this case is very rare nowadays owing to the Global Warming and Greenhouse effect).

Aim of my research is to highlight the responsibility thiocyanates which are present in this corrupted aerosol, that is our polluted atmosphere, have with regards to human health, depending on the heat and humidity, trying to explain the concern using the Eötvös' rule.

First of all thiocyanates, like perchlorates or nitrates, commonly present in the polluted atmosphere of metropolis or industrialised areas, may dramatically affect thyroid function in humans. Foetuses and infants are most vulnerable to these effects because they need thyroid hormone for normal neurodevelopment. All the aforesaid chemical substances are competitive inhibitors of the sodium/iodine symporter (NIS) in pharmacologic doses, but their effects on human thyroid function at environmental exposure levels may be considered very risky when exposure to them is prolonged.(1)

A very impressive study conducted by German researchers asserts that the concentration of thiocyanates in air is dependent from antithyroid properties and a role in the etiology of goiter was been suggested in several prior studies. In 1991 an epidemiological survey conducted in the region of Halle/Leipzig (Saxony), an area with significant air pollution, suggested an inverse relationship between urinary iodine (I-)/SCNs- excretion and goiter prevalence. 10 years later, the AA reinvestigated the same industrial area to clarify if the situation had changed after the elimination of most industrial waste products albeit they had to state that the levels of urine SCNs- were important meanwhile iodine was not present in urine.(2)

Now, since thiocyanates are present in manifold plant foods such as cassava, cabbage, turnips, broccoli, Brussels sprouts, and cauliflower, rocket salad (arugula), it has been argued that diets high in thiocyanates can be part of the reason someone develops goiter (enlarged thyroid) in parts of the world where there is not enough iodine in the diet, independently from the atmospheric pollution.

Even tobacco smoking constitutes a significant source of indoor air pollution. Various chemical compounds that are emitted during tobacco smoking can have a direct cytotoxic effect on spermatozoa by damaging DNA. There is some evidence that tobacco smoking in men could affect male fertility.(3)

For sake of clarity it must be stressed that even in female the danger is not to be underestimated: it is known that women who smoke during pregnancy are more likely to give birth to babies with low thyroid hormone levels in their blood. Women in the first trimester of pregnancy have lower thyroid hormone levels when they are smokers vs. non-smokers. A recent study showed that cigarette smoking lowers the amount of iodine in breast milk. And this is to be attributed to the thiocyanates.(3)

My attention was mainly focused on the indoor and outdoor presence of thiocyanates, as possible latent cause of hypothyroidism, hypogonadism , since it is undeniable that countries that produce massive harvests of turnips and cabbages (and consequently are usual big consumers of these aliments), people who love to consume mustard (Germans and British) or horseradish (the inhabitants of some reasons of Central Europe and Scandinavia and more recently people form Illinois, Wisconsin and California where Armoracia rusticana is considered a delicacy) use to excrete thiocyanates by urine, perspiration insensibilis and flatulence, but the incidence of these diseases is not the same at all, with regard to the latitude and temperature and humidity of the country itself.

China and Uzbekistan, for instance, are the greatest producers and consumers of turnips, even Russia and many countries of North and East Europa are too, and presence of thiocyanates in air vary depending on the country they are measured.

Even the competent authorities dictates standard levels for the presence of thiocyanates in air, for instance: OSHA allows 10 ppm, NIOSH permits levels never trespass 4,7 ppm and so even ACGIH: never over 4,7 ppm.

It must be considered the difference of climate of the countries where thiocyanates are measured, and even if values seem to be highest in coldest regions, it is not to underestimate the Eötvös' rule.

This equation enables the prediction of the surface tension of an arbitrary liquid or volatile solid or a mist of gaseous nanoparticles or an aerosol of liquids in gases of pure substances at all temperatures. The density, the molar mass and the critical temperature of the substance have to be known, keeping on account that at the critical point the surface tension is zero.

The first assumption of the Eötvös' rule is that the surface tension is a linear function of the temperature and that the surface tension (or vapour pressure whenever the relative humidity reaches more than 90%) is always a linear function of the temperature.

The equation is the following

$$\gamma V^{2/3} = k(T_c - T)$$

where V is the molar volume and T_c the critical temperature of the substance and the surface tension γ may be calculated. k is a constant valid for all liquids. The Eötvös constant has a value of 2.1×10^{-7} J/(K·mol.

When thiocyanates are in the air, man is forced to inhale those and the SCNs- (gaseous) have a peculiar spreading coefficient onto the oral and bronchial mucosae depending strictly from the "wettability index".

Wetting index W is positive (W>0) when the liquid spreads completely onto the surface of the mucosa, both wet and dry. The more favourable condition for this phenomenon is when the value of the surface tension of the liquid or gas to spread onto the surface of the mucosa is lowest.

Wetting index will be negative (W<0) when the contact angle Φ is < 90° and the surface tension of the liquid or gas tends to be higher.

Here follows the Eötvös' equation solved for thiocyanates at 20°C(293.15 K)

In a working place the concentration of thiocyanates allowed is 24.3 μg/L and thus the molar volume is 0,319.

Critical temperature of a saturated solution of thiocyanates is 362.3°F = 183.5°C = 456.7°K.

K is 2.1×10^{-7}

And so the surface tension γ will be, solving the equation:

γ 0.188 = 2.1×10^{-7} (456.7 – 293.15)

0.1827

Whenever the concentration of thiocyanates should be 140 μg/L and the room temperature could be 40°C (313,50 K) γ will be 0,01591.

It is undeniable that this lower value of γ interferes with the wettability of oral and bronchial mucosae in man.

II. Materials And Methods

I have made all the experimentations on myself, (in corpore vili, with no necessity of consensus) ,considering that a solution of sodium thiosulfate and strawberry juices can be drunk easily to afford the lowering of the concentration of thiocyanates in urine, since these beverages are reputed to act as mild antidote against fatal toxicity from potassium thiocyanate In my university there is a lab where experiments on thiocyanates have been performing for months and air was saturated by vapours of thiocyanates (more than 140 μg/L).

It must not forgotten that the vapours of Zyklon B had been used profusely in gas chambers of Nazi death camps and the concentration of Auschwitz and Majdanek and the penetrant and sweetish smell of these vapours is still present after more than 70 years.

In effect, thiocyanates have the capability of adhere to all porous and non porous surfaces.

The lab is exposed to the sun and in Italy temperature in springtime is 40°C and room temperature is more than 40°C.

When people have to work in lab, forced air is switched on and temperature is 19°C.

It is superfluous to repeat the calculations I right did before in the background.

I used to stay in the lab in the morning (2-3 hours), before people came to work, when forced air was switched off and temperature raised 42°C, for almost one hour, to read or to spend time otherwise.

Afterwards I did urine test to evaluate the concentration of thiocyanates.

Similarly I used to stay to work in the lab during the day, (2 or 3 hours) together with other people, when forced air was on. (19°C) and have the urine test done afterwards.

III. Results

After one hour of exposure to thiocyanates (temperature 42°C) the concentration in my urines was: 698 μmol/L (I am smoker)
After one hour of exposure to thiocyanates (temperature 19°C) the concentration in my urines was: 386 μmol/L.

IV. Conclusions

Everyone, even if he is not a medician or a physician, may draw conclusions.

Acknowledgements

I have not to thank anybody for all that concerns my pursuit.I have not received funds or finantial supports from any Institutions, Chemical substances I had used as antidote were available in my own reagents cupboard.

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