The Impact of Industrial Oil Processing Activity on the Air Quality

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The free air is the main component of the environment, directly involved in pollution. The air, together with the other sequences of the biosphere, being a key element to maintaining life, preserving its natural quality, represent an major objective for human communities. This paper presents an experimental research into how the air quality is influenced by the work of oil industrial processing at a chemical plant from Constanta County.

Keywords: pollution, natural quality, industrial processing

The main sources of atmospheric air pollution can be grouped as follows:

- industrial pollution;
- pollution caused by transport;
- agricultural pollution;
- anthropogenic pollution mainly due to combustion.

The pollutants emitted into the atmosphere from these four categories of pollution sources, can be chemically classified in the following way [1-3]:

-gas or inorganic substances, which include:

- oxygenated derivatives of sulfur: sulgur dioxide and sulfur trioxide, sulfuric acid, sulfates;
- oxygenated derivatives of nitrogen: nitrogen oxides, nitrous and nitric acid;
- ammonia, hydrogen sulfide, chlorine, etc.

-gases or organic substances, which include:

- aliphatic saturated and unsaturated hydrocarbs, cyclic, aromatic, fused polycyclic;
- aldehydes and ketones: formaldehyde, acrolein, acetone;
- other organic pollutants: alcohols, mercaptans, chlorinated derivatives, various compounds structurally complex and undefined.

-aerosol, which include:

- solids particulate in the form of fum; carbon powders;
- particles of liquid materials in the form of oil mist or tars, droplets entrained, etc.

The impact of irritants and pollutants, asphyxiation or allergising, as well as the specific toxins from the atmosphere is manifested mainly on the respiratory and cardiovascular systems, causing most often chronic poisoning, which ultimately lead to an increase in morbidity and mortality.

The effect of pollutants on the living world can not rule out the plants, which are directly influenced by the presence of pollutants in the atmosphere. It must be emphasized that in general inorganic substances have a harmful effect on plants, greater than that of organic compounds.

The presence of different pollutants in the atmosphere directly influence the plant development [4, 5]. Below, in the relation 1 is shown the ranking of the chemical about the chemical compounds and their effect on plants, namely:

$$SO_2 > HCl > NO_2 > CO_2 > NO_x > CO \quad (1)$$

In table 1 is shown the sensitivity of plants to the influence of air pollutants.

Experimental part

Knowing these general characteristics related to the influence of air pollution on plants in the following, was monitored air quality in the warm seasons, in the area of influence of industrial activity for company XXX.

For this, air samples were collected in accordance with STAS 12574/87, in May - September 2003 - 2007, from 5 points station, namely: Navodari, Mamaia Sat, Lumina, Ovidiu, and Sacele Corbu.

From the multitude of p ossible air pollutants, with major negative effects on plant development, were selected only those synergistic, present simultaneously in the air and that which may have as a cause the industrial oil processing by XXX company, namely: ammonia, nitrogen and sulfur dioxides, hydrochloric acid, phenols and aldehydes.

Their determinations were made according to current standards, namely: ammonia STAS 10712/76, nitrogen dioxide -STAS 10329/75, sulfur dioxide STAS 10194/75, hydrochloric acid- STAS 10943/77, phenols and aldehydes- STAS 11027/76 and STAS 11332/79.

The monthly average concentrations of pollutantsau stat la baza, formed the basis for calculating the coefficients of contaminant, as the ratio between these values and the maximum permitted levels.

Subsequently, using these coefficients, were calculated according to STAS 12574/87 section. 2.1.2. , an average monthly indicator of pollution for the exhaust system NH_3 + NO_2 + SO_2, which have a synergistic action.

It must be emphasized that, in our country there isnot a *law of the air.* For the interpretation of analytical data is used STAS 12574/87 Air of protected areas in terms of quality which sets the maximum allowable concentrations (CMA) for different substances.

The spread of gaseous and solid pollutants into the atmosphere is achieved through the wind vector, to express the movement of air masses on a specific area egret.

Below, in table 2 is shown an extract from the data recorded in May - September 2003 - 2007, in 5 points, namely: Navodari, Lumina, Ovidiu, Corbu, Sacele , Poarta

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Table 1

THE LEVEL OF SENSITIVITY OF PLANTS TO THE INFLUENCE OF THE POLLUTANTS

Nr. crt.	Plant	pollutant		
		SO_2	HCl	NO_X
A	**CEREALS**			
1	Wheat	SR	SR	S
2	Barley	FS	S	S
3	Oat	S	S	S
B	**FODDER**			
1	Clover	FS	FS	S
2	Lucerne	SR	SR	S
C	**VEGETABLES**			
1	Cabbage	R	R	-
2	Beans	SR	SR	S
3	Pepper	R	SR	-
4	Cucumbers, zucchini	SR	-	-
5	Tomatoes	R	R	-
6	Onion	R	R	-
D	**ORNAMENTAL PLANTS**			
1	Lilac	R	S	-
2	Rose	SR	SR	SR
3	Carnations	SR	SR	-
E	**FRUIT TREES**			
1	Fleshy fruit	S	S	S
2	Dried fruits	SR	S	SR
3	Walnuts	S	S	S
4	Vine	FS	S	S

FS - very sensitive SR - reduced sensitivity S – sensitive R – resistant

Table 2

AN EXTRACT FROM THE DATA RECORDED IN MAY - SEPTEMBER 2003-2007

Pollutant	CMA STAS 12574/87 mg/dm^3	Total number of samples	Number of samples exceeded	Average concentration mg/dm^3	Maximum concentration mg/dm^3	Noxa coefficient
NAVODARI						
HCl	0.1	9	0	0.004-0.0097	0.004-0.02	0.04-0.0971
H_2CO	0.012	9	0	0.0012-0.0036	0.0020-0.0060	0.1008-0.2975
NH_3	0.1	9	0	0.0122-0.0186	0.0100-0.0200	0.1200-0.1857
NO_2	0.1	30	0	0.0040-0.2973	0.0100-0.0500	0.040-0.2973
SO_2	0.25	30	0	0.0314-0.0611	0.0400-0.1300	0.1257-0.2444
CO	2.0	30	0	1.3048-1.5861	1.8000-2.0500	0.6524-0.7931
Fenol				0.0008	0.0010	0.0260
MAMAIA SAT						
HCl	0.1	17	0	0.01412	0.04000	0.1412
H_2CO	0.012	17	0	0.0017	0.00700	0.1375
NH_3	0.1	17	0	0.0247	0.07000	0.2471
NO_2	0.1	17	0	0.0129	0.02002	0.1294
SO_2	0.25	17	0	0.0535	0.09000	0.2141
Fenol	0.03	17	0	0.0008	0.00200	0.0273
LUMINA						
HCl	0.1	17	0	0.0090-0.0123	0.0200-0.0300	0.0900-0.1235
H_2CO	0.012	17	0	0.0012-0.0016	0.0040-0.0300	0.1000-0.1325
NH_3	0.1	17	0	0.0040-0.0320	0.0700-0.1000	0.0400-0.3200
NO_2	0.1	17	0	0.0100-0.0135	0.0200-0.0300	0.1000-0.1353
SO_2	0.25	17	0	0.0653-0.0670	0.1000-0.1200	0.2612-0.0653

CORBU						
HCl	0.1	17	0	0.0080-0.0177	0.0100-0.0800	0.0800-0.1765
H_2CO	0.012	17	0	0.0007-0.0008	0.0020	0.0600-0.0683
NH_3	0.1	17	0	0.0147-0.0240	0.0300-0.0400	0.1471-0.2400
NO_2	0.1	17	0	0.0090-0.0112	0.0200-0.0300	0.0900-0.1118
SO_2	0.25	17	0	0.0440-0.0541	0.0900-0.1100	0.1800-0.2165
Fenol	0.03	17	0	0.0010	0.0020	0.0333

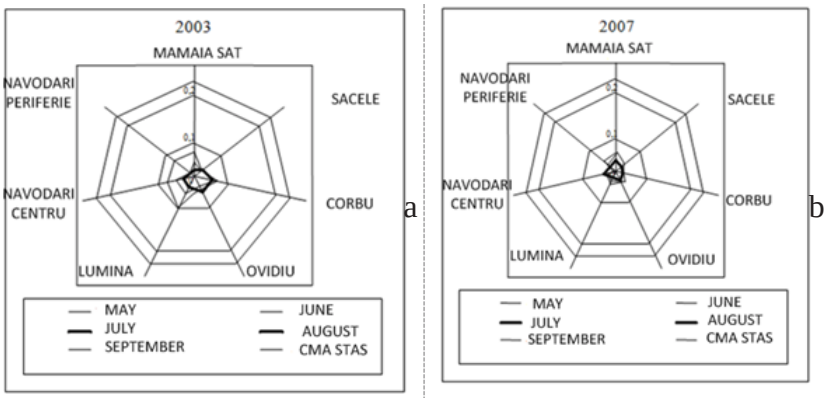

Fig. 1 Changing of the SO_2 air concentration of SO_2 in the area of influence Of XXX company in May – September period of 2003 – 2007 years STAS limit: 0.25 mg/dm^3. a - for 2003 year; b- for 2007 year

Alba, and in figure 1 is shown two charts, regarding the evolution of main pollutants in the air at the beginning and at the end of the monitoring period, as well as the variation throughout the period. (Exemplify only for SO_2).

Results and discussions

The database obtained highlights the following issues:

- the tendency to reduce SO_2 content in the atmosphere in 2007 compared to 2003.
- the variation upper limit of the content of SO_2 is below the standard value;
- fairly high content of nitrogen oxides in 2003, with an overtaking of the CMA in *Lumina* and a sharp decline in 2007. The zonal representation of the limit variation throughout the entire period, indicated slightly higher values in the urban and suburban area, with the exceeding of the maximum admitted to Lumina;
- although ammonia is not a specific contaminant activity in the industrial processing of oil, in the atmosphere it can react with specific compounds which are among the constituents of smog. There has been a tendency of decrease in 2007 compared to 2003.
- the content of hydrochloric acid present in the atmosphere, fairly uniform in the test area, was well below the maximum allowed limit, over the entire period of monitoring.

The range zone, showed a slight decrease in Corbu.

- aldehydes had an increasing trend in *Navodari* in summer, indicating, apparently, a contribution of road transport. Recorded concentrations is located in time and space, far below the maximum allowed by standards.
- quantities of phenolics present in the atmosphere, stood at very low levels, well below the maximum allowed by standards. The highest concentration was determined in July 2003 to *Navodari.*

Air quality in every point-station has some peculiarity well defined through which is made a hierarchy of the effect of industrial processing of oil on the environment.

In this context, in the following are detailed on points - station some particular issues related to air quality, namely:

Navodari

In this point station, air quality monitoring in the warm seasons, indicates:

- not exceeding standardized concentrations, except carbon oxide content in May 2003;
- SO_2 content showed a downward trend from spring to autumn, from July it was virtually constant;
- very low content of phenols and aldehydes, the most often situated at the trace levels.

Mamaia Sat

In this point, air quality monitoring in the warm seasons, indicates:

- throughout the period investigated there were no exceedances of concentrations of the chemical compounds studied, coefficients contaminant being situated in a field of variation below par;
- the highest concentrations of pollutants recorded in the warm seasons, but stood below the maximum allowed standardized, were for ammonia;
- it is interesting to note that in June, considered highly polluted, the main pollutants monitored developments indicate a downward trend;
- phenols were dosed in very small amount, well below the standard limit, which indicates that the industrial processing of the oil, the atmosphere is not contaminated with the contaminant.

Ovidiu

Performing over 15 daily air quality samples from Ovidiu it presents the following issues:

- the air was quite polluted during the warm season, the biggest recorded contaminant factors being in case of aldehydes and sulfur dioxide in July, then the concentration of these compounds decreased in September, but not at spectacular levels;
- all potential pollutants tested were below the maximum permissible limit standardized;
- some chemicals like ammonia and aldehydes, decreased pretty much over 2 times in September compared to July;

- the ranges are quite large for all chemical compounds tested.

Lumina

Chemical-analytical data obtained from air quality testing from this point-station, highlights the following issues:

- atmosphere was not polluted, the concentrations considered noxious from chemical compounds, hovering much below the maximum allowed, with the exception of May 2003, when the sum of the system concentrations (NH_3 + NO_2 + SO_2) was located above the standardized;
- the concentration of the possible specific main pollutants plant-specific activity, recorded uniform variations;
-the highest concentrations were recorded in SO_2, contaminant coefficients is still at very low levels in 2007;
- contaminant coefficients values were quite low compared to other station points;
- contaminant coefficients of phenols and aldehydes were located at relatively high levels compared to the other station points;
- air quality from this point-station was improved at the end of the monitoring period.

Corbu

The air samples collected in this state, highlights the following:

- whether it about plant specific chemical compounds or collectives human activity, nuisance coefficients have been rather low, well below the maximum permissible, only sulfur dioxide having a higher value, but far below the CMA;
- for phenols, they have been rather low values, even the maximum values were located very far from the maximum permissible limit;
- contaminant coefficients recorded, indicate a cleaner air.

Sacele

In this state, analyzing the air quality shows the following:

- low contaminant content, much lower than under the *CMA* and other points-station in the area;
- concentration and thus the highest rate of contaminant was registered to the sulfur dioxide;
- phenols and aldehydes were contaminant coefficients well below the standard;
- the coefficients of the tested contaminant compounds have a fairly constant value located at low levels throughout the period of monitoring. This shows on the one hand that the atmosphere was not polluted, and on the other hand illustrates, that existing hazards are not due to plant activity, but have another generator.

Using the contaminant coefficients determined from the concentrations, was calculated the coefficient pollution for the system (NH_3 + NO_2 + SO_2), substances having a synergistic effect on the environment.

In another paper was studied the quality of the air polluted with $PM_{2.5}$ and PM_{10} [17].

Conclusions

It notes the following aspects:

- nitrogen oxides and ammonia are not specific noxious from industrial processing of oil activity, but are specific noxious for transportation, agriculture and livestock;
- the existence of a direct link between air quality, represented by average monthly indicator of pollution for substances that act synergistically (NH_3 + NO_2 + SO_2), wind direction and the amount of precipitation;
- average monthly indicator of air pollution system (NH_3 + NO_2 + SO_2) is generally in the range of variation below the standardized STAS 12574/87. In May 2003 at Lumina and in August 2003 at NAVODARI, exceedances were located in an area of over 10%;
- fields of monthly variation of this index almost equal, regardless of the point-station monitored;
- zonal growth trend of this index southwest of the area at the start of monitoring, then in 2007 nuisances accumulation takes place mainly in the city;
- the worst air quality frome the monitored area, generally were recorded in June;
- in MAMAIA SAT and SACELE, general indicator of pollution for the considered system, recorded the lowest values, air quality being superior to the Ovidiu – Lumina area.

Of the presented, both as concentrations and synthetic as indicators of pollution with some specific noxious from processing of oil industrial activity, it was clear that the air in the influence area of the plant was not polluted, except for May 2003 in Lumina.

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Manuscript received: 26.04.2016