THE ANNUAL EVOLUTION OF THE SUSPENSION POWDERS IN CORRELATION WITH THE RAINFALL IN ARAD COUNTY AREA

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Abstract

This study related to the relation between the concentration degree of the suspension powders and the rainfalls from Arad county area is a work that comes to complete the alredy existent scientific information from this field for the central part of the West Plain uniting and harmonizing them in a most unitary and complete material.

The aim of this work is to emphasize the temporal and the space variations of the suspension powders, their evolution tendency as well as their interrelation with the meteorological elements and with the rainfalls respectively.

Key words: pollution, maximum admitted concentrations, powders in suspension.

INTRODUCTION

The pollution of the air with solid particles has been known since very old times and it still holds an important role in the studies related to the atmosphere pollution and in its influence on the environment.

The pollution with matter in form of particles (PM) includes solid or liquid particles made up of one or more chemical substances and which are pretty small to be able to stay suspended in air. This particles can be in the form of: dust, smoke, soot, nitrates, asbestos, pesticides, bioaerosols. Pollution with such particles leads to the reduction of visibility in towns, and cities, in industrial areas, causing a lot of damage to health (Pereş Ana, 2011).

Industry is the most important pollution source in Arad county. The highest pollution of the atmosphere is produced by the energetic industry which is being performed during the conversion of primary energy into thermo-electrical power.

The thermo-electrical central (the TEC) represents the major air pollution source in urban areas because this plant functions with liquid fuels that have a high content of sulfur, releasing important quantities of SO_2, NO_X, CO, CO_2, powders, smoke, flying ash into the atmosphere. They release a great volume of burning gases into the atmosphere, gases which, according to the type of used fuel has a variable volume of polluting agents.

The share of the building activities has increased a lot, these building sites and concrete mixers remain potential sources of air pollution, especially powder pollution sources.

The industry of building materials is the main source of air pollution through suspension powders and through remanent powders. The particles in suspension, due to their small dimensions, resulted from the basic matter processing or from the storage of the sterile matter leads to a difficult breathing of the air.

The vehicle traffic has a great importance in the atmosphere pollution producing a great part from the powder quantities released in town. The mobile sources determine a disseminated pollution and all the means of transport are included here.

MATERIAL AND METHODS

The data related to the concentrations of the suspension powders and to the rainfalls have been analyzed for a period of 10 years, for the time interval 2000-2009. Mathematical, statistical and graphical methods have been used in order to process the data in this study.

The analysis of air quality in Arad county is done with the help of the automatic and semi-automatic monitoring (manual) stations.

In Arad county the pollution of the atmosphere is monitored by the monitoring stations, especially and mainly in Arad town (industrial town, where the whole industry of the county is concentrated with an intense vehicle traffic and a high population density) and in Nădlac town, a town bordering Hungary characterized by a very intense vehicle traffic. The quality of the air in Arad county is monitored through continuous measurements in two automatic stations from which one is placed in Arad town and the other in Nădlac town (www.apmar.ro).

In Arad town

- Industry/traffic station – AR-1 station – Micalaca passage – placed in an intense traffic area;
- Urban fund station - AR2 station – Fluieraş street, no. 10c – placed in the precincts of the Technical College of Construction and Environmental Protection, which is a residential area, in order to emphasize the exposure degree of the population at the urban pollution level in Nadlac town.
- Suburban/traffic station – AR-3 station on Dorobanti street FN at the exit towards the border.

In the monitoring stations from Arad town - an integrant part of the national air quality monitoring net – continuous measurements are done for: sulfur dioxide (SO_2), nitric oxide (NO, NO_2, NO_X), carbon monoxide (CO),

suspension powders (PM_{10} and $PM_{2,5}$) automatic and gravimetric, ozone (O_3) and organic precursors of ozone.

In the monitoring station from Nădlac town – an integrant part of the national air quality monitoring net – continuous measurement are done for : sulfur dioxide (SO_2), nitric oxide (NO, NO_2, NO_X), carbon monoxide (CO),suspension powders PM_{10} automatic and gravimetric and organic precursors of ozone.

The correlation of the concentration level of the polluting agents is also done on the basis of the meteorological data obtained in the stations, stations fit out with meteorological sensors of: direction and wind speed, temperature, pressure, humidity, rainfalls and solar radiation intensity.

The measurement methods used for determining the specific polluting agents are reference methods stipulated in the OM 592/2002, or equivalent methods for which the equivalence factor is determined.

RESULTS AND DISCUSSION

The rainfalls are part of the meteorological elements that condition the spreading of the powders in suspension. Through their duration and quantity the rainfalls greatly contribute to the air purification, because the dust threads can be condensation nuclei for the water vapors and they lead to the formation of water drops which in the falling process drive the atmosphere impurities (Pereş Ana, 2011).

The rainfalls play a major role in the purification of the urban atmosphere. The purifying role is conditioned by the duration and by the intensity of the rainfalls. The atmosphere is clearer after a great quantity of rainfall. The long duration rains are the most efficient in washing the atmosphere, even if they are not in high quantity. The solid rainfall has a decreased efficiency in the decontamination of the atmosphere.

The rainfall washes away the dust and other polluting products from the air. If there is no rainfall or if its number is reduced then the continuous deposition of impurities on the tree leaves can have one of the most catastrophic consequences for the biological activity of the plants (Marcu M., 1983).

In the ten years studied the highest values of the suspension powders have been registered in 2003 with a value of 0.198 mg/m^3, a close value has been registered in 2000, this one being of 0.187 mg/m^3. Those two years register the lowest rainfall quantities, thus in the year 2000 a quantity of 250 mm falls. This value was produced due to a circulation from the south sector which favored the transport of the warm and dry tropical air from northern Africa and south-east Asia. In the year 2003 a quantity of 440 mm is

registered. As a consequence the reduced quantities of rainfall leads to an accumulation of suspension powders in the atmosphere air.

In the year 2001 the lowest values of the suspension powders are of 0.128 mg/m^3, and in 2005 the value is of 0.148 mg/m^3. In these two years the rainfall registers the most significant quantities from the studied period. Thus, the maximum quantity of 750 mm is produced in 2005 while in 2001 the rainfall registers 730 mm. The link between the two phenomena, the evolution of the suspension powder quantities and the rainfall are presented in drawing 1 and from the graphic we can notice a reverse lapse between these two phenomena.

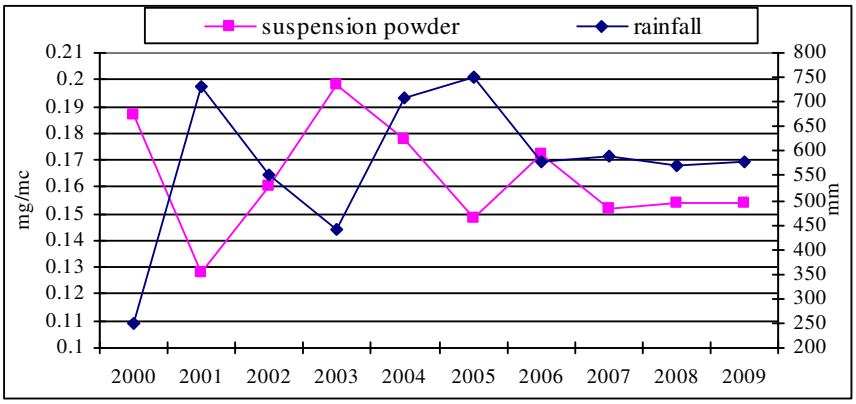

Fig. 1. The annual average suspension powder concentrations (mg/m³) and the annual rainfall quantities, in Arad
(Source: data processed from the National Meteorological Administration (N.M.A.) archive and from Environmental Protection Agency, Arad)

In the other studied years the suspension powders register intermediary values with 0.178 mg/m^3, in 2004, 0.172 mg/m^3, in 2006, 0.160 mg/m^3, in 2002, 0.154 mg/m^3 in 2008 and in 2009 and 0.152 mg/m^3, in 2007.

No exceeding has been registered in what the maximum admitted limits were concerned, the values being within the limits imposed by the STAS 12574/87.

The lowest quantity of suspension powder is registered in the hot season when the rainfall quantity has the highest value. The highest quantity of suspension powders is registered in winter when the rainfall quantity has the lowest value in the year. This fact emphasizes the purifying role of the rainfall for the atmosphere air.

The rains can also lead to the washing of the acid gases (SO_2, NO_X, CO_2) and to their fastening under the form of sulphates, nitrates and carbonates. Through the acid rains the decontamination role of the atmosphere rainfall becomes negative because such polluting factors washed

by the rains, like the sulfur acid or the nitric acid, lay free hydrogen ions directly on the surfaces on which they fall.

The gas polluting factors of anthropogenic origin (SO_X and NO_X) are dissolved in the water drops that are suspended in the air (fog, clouds) and fall under the form of rainfall which, from this reason can be extremely acid. In the industrial regions polluted with SO_2, the rains can have a highly acid pH (4.5), with catastrophic consequences on the soil, accelerating their leaching process or their immobilization (Marcu M., 1983).

The rainfall washing takes place in the clouds or under the clouds and depends on the drops' composition. The acid rains contaminate the surface waters and they damage the ecosystems, the buildings, the works of art and people's health (Marcu M., 1983).

The acid deposits are the result of the conversion of two impurity factors: the sulfur dioxide (SO_2) and the nitric oxides (NO_X). Once these factors get into the atmosphere they can be transported at far distances from the source and through the intervention of rainfall they fall on the ground or in the water. The process of acid deposits formation begins with the driving of the two polluting factors into the atmosphere which when in contact with solar light and with water vapors form acid compounds. During a rainfall the acid compounds fall on the ground or in the water.

CONCLUSIONS

A number of polluting sources had been identified in Arad, mainly sources from industry and transport but their emission of pollution do not exceed the maximum admitted quantities (C.M.A), only in accidental situations.

The reduced quantities of rainfall lead to an excess of suspension powders in the atmosphere air while the lowest concentrations of suspension powders are registered when the rainfall is in higher quantities.

The presence of the polluting agents in the town air has a considerable impact upon the values, the weather and the meteorological phenomena manifestation way.

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