

THE LEVEL OF AIR POLLUTION WITH AMMONIA IN THE CITY OF SATU MARE IN 2014-2016

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Abstract

Ammonia monitoring in the city of Satu Mare is performed at two sampling points. The first one is in the centre of the city, at the venue of the Satu Mare Environmental Protection Agency (APM Satu Mare), and the second one in the north of the city, at Şoimoşeni Platform, where the industrial area is located, with a high pollution potential.

The variation of ammonia concentration in the city of Satu Mare was monitored from 2014 to 2016, at the sampling points mentioned above. Although the maximum permissible daily ammonia concentration ($100\mu\text{g}/\text{m}^3$) was exceeded nine times (2015-2016), it was not exceeded by the annual and monthly averages. In 2015 the maximum permissible concentration was exceeded 4 times, and in 2016, 5 times. Excesses over the reference value were recorded mainly in the warm season of the year and the major pollutant was the chicken slaughterhouse.

Key words: ammonia, maximum permissible concentration, pollutant

INTRODUCTION

Ammonia (NH_3) is a colourless, irritant gas with a pungent smell, which is soluble in water and is 1.7 times lighter than air. The density of ammonia is $0.7198\text{ kg}/\text{m}^3$, the melting point is -77.73°C and the boiling point -33.35°C (Măhăra, 1969, 1976; Vancea et al., 1992; Petrea, 2001; Pereş, 2011).

The sources of ammonia are both natural and anthropogenic activities. The latter ones are responsible for about 80% of the amounts. The most important source of ammonia is agriculture, the livestock sector in particular, where it is emitted from manure, then it also results from burning vegetation on the fields in order to prepare the land for next year's crops, from the fermentation processes of organic substances, as well as from using nitrogen-based fertilizers (Ciulache, 2004; Köteles et al., 2016). The industrial pollutants are the ammonia, nitric acid, ammonium nitrate, urea factories, coke ovens, the refrigeration industry etc. (Moza, 2009; Pereş, 2011; Köteles, 2011).

As ammonia is extremely water-soluble, it is dissolved in the nasal passages and in the end it is swallowed and gets into the stomach. A very small amount of the inhaled ammonia enters the lungs. From the lungs and the stomach ammonia gets into the blood. The biological effects of acute exposure depend very much on the concentration in the air, on the inhaled

amount and on the duration of exposure (Rojanschi et al., 1997; Pereş, Kőteles, 2010; Pereş, 2011).

MATERIAL AND METHOD

Monitoring and determination of ammonia in the area of Satu Mare is performed at two places, in the centre of the city, at the venue of the Environmental Protection Agency, and the industrial area called Şoimoşeni Platform, located in the north of the city (apmsm.anpm.ro).

The ammonia pollution level in Satu Mare was monitored from 2014 to 2016. The data used in the study were provided by the APM Satu Mare. The results obtained using mathematical and statistical methods were graphed so that the fluctuation in time of the air pollutants could be better followed. According to STAS 12574 – 87, the maximum permissible ammonia concentration is $100 \mu\text{g}/\text{m}^3$.

RESULTS AND DISCUSSION

Evolution of the annual average ammonia concentrations in Satu Mare

The data show that the highest ammonia concentration was recorded at the Şoimoşeni Platform sampling point in 2016, $31.89 \mu\text{g}/\text{m}^3$, followed by $29.75 \mu\text{g}/\text{m}^3$ in 2015, and in 2014 the concentration was $23.66 \mu\text{g}/\text{m}^3$. At the APM Satu Mare sampling point the concentrations were smaller over the whole period included in the study. Thus, in 2015 the value was $21.24 \mu\text{g}/\text{m}^3$, in 2014 $14.89 \mu\text{g}/\text{m}^3$, and in 2016 $10.24 \mu\text{g}/\text{m}^3$ (Fig. 1). It can be noticed that in the period included in the study the maximum permissible concentration of $100 \mu\text{g}/\text{m}^3$ (STAS 12574-87) was not exceeded.

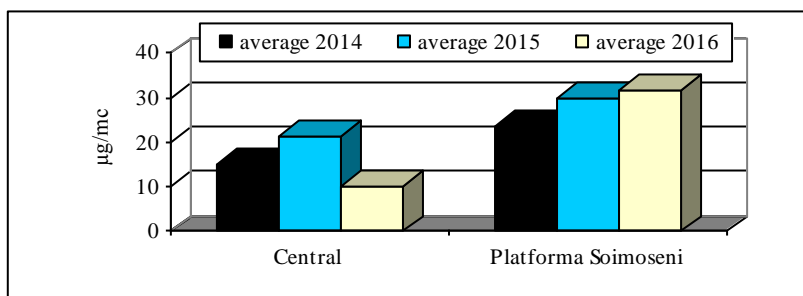


Fig. 1. Evolution of annual average ammonia concentrations in Satu Mare, 2014-2016

Evolution of the monthly average ammonia concentrations at the two sampling points in Satu Mare

The monthly pattern of ammonia concentrations at the two sampling points shows that concentration reached its highest value in July 2015, $48.67 \mu\text{g}/\text{m}^3$.

$\mu\text{g}/\text{m}^3$. Values close to that one were also recorded in August and September 2015, $47.61 \mu\text{g}/\text{m}^3$ and $43.43 \mu\text{g}/\text{m}^3$ respectively. The lowest concentration was that of December 2016, $9.95 \mu\text{g}/\text{m}^3$, followed by September 2014 with $12.87 \mu\text{g}/\text{m}^3$ and October 2014, with a concentration of $13.36 \mu\text{g}/\text{m}^3$ (Fig. 2).

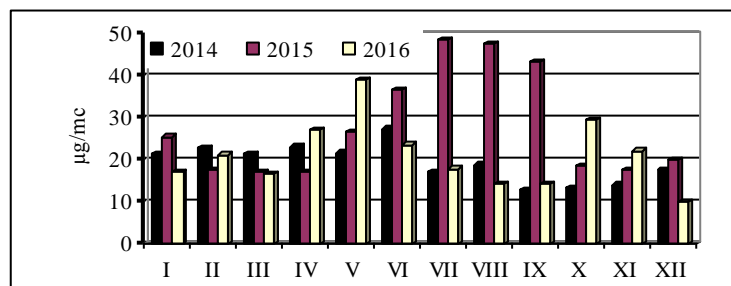


Fig. 2. Monthly average ammonia concentrations in Satu Mare, 2014-2016

Evolution of the daily average maximums recorded at the sampling points in Satu Mare

The evolution of the daily average maximums at the two sampling points (in the city centre – the APM Satu Mare venue and Şoimoşeni Platform) shows that in 2014 the maximum permissible concentration ($100 \mu\text{g}/\text{m}^3$) was not exceeded, the highest value was reached in June, $66.44 \mu\text{g}/\text{m}^3$, values close to that one were obtained in March and January, $50.29 \mu\text{g}/\text{m}^3$ and $44.90 \mu\text{g}/\text{m}^3$ respectively. In 2014, the lowest values were recorded in October ($16.61 \mu\text{g}/\text{m}^3$), September ($19.31 \mu\text{g}/\text{m}^3$) and May ($23.35 \mu\text{g}/\text{m}^3$) (Fig. 3).

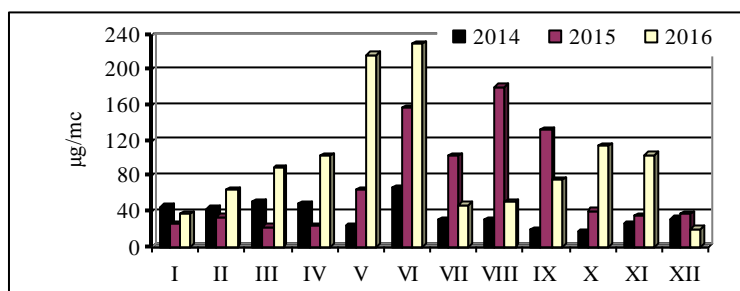


Fig. 3. Monthly maximum ammonia concentrations in Satu Mare, 2014-2016

In 2015, the maximum permissible concentration was exceeded four times, in August, $181.64 \mu\text{g}/\text{m}^3$, June, $157.39 \mu\text{g}/\text{m}^3$, September, $133.14 \mu\text{g}/\text{m}^3$ and July, $102.83 \mu\text{g}/\text{m}^3$.

Over the year 2016, the maximum permissible concentration was exceeded five times, the highest value was that of June, $229.46 \mu\text{g}/\text{m}^3$,

followed by May (218.01 $\mu\text{g}/\text{m}^3$), October (114.96 $\mu\text{g}/\text{m}^3$), November (104.18 $\mu\text{g}/\text{m}^3$) and April (103.50 $\mu\text{g}/\text{m}^3$) (Fig. 3).

CONCLUSIONS

The analysis of ammonia concentrations in the city of Satu Mare between 2014 and 2016 shows that the maximum permissible concentration was exceeded only for short periods. That happened mainly in the warm period of the year due to more intense manure fermentation. The district most affected by pollution is the Șoimoșeni Platform, where the industrial area is located (the chicken slaughterhouse, a milk processing plant).

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