MEASUREMENTS MADE USING DSM501A SENSORS VERSUS MEASUREMENTS MADE BY NATIONAL AIR QUALITY MONITORING NETWORK

ALEXANDRA STANIMIRESCU[1], SORIN MIHAI RADU[2], SOICA FLORIN FLAVIUS[3]

Abstract: This paper analyzes and monitors an important environmental factor, namely air. This paper checks the air quality with the help of DSM501A sensors in the Jiu Valley. The device used in the paper uses the "DSM501A" dust sensor, which is one of the cheapest sensors on the market and is capable of detecting PM2.5 and PM10 particles.

Keywords: environment, contamination, mines, pollution

1. INTRODUCTION

Particles - also known as atmospheric aerosol particles, atmospheric particles, are microscopic particles of solid or liquid matter suspended in the air. Particle sources can be natural or anthropogenic. They have an impact on the climate and precipitation and negatively affect on human health, by direct inhalation and the environment by deposition on its surface.[7]

Atmospheric particle types include suspended particles; thoracic and respirable particles. These inhalable coarse particles, called PM10, are particles with a diameter of 10 micrometers (μm) or less, and fine particles with a diameter of 2.5 μm or less are called PM 2.5.[7]

Particles are the most harmful form of air pollution due to their ability to penetrate deep into the lungs, blood and brain, causing health problems, including heart attacks, respiratory diseases and premature death. According to studies conducted by IARC and WHO, particulate matter in the environment is the sixth risk factor for premature death globally.

[1] *PhDC. eng., University of Petrosani, alexandra_valynikalay@yahoo.come*
[2] *Professor, Ph.D.eng., University of Petrosani*
[3] *Engineer, SC CEH SA*

The particles appear both naturally - from dust storms, volcanic eruptions, vegetation fires, etc., and artificially - such as human activities of burning fossil fuels, road dust, various industrial processes, etc.

This paper analyzes and monitors an important environmental factor, namely air. This paper checks the air quality with the help of DSM501A sensors in the Jiu Valley. Jiu Valley is an intramontane region of Romania, where the main economic activity is coal mining.[2]

Air quality monitoring is a well-known and established science that began in the 1980s. At that time, the technology was quite limited, and the solution used to determine the air pollution, really cumbersome and expensive. Fortunately, nowadays, with the latest and most modern technologies, the solutions used for air quality monitoring are much more accurate, but also faster to measure. The devices are getting smaller and have a much lower price.

The device used in the paper uses the "DSM501A" dust sensor, which is one of the most available sensors on the market and is capable of detecting PM2.5 and PM10 particles.

Dust sensor module: the DSM501 series detects the level of dust, particles and pollen inside the air, being ideal for use in a self-contained air filter or IAQ monitor. The detectable particle size is limited to a minimum of 0.7 μm.

2. METHODOLOGY AND RESULTS

The measurements made for this paper work were made with the help of 3 DSM501a sensors connected to three Raspberry Pi boards. These systems were placed in 3 different parts of the Jiu Valley, as following: one in Petrosani, one in Vulcan and one in Lupeni. We chose to place these devices in the three cities, because these are mining cities where the mining units still operate.

The purpose of this study was to determine the air quality in these areas with the help of these sensors, and to compare the data obtained with the official data presented by the RNMCA stations in Romania. From the study conducted in 2020 we chose to present in this paper the results obtained in May, August and December 2020 and to compare the measurements obtained by us using the system created with the measurements made by RNMCA stations.

The measurements were made taking into account the regulations of law no. 104/2011. According to the law for a healthy environment pm values must be between -∞ and 10 μg/m3. A very good environment has values between 10 μg/m3 and 20 μg/m3, and a good one values between 20 μg/m3 and 30 μg/m3 . Values that exceed 30 μg/m3 points to worst environment conditions. Thus, indicating an average environment when values are between 30 μg/m3 and 50 μg/m3, and a bad one when values are between 50 μg/m3 and 100 μg/m3 or very bad for values exceeding 100 μg/m.[5]

Below are the results obtained in the form of graphs in which the x-axis represents the environment and the y-axis the number of days in the month.

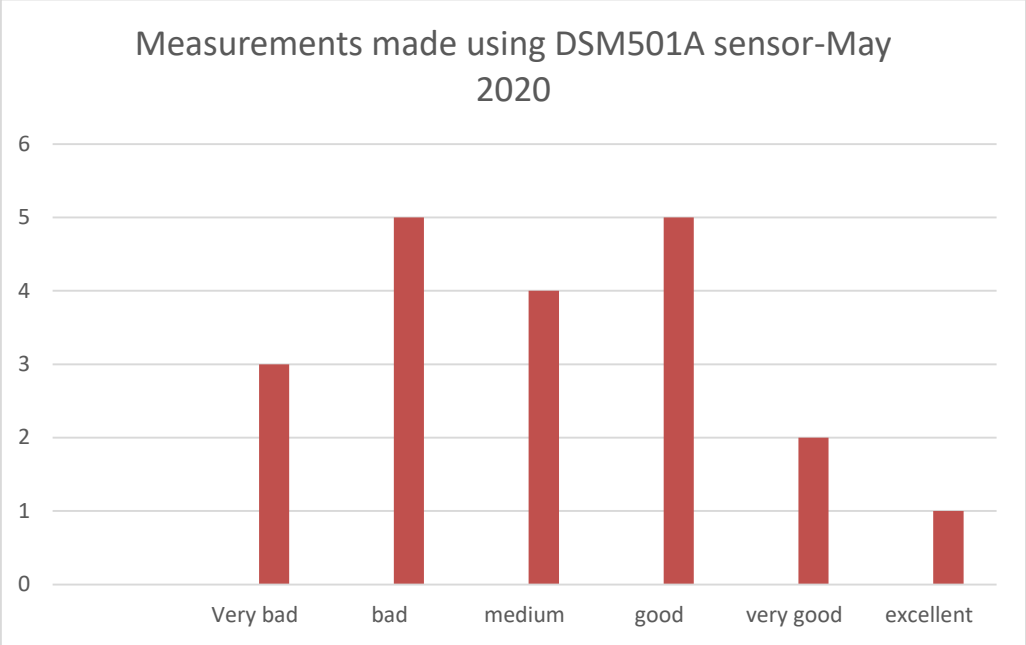

Fig.1 Graphical representation of the results obtained using DSM501A sensor-May 2020

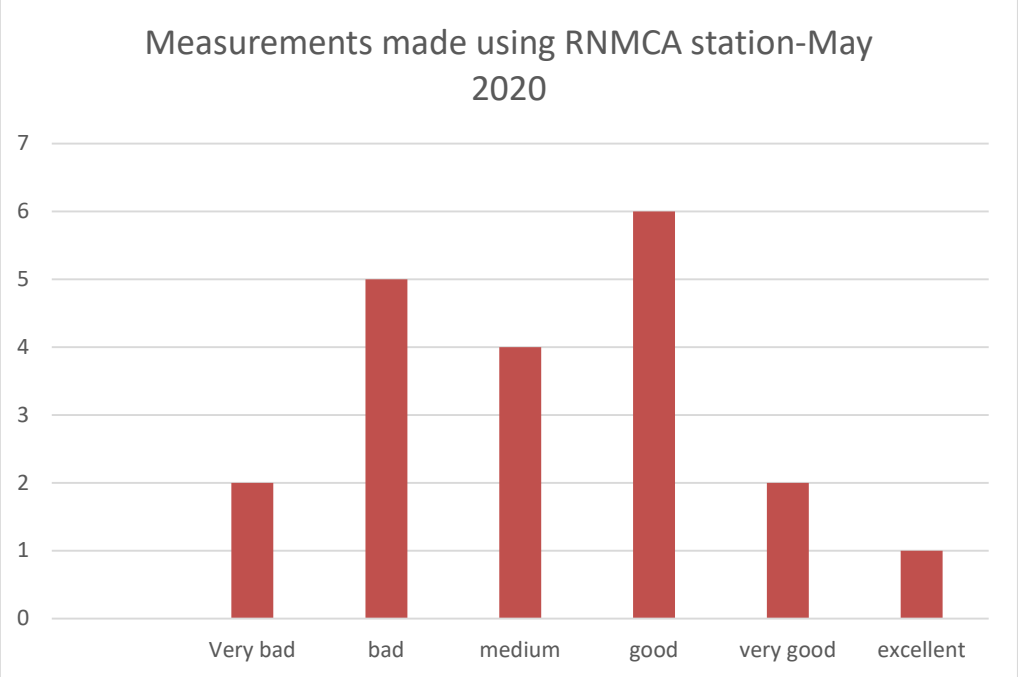

Fig.2 Graphical representation of the results obtained using RNMCA station -May 2020

As we can observe in the two graphs above, the measured values are approximately identical, from both variants resulting that may 2020 being a month with average air pollution values.

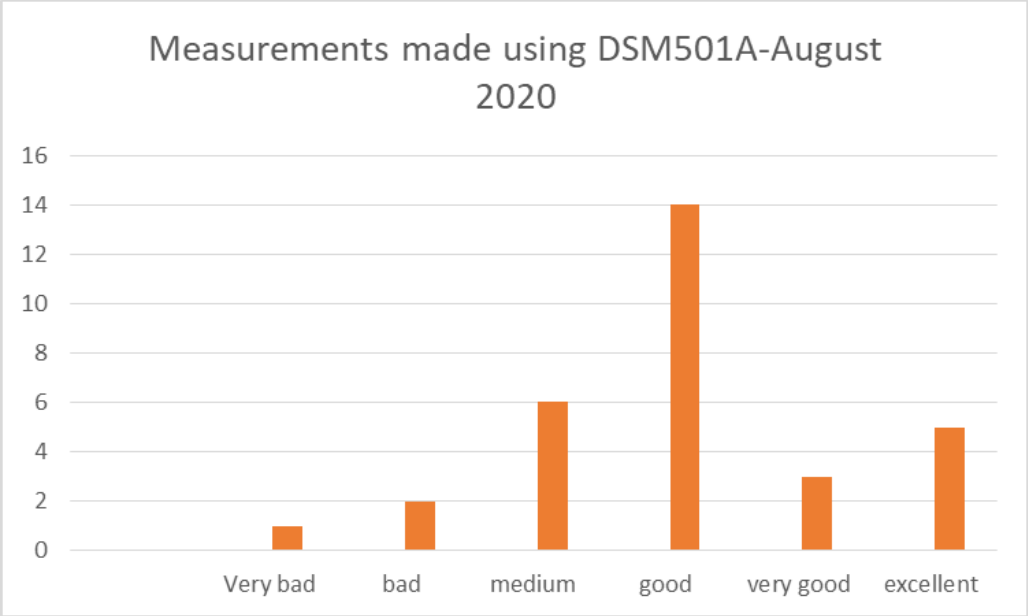

Fig.3 Graphical representation of the obtained using DSM501A sensor-August 2020

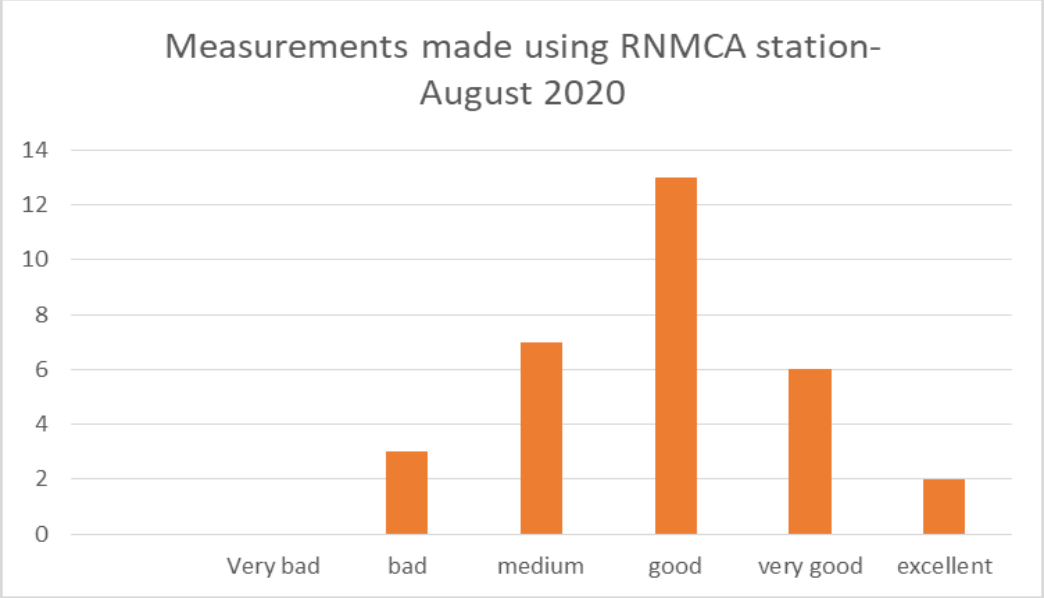

Fig.4 Graphical representation of the obtained using RNMCA station-August 2020

August 2020 is a month with some air values that frame the environment in a good one. As we can see in figures 3 and 4, the sensors recorded 14 days with values that charge the environment in a good one, and the RNMCA stations recorded 13 days that charge the environment in a good one.

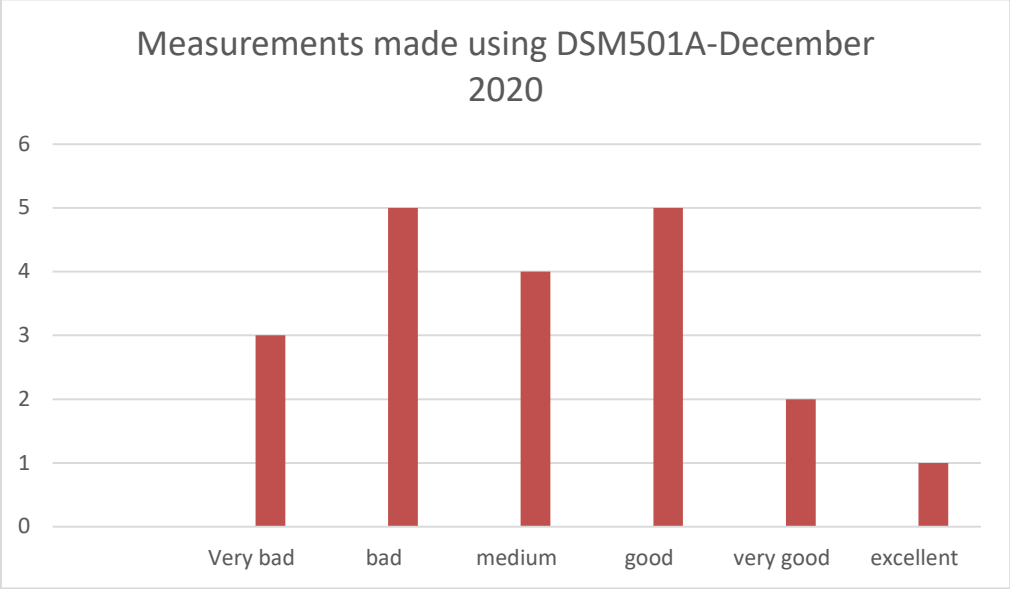

Fig.5 Graphical representation of the obtained using DSM501A sensor-December 2020

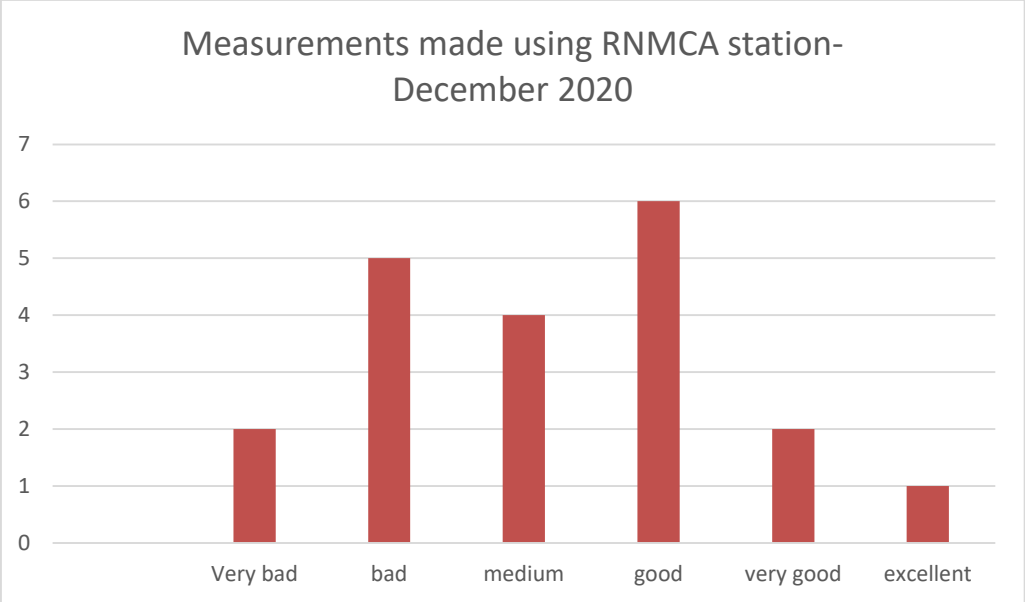

Fig.6 Graphical representation of the obtained using RNMCA station-December 2020

Because December 2020 is not over yet, we chose only 20 days for our study. As with the other chosen months, we can see that the values are approximately equal in the case of both variants and both the sensor chosen by us and the RNMCA stations place the environment in a good one.

3. CONCLUSIONS

The objective of this study was to verify whether adjacent devices can provide exact values or close to those measured by nationally approved stations.

As we could see in the graphs presented in this paper, the measured values are approximately equal or identical to those identified by the approved devices.

Taking into account the laws of Romania we can say that the air in the Jiu valley measured both with the device created by us and with the RNMCA stations is clean air and frames the environment in an acceptable one.

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