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IMPACT OF SUGAR BEET MANUFACTURING ACTIVITY WITHIN S.C. AGRANA ROMANIA S.A. – ROMAN, NEAMȚ COUNTY ON THE ENVIRONMENT

BY

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Abstract. The industrial activities have a major impact on all environmental factors, by affecting the quality of air, water, soil, generation of different waste types, and through use of natural resources and energy. Sugar beet production has gained momentum and reached approx. 30% of today’s world beet sugar production. Also called “white gold”, sugar came to be taxed with astronomical sums due to growing demand for it. The present paper analysis the impact of beet sugar manufacturing activity on the main environmental factors, starting with technological wastewater, domestic water, purified and directed through pipes in the natural emissary, studying the concentrations of nitrites, nitrates, iron and nickel ions, in three different analysis period, calculating the retention yields at the station for the most important chemical indicators. We studied emissions into atmosphere from technological sources, from micro-power-plants, checking the flue gas circuits, by measurements at the flue gas dispersion basket, by checking the dust entrainments. We also identified, one by one, the local pouring areas inside, we measured the pollutants concentrations in soil, and previous and present damage of the soil. Following the findings, we analyze the degree of pollution on each environmental factor, establishing conclusions and recommendations.

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1. Introduction

The industrial activities have a major impact on all environmental factors, thus it is necessary to monitoring them, to ensure compliance with existent legislation in the field of environmental protection.

Sugar beet production has gained momentum and reached approx. 30% of today's world beet sugar production.

Also called "white gold", sugar came to be taxed with astronomical sums due to growing demand for it.

Since 2005, the company S.C. AGRANA Romania S.A. is one of the largest suppliers of sugar for both sweeteners and soft drink industry, for the retail sale of sugar internationally, but it is especially a supplier for retailers who sell sugar in small towns and villages across the country.

This paper analysis the impact of beet sugar manufacturing activity on the main environmental factors, starting with technological wastewater, domestic water, purified and directed through pipes in the natural emissary, studying the concentrations of nitrites, nitrates, iron and nickel ions, in three different analysis period, calculating the retention yields at the station for the most important chemical indicators.

2. Materials and Method

Founded in 2005, the company SC AGRANA Romania SA produces sugar, both from imported raw sugar, and sugar beet and supplies retail sugar for small towns and villages across the country.

The factory in Roman, Neamţ County is a partner for thousands of sugar beet growers and owners of agricultural land in eastern Romania, from the border with Ukraine to the South of Galaţi City (Fig. 1).

Fig. 1 – Location of the sugar factory SC AGRANA Romania SA - Roman, Neamţ County.

By continuously equipping with new production lines and packaging machines for each type of sugar product, it was possible to diversify the assortment range to over 100 types of products, using various packaging from the country and imported, with its own laboratory for creating new sugar products, at a high quality standards, with low prices.

The factors that influence the quality of beets are: genetically (seed quality, hybrid characteristics), pedo-climatic (soil, climate), phyto-technical (cultivation and maintenance technology), factors regarding the harvesting method, and storage conditions (alteration, wilting, and degradation) (Fig. 2).

Fig. 2 – Storage conditions at AGRANA - Roman, Neamţ County.

External appearance indicators are: package indicator, shape indicator and diameter indicator.

Technological quality beets indicators are: sugar content, purity of cell juice, beet pulp content, reducing substance content, distillate content of beets, molasses quantity, and theoretical crystal sugar yield (Cojocaru, 1995).

The beet is stored in the factory: - on the platform, with a 10-15° slope of the side walls; - in deep channels, with a triangular section, and the side walls slope of 45°.

Below the storage channel is the transport channel with a drainage slope. From the storage platforms or channels, the beets are sent to the washing-cutting section. The beet is transported with water, which represents 600 - 1000 L/100 kg of beets. The water has a temperature of ~ 20°C and a speed of 0.6 - 0.7 m/s.

In order to ensure the efficiency of the sugar factory's operation, it is necessary to clean the beet of impurities (organic and mineral) in the field, load it in transport machines, and transport the beet to the factory without impurities (Banu, 2000).

A Maguin installation type is used to separate the mineral and vegetable impurities from the beet mass. Washing sugar beet in special machines is necessary for:

– remove the adherent soil on the surface of the beet that would cause wear of the washing machine;

– stones, sand, straw removal for those which have not been removed on the route of the transport channel;

– microorganisms removal from the surface of beets with impurities (Dima, 2008).

The amount of water for washing is about 40 kg/100 kg beets.

When wastewater is re-circulated in the cold state, there is a gradual transformation of sugar into organic acids, a change due to fermentation bacteria. In this case, more acetic acid and less butyric acid are formed.

We estimated sugar losses in the hydraulic transport, also at sugar beet washing process.

The diffusion juice is subjected to the purification process, which consists in the following operations: pre-defecation, defecation, 1st saturation, 2nd saturation, boiling thin juice of 2nd saturation, sulphite of thin juice, precipitate separation, decantation and use of concentrating filters.

We analyzed, step by step, the physical-chemical processes from technological stages. We inventoried the most important sources of microbiological infections from AGRANA factory (*Streptococcus, Pseudomonas, Aerobacter aerogenes* etc.).

By monitoring the quality of main environmental factors, we evaluated the impact of sugar production on the environment (Codex Alimentarius, 2007).

Results and Discussions

Impact on the environmental factor WATER

The departments activities results in technological wastewater and domestic water, which, after purification, are directed through pipes in the natural emissary. Inside AGRANA were drilled two wells to observe the groundwater chemistry: F1 in the oil fuel storage, and F4 in the fuel storage area - diesel. At Cordun Pond, there is another F2 drilling, where samples were taken in September 2016.

The reference sample was taken from an F3 well, located in the village of Cordun, on the road. No drilling was found in the landfill. The pH value is in the range of 6.5 to 8.5, for all samples ranging from 6.97 to 7.37. A pH of 7.37 was determined for water from the Cordun village well, which falls within the allowed limit value -AVL, corresponding to the second class of surface water quality.

The filterable residue was within the concentration limits 644 - 902 mg/L for F1, F2 and F4, with values falling within the AVL of the fourth class of surface water quality, values higher than the measured one for well F3 from the village of Cordun, of 340 mg/L, a value that falls into second class of surface water quality.

The value of organic substances, measured as CCO-Cr indicator for samples from F1, F2 and F4, falls within the limits of 49.2 - 81 mg/L, which exceed the maximum allowable concentration of 25 mg/L, corresponding to 2nd class quality for drinking surface water and the value of 9.6 mg/L was obtained from a well in Cordun - F3. A high concentration of CCO-Cr of 532 mg/L was obtained for the drilling in the Cordun Pond - F2, which corresponds to the 5th quality class.

Nitrates recorded values of concentrations lower than the MAC of 50 mg/L. In sample F4, the nitrate concentration was between 48.5 - 86.4 mg/L, the maximum value exceeding by 72% MAC.

Groundwater samples have non-nitrite concentrations in the range 0.189 - 0.465 mg/L, all being below the MAC of 0.5 mg/L. The concentrations of iron ions in the boreholes related to the fuel oil storage - F1, the diesel storage - F4, the Cordun Pond - F2 and the well - F3, exceed the MAC for drinking water of 0.2 mg/L.

Exceedances are 75% in the case of iron ion concentrations from F3 and 60 - 284 times higher than MAC for other boreholes.

Impact on the environmental factor AIR

Emissions into atmosphere are provided from technological sources and from electrical thermo-central CET4000.

Emissions of sugar dust do not contain pollutants and in this case, the losses in the atmosphere are only technological losses, losses that reduce the yield of white sugar from raw sugar, or to obtain white sugar from sugar beet. The results of direct physical measurements of the pollutants analyzed were reported at the reference value of 3% O_2 in the flue gases.

During the analysis periods, the boilers in CET 4000 operated in normal parameters. The quantities of dust discharged with the flue gases to the chimney of the energy boilers are exceeded.

One of the major causes of dust entrainment is excess combustion air.

The impact produced on the environmental factor SOIL

The nature and degree of soil pollution was established based on the results of physical and chemical analysis of soil samples, collected from the main premises of the company, the area of functional and non-functional installations, of industrial waste landfill, as well as from outside the company.

We considered: - areas that have served and are serving for the temporary storage of raw materials, auxiliary materials and fuels containing hazardous substances and / or hazardous waste - distribution in all cardinal directions nearby sources of pollution, including sources of air pollution.

Soil samples at both depths showed the presence of chemical elements in soils, sulphates, chlorides, nitrates and nitrites as follows: pH values of aqueous solutions, register the analyzed soils in low alkaline soil types (7.21 – 8.4) and moderately alkaline (8.4 - 9) according to the reaction classes provided by the pedological norms (the presence of carbonates in soils).

Concentrations in chemical elements - sulphates, on the site of the company and the land for industrial use ranged from 4 to 756 mg/kg dry matter. The highest value - 756 was determined in the area of the fuel storage, but all values were below the alert threshold threshold (Eggleston and Lima, 2015).

3. Conclusions

Based on the average values of the wastewater pollution indicators at the entrance and exit of the treatment, for three considered periods of determination, the detention yields at the station were calculated for the main indicators: TSM, CBO5, CCO-Cr, total nitrogen and total phosphorus.

Following the researches carried out, after the analyze of the degree of pollution made on each environmental factor, we recommended the correlation of fuel flow with combustion air for loading within the limits provided by norms (Banu, 2002).

Also, to check flue gas circuits to reduce air infiltrations at the common basket of three energy boilers, especially since two of them are permanently operating energy and the third one is off.

The amounts of dust discharged with the flue gases to the boiler basket energy exceeds.

One of the major causes of powder entrainment is excess combustion air, also the lack of specific dust containment equipment (electrical filter, etc.).

We also compared resulted measurements with conclusions of the „Reference Document on Best Available Techniques for Large Combustion Plants”, and we observed that emissions of recording pollutants are within normal limits or higher, depending on the pollutant emitted (SO_2, CO, NO_2).

No areas of local pollution were identified. Pollutant’s concentrations are below the alert value.

The soil from the factory surface is not affected by current activity or previous operation.

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IMPACTUL ACTIVITĂȚII DE PRELUCRARE A SFECLEI DE ZAHĂR ÎN S.C. AGRANA ROMÂNIA S.A. - ROMAN, JUDEȚUL NEAMȚ ASUPRA MEDIULUI

(Rezumat)

Activitățile industriale au un impact major asupra tuturor factorilor de mediu, prin afectarea calității aerului, apei, solului, generarea diferitelor tipuri de deșeuri și prin utilizarea resurselor naturale și a energiei.

Producția de sfeclă de zahăr a luat avânt și a atins aprox. 30% din producția mondială de zahăr din sfeclă de astăzi. Numit și „aur alb", zahărul a ajuns să fie impozitat cu sume astronomice din cauza cererii tot mai mari pentru acesta.

Prezenta lucrare analizează impactul activității de producție a zahărului de sfeclă asupra principalilor factori de mediu, începând cu apele uzate tehnologice, apa menajeră, purificate și dirijate prin conducte în emisarul natural, studiind concentrațiile de nitriți, nitrați, fier și ioni de nichel, în trei perioade de analiză diferite, calculând randamentele de retenție la stație pentru cei mai importanți indicatori chimici.

Am studiat emisiile în atmosferă din surse tehnologice, de la micro-centrale, verificând circuitele de gaze arse, prin măsurători la coșul de dispersie a gazelor arse, verificând antrenările de praf.

De asemenea, am identificat, una câte una, zonele locale de turnare din interior, am măsurat concentrațiile de poluanți din sol și daunele anterioare și actuale produse solului.

În urma constatărilor, analizăm gradul de poluare pe fiecare factor de mediu, stabilind concluzii și recomandări.