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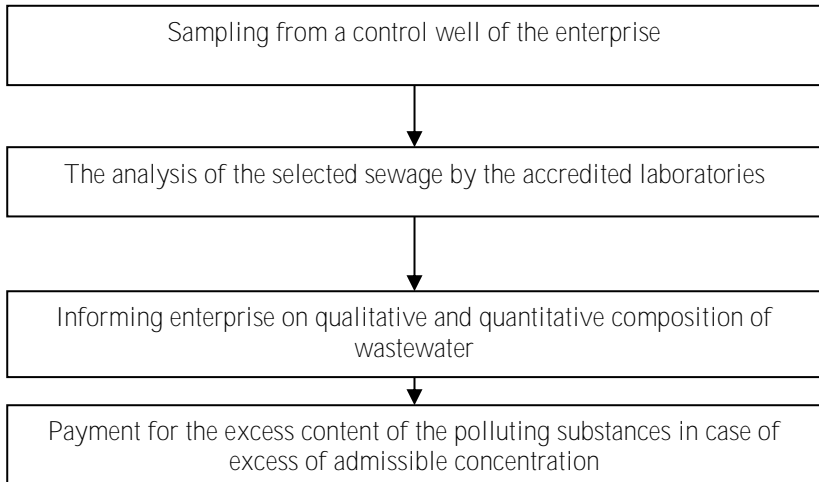
## **WATER MANAGEMENT OF THE FOOD INDUSTRY ENTERPRISES**

*The new tool - calculation of concentration of the polluting substances it is offered to enter into the monitoring system on the basis of drawing up material balance of technological process of production that will allow to predict qualitative and quantitative composition of sewage for the chosen period.*

*Предложено использовать в системе контроля сточными водами предприятия пищевой промышленности новый инструмент – расчет концентраций загрязняющих веществ путем составления материального баланса технологического процесса производства, что даст возможность прогнозировать качественный и количественный состав сточных вод за выбранный период времени и тем самым уменьшить влияние на окружающую среду. Данная система дает возможность определить полную характеристику влияния производства на окружающую среду, а именно на водные объекты, а также знать, какое влияние имеет каждый технологический процесс производства в общее загрязнение сточных вод, что позволит осуществлять эффективный экологический менеджмент производства.*

The modern water management system in Ukraine consists in periodic sampling, carrying out the laboratory analysis of their structure and informing the enterprise on the conducted research (fig. 1). However the prospect of achievement of a sustainable development is possible when not simple measurement of composition of sewage is taken, and there is a control of their structure at each production phase. Such system allows presenting better influence of the plant on environment, to estimate a contribution of each division to the general influence, to control

process of sewage formation and to operate production for the purpose of reduction of impact on environment.



*Fig. 1* - The present wastewater control system in Ukraine

There is a possibility of forecasting of qualitative and quantitative composition of sewage for any period on all divisions of the enterprise, being essential addition to laboratory methods of the analysis which not always are indicative, demand time, not all attendees of substance can define.

The research purpose is modernization water management **system on the basis of calculation of substances' mass balance**.

For modernization of the water management system there was a need of studying of the technological scheme of production. The analysis of beer production process on Mykolaiv Branch of "SUN InBev Ukraine" showed the main points of wastewater formation:

1. Reception of barley and malt; there isn't using of chemicals and dumping of industrial sewage.
2. Barley crushing; there isn't using of chemicals and dumping of industrial sewage.
3. Preparation of water for beer production: chemicals for reduction of water in the corresponding quality are used.
4. Preparation of beer wort consists of the following stages:

- **grout** - extraction of malt's soluble substances and transformation under the influence of enzymes of insoluble substances in soluble with the subsequent introduction to solution;

- **filtration** - separation of a beer mash from a pellet. A mash and insoluble substances in water - a pellet is received.

- **mash boiling with hop**. The mash comes to the machine where hopes are added and boiled. A mash it will be sterilized during cooking; enzymes are inactivated; bitter substances of hop are dissolved in a mash, proteins coagulate.

- **separation from hop and cooling**.

The carried-out analysis allows to define the main divisions, polluting sewage such as office of brewing, including filtration, packing and logistics. Therefore it is necessary to study, what means are used in these divisions, and what polluting substances get to composition of sewage.

So, the brewing department uses a number of chemicals and means. At a brewing stage: solution of nitric acid  $\text{HNO}_3$ ; solution of phosphoric acid  $\text{H}_3\text{PO}_4$ ; solution of sodium hydroxide  $\text{NaOH}$ ; P3-stabicip OXI; P3-topactive 200; at the stage of fermentation and filtration of beer: solution of nitric acid  $\text{HNO}_3$ ; solution of sodium hydroxide  $\text{NaOH}$ ; P3-oxonia active 150; P3-topax 66; P3-oxonia; P3-trimeta DUO; Hlorantoin; P3-ansep CIP. The mentioned substances get to sewage together with organic pollution: shares of the fulfilled yeast; extract losses; beer losses; diatomaceous earth shares; share pellet [1–6].

Department of packaging uses such materials: solution of phosphoric acid  $\text{H}_3\text{PO}_4$ ; solution of nitric acid  $\text{HNO}_3$ ; solution of sodium hydroxide  $\text{NaOH}$ ; P3-oxonia active; P3-topax686; P3-topax 56; P3-stabilon WT; P3-oxonia; P3-stabilon plus; P3-topactive 200; P3-topactive DES; DryExx; P3-polix XT; P3-lubodrive; P3-oxonia active 150; P3-ansep CIP.

Logistics department conducts regular showers substandard products.

According to the enterprise about those means which are used, their chemical composition was studied by material safety data sheets of chemical production. For example, detergent P3-topax56 characterized by the following composition:  $\text{H}_3\text{PO}_4$  - 25-30%; 2-(2-butoksyetoksy) ethanol - 2.5%; surfactant (alkilaminoksidy) - 2.5%; P - 9.6 %, N - 0,18%, COD - 170 mg  $\text{O}_2$ /g. Similar results obtain by

all means, but choose to calculate the average amount of each substance content.

The technological scheme of production with the image of the main stages is made for modernization of wastewater control system. We will represent all necessary resources, chemicals and means which are used at the enterprise and which as a result can get to composition of sewage. Thus technological operation is "a black box" for us. We are interested in only those substances which are on an entrance and at the exit at the technological process.

At the exit wastewater will be full of those substances that are used in the company at a particular time. Besides, from department of brewing the remains of beer, yeast, diatomaceous earth, a pellet and extract get to sewage. Their structure may be different, however, for calculation we use their average data given to contents of nitrogen, phosphorus and COD.

Analyzing the composition of the means used at the enterprise, structure of organic pollution, and also Rules of Admission of Sewage in the Municipal Sewerage of the City to control composition of sewage, we choose the following indicators:

- COD - this indicator is given for all used means, and also for organic pollution. It is an integrated and informative indicator of waters pollution;
- phosphates are a part of some means;
- surfactants are part of some means;
- nitrogen content calculated by the nitrate form, as part of some assets is nitric acid. Nitrogen in ammonium and nitrite form, regulated by the Rules, it is not contained in the compounds, but it is a part of organic matter, and then can go into ammonia, nitrite and nitrate form. Based on this we also take into account the total content of nitrogen.

As daily calculation is made generally to know load of local treatment facilities, it is necessary to consider also the general content of phosphorus therefore this indicator will also enter calculation.

The analysis of structure of the used substances shows that the numerous amounts of chemicals are their part. All these substances will be presented in the form of certain indicators: COD, phosphates, surfactants, nitrates, general nitrogen.

To show viability and effectiveness of similar calculation we show the obtained data in the form of the schedule.

Fig. 2 shows the calculated COD for selected period indicating the volume of beer produced.

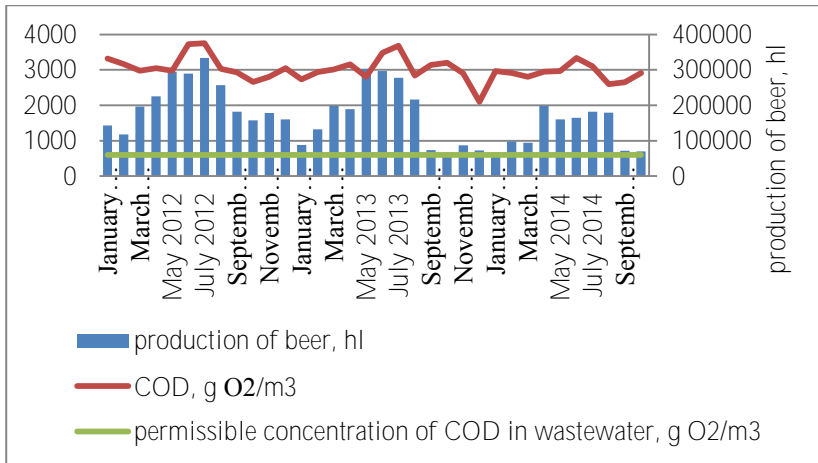
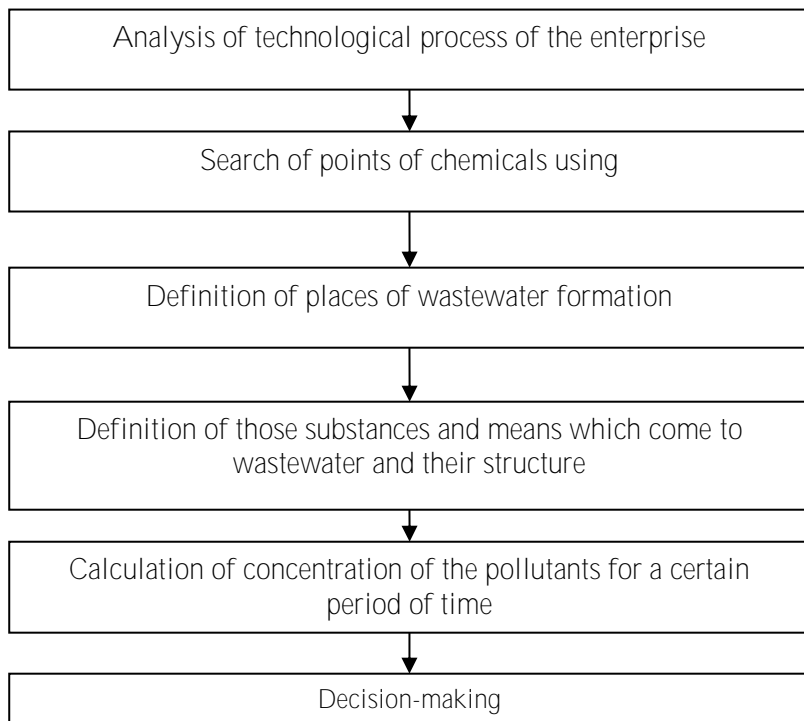


Fig. 2 - Calculated COD of wastewater

Such calculation is necessary to exercise control of compliance to admissible concentration not to be relied by single analyses which often happen inexact, for decision-making and modification the technological processes, for adaptation of technological process of production to new requirements, for the best representation of an overall picture of activity of the enterprise.

Thus, the proposed system of calculation of concentration of the pollutants is the additional effective instrument of wastewater control system of the plant, allows identifying the processes that perform most pollution. This system allows making decisions on reduction of influence on environment by change or improvement of production process, replacing some means so on (fig. 3).



*Fig. 3 - The offered water management system*

#### Conclusions.

The main problem of the plants of the brewing industry is using a lot of water and formation of the wastewater polluted by various substances. The pollutants are a pellet, diatomaceous earth, yeast, the beer remains, etc., and also components of those means that used at the plant in the certain period of time. The wastewater control system has the stating character: single tests at the exit from **the enterprise one time a week are investigated, and then it's** determined if the company complies with the standards, but this approach is not quite correct. Therefore there is a need in continuous wastewater control by introduction of the new tool on the basis of **calculation of the pollutants' concentration.**

This system has a number of functions:

- illustrative, as shows all processes of production and gives a better picture of the overall impact on the environment;
- controlling, as calculation shows at what stage of the process are generated the most waste water, which unit is the biggest polluter; the result is valid, not single concentration of pollutants;
- predicting: by data of norms of use of means and of the planned quantity of production we can expect qualitative and quantitative composition of wastewater at the exit from each department and from the enterprise in general;
- management, after all on the basis of the analysis of the obtained data on processes which make the greatest pollution, it is possible to make operational decisions on reduction of impact on environment;
- informative: provided data on the concentrations of substances, including those that are not controlled by laboratory methods.

#### Literature

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