Ukrainian universities web-sites made it possible to limit the possible attack surface, which would speed up the search and analysis of vulnerabilities at the first stage of the proposed methodology.

Key words: *penetration testing, web-site, OWASP, OWASP ZAP.*

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THE EFFECTIVE WASTEWATER TREATMENT FOOD PROCESSING AND AGRIBUSINESS

The proposed sewage treatment process using ozone carried out in bubblers in countercurrent motion of phases.

Key words: Ozone, phase, the apparatus, the intensification, the process.

Formulation of the problem. In the processing industries of the agro-industrial complex, where in the cost of production the share of material and energy costs is more than 80%, the importance of reducing the material consumption becomes especially urgent. This can be achieved thanks to the wide introduction of non-waste technologies, the integrated use of raw materials and secondary resources in combined production. Another important aspect of the problem is ensuring the ecological safety of food production plants, eliminating the harmful effects of waste on the environment. The food industry belongs to the most material-intensive industries, therefore the rational use of raw materials is especially important. The problem of waste disposal is one of the most important issues faced by food industry enterprises.

Every year the pollution of the natural environment increases. Food processing and agribusiness companies by its emissions significantly affect the water environment and air.

Analysis of recent research and publications. Famous domestic and foreign scientists have devoted considerable attention to research on the effective treatment of water from processing and food enterprises. However, despite the presence of a large number of scientific studies on this issue, some aspects of modern sewage treatment using ozone are still not well-researched, which have an important scientific-theoretical value and practical value.

The purpose of the article. To estimate the state of sewage of processing and food industries, and the proposed sewage treatment process using ozone carried out in bubblers in countercurrent motion of phases.

Presentation of the main research material. A promising method of water treatment is an ozonation. Ozone eliminates bad tastes and odors, oxidize soluble organic compounds and provides a fast and reliable disinfection and improves organoleptic properties of water. The ozone promotes oxidation and causes the precipitation of iron and manganese, precluding the colour of water.

Thus, the universal nature of ozone makes it promising for water treatment and sewage treatment of the enterprises of processing and food industry. However, the wide practical use of ozone is constrained by insufficient study of the process and the lack of high performance of the hardware and technological design.

The solubility of ozone in water depends not only on temperature and pressure and pH of the water and the presence of impurities [1-3]. When a small increase in acidity and the concentration of neutral salts, the solubility of ozone is increased, and in the presence of alkali it decreases. While the ozonization of the river water its concentration with the increase in pollution decreases, and if contaminated, the ozone is almost completely absent.

Ozone is a strong oxidizer and the reaction may oxidize the substance by the joining of one atom, to become a molecule with the formation of ozonides, catalytically to enhance the oxidizing properties of oxygen. In a clean, dry air, the ozone decomposes slowly, but with increasing temperature, pollution and humidity of its collapse is accelerating. In water, ozone decomposes much faster.

Among its decomposition products installed O2 HO2-, HO3-. There is sufficient evidence to show that the course of the reaction and the rate constants of the decomposition of ozone may vary within a wide range. The rate of decomposition of ozone is not affected by the glass, some metals, fluoride and chlorine-containing plastics, at the same time, the catalysts of these reactions are oxides (P2O5, BAO2), metals of variable valency (Mn, Cu, Co, Fe), silica gel, activated carbon and some other materials [3].

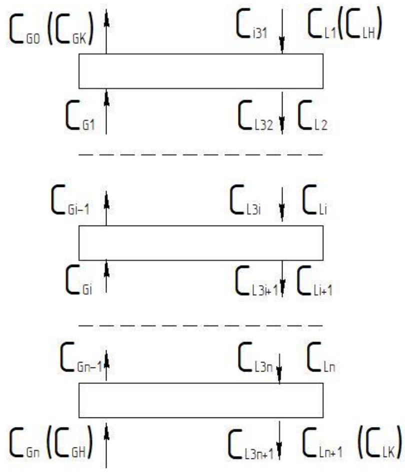

Fig. 1. Diagram of material flow in countercurrent

Analytical review of the literature has shown [1,3], that in pure water the rate of decay of ozone is small. With increasing concentration of the substances that are oxidized by the ozone or can be used for a catalyst, and also with creation of conditions for the activation process (temperature, pH, ultraviolet radiation, etc.), decomposition of ozone in water is accelerated by 3-5 orders of magnitude . Virtually no data showing which portion of ozone is disintegrating, and which enters into a chemical reaction.

The slow decrease of the concentration of ozone in water ozonation process is limited by reaction rate in the liquid phase, that is, to increase need to increase the time spent or to intensify the mixing process in volume. With the rapid decrease in ozone concentration or lack of ozone in the bulk liquid, the process of ozonation is limited by the diffusion of ozone into the liquid, so you need to create a developed contact surface phases, as in the surface layer of the oxidation reaction occurs or the self-destruction of ozone. The process of wastewater treatment is the ozonization that is advantageously carried out in countercurrent mode of motion phases.

You can use the vertical column bubbling apparatus which consists of a number of stages (plates). Consider the case when the gas in the apparatus is fed from the bottom up, the liquid is discharged from the top down. On each plate are mounted cross-flow phases (Fig. 1).

Make the equation of material balance of ozone in gas and liquid phases for the i-th plate based on the process of absorption, chemical reaction and decomposition of ozone in gas and liquid phases, and the oxidizing component in the fluid:

$$GC_{GI} = V_G K_{GP} C^m_{GI-1} + GC_{GI-1} + K_L aV_L \left(C^*_{LI+1} - C_{LI+1}\right) \quad (1)$$

$$LC_{LI} + K_L aV_L \left(C^*_{LI=1} - C_{LI+1}\right) = LC_{LI+1} + V_L K_{L_{p3}} C^{m1}_{L_{3I}} C^{m2}_{LI} \quad (2)$$

$$LC_{L_3 I+1} = LC_{L_3 I} - \alpha K_L aV_L \left(C^*_{LI+1} - C_{LI+1}\right) \quad (3)$$

Where *G, L* – expense respectively of gas and liquid, м³ / с; *CG, CL* - ozone concentration, respectively, in the gas and liquid, кг / м³; *VG, VL* - the amount on the plate, respectively, gas and liquid, м³; *KGP, KLp3* - the rate constants of the reaction of decomposition of ozone, respectively, in the gas phase and in liquid and reaction in the liquid phase with the impurities; *KL* - the coefficient of mass transfer, м / с; *a* - the specific surface of phases contact , м² / м³; *CI ** - equilibrium concentration , кг / м³; *a* - the proportion of ozone that is consumed for the oxidation of impurities in the liquid*; CL3* the concentration of contaminants in a fluid.

According to Henry's law for dilute solutions the equilibrium concentration can be determined in consideration of pressure drop in the apparatus to the *i*-th disk:

$$C^*_{LI+1} = M_Г \rho_ж \left(C_{GI} + C_{GI-1}\right) / \left[2 \rho_Г M_ж \left(1 + P_T (I - 0{,}5)/P_{атм}\right) H\right] \quad (4)$$

or

$$C^*_{LI+1} = \left(C_{GI} + C_{GI-1}\right) \quad (5)$$

where

$$B_I = M_Г \rho_ж H / \left[2 \rho_Г M_ж \left(1 + P_T (I - 0{,}5)/P_{атм}\right)\right] \quad (6)$$

where *H* - the Henry's law constant; Мг, *m*- molar mass, respectively, of the ozone-air mixture and waste water.

After solving the equations we get:

$$C_{GI} = \left[\left(L + K_L aV_L\right) A_1 - K_L aV_L A_2\right] / \left(GK_L aV_L + GL - LB_I\right) \quad (7)$$

where

$$A_1 = V_G K_{GP} C^m_{GI-1} + GC_{GI-1} + K_L aV_L B_I C_{GI-1} \quad (8)$$

$$A_2 = LC_{LI} + K_L aV_L B_I C_{GI-1} - V_L K_{LP3} C^{m1}_{L3I} C^{M2}_{LI} \quad (9)$$

$$C_{LI+1} = \frac{\left[B_I K_L aV_L B_I C_{GI-1} + V_G K_{GP} C^m_{GI-1} + GC_{GI-1} - \left(G - K_L aV_L B_I\right) C_{GI}\right]}{K_L aV_L} \quad (10)$$

The proposed model is useful for calculating the number of contact stages countercurrent disk bubbler apparatus. To determine the number of disks you need to set the output values CG0, CGn, CL1, CL31, L, G and perform on computer the following calculation formulas (3, 9, 10) of ozone concentration in the gas phase at the inlet to each stage and contact to that value when CGI ≥ CGH.

The most common devices for the mixing of ozone-air mixture with water are bubbling contact cameras. The height of the water layer depends on the pressure of the ozone-air mixture after the ozonator. The contact chamber has the following disadvantages: large size; the inability to reach more than 1-2 steps contact; low coefficient of mass transfer. To increase ozone use, the researchers increased the resistance of the input devices of the gas. However, such measure even after increasing the resistance more than 2 orders of magnitude did not affect the magnitude of the loss of ozone for a further merging of streams and small bubbles near the input device in large bubbles. Therefore, the use of fine-pored input devices ozone-air mixture was ineffective [1].

In the pit chamber with hydraulic emulsifier [2] used the energy of water for the ejection of the ozone-air mixture. In emulator the smallest particles of the gas after ejection received in the lower part of the contact chamber and pass directly from the water up.The duration of the contact phase in the chamber is 5 minutes, the height of the layer of water is 5 metres.

To intensify the process designers mass transfer machine administered mechanical energy using rotary mechanical emulsifier [2]. When the rotor rotates at a speed of 2900 R / min it is the circulation of water and gas, together with water moving downwards through the perforated wall of the rotor. At the surface of the rotor gives rise to large gradients of speed and creates good conditions for the crushing of gas bubbles and formation of the developed surface of phase contact. However, a good turbulence of the phases observed in the rotor, and the rest of the volume of the chamber it is insufficient and gas barbituate up. Therefore, the utilization of ozone in such apparatus is not higher than 70-80%, the energy consumption for mixing water with gas is 8 ... 13 kWh per I kg of ozone.

Also known methods of activation treatment of waste water by creating foam pre-exposed to a magnetic field, temperature rise and pressure exposure to electric current [3].

Apparatus for gas-liquid ozonation of wastewater characterized by the ratio of cost of gas and liquid in the range m = 3÷20. Only in exceptional cases, at elevated pollutant concentrations, the ratio of m increases. Therefore, the ozone treatment apparatus needs to operate in a wide range of gas flow rate. This effect can be achieved in the apparatus with stirrer, column apparatuses, for example, with a valve contact devices.

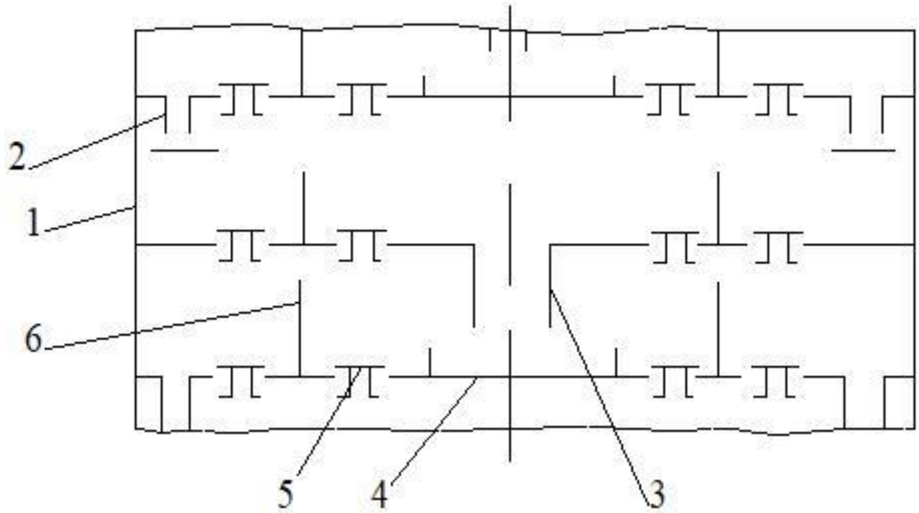

Fig. 2. Bubbling reactor.

While the ozonation of wastewater a series of machines with agitators are often used. To intensify mass transfer process through the turbulence of the phases in the whole volume and create a ripple can be offered in the blades of the stirrer in the hole and attach the spring [1]. During the rotation, due to changes in speed, the spring will vibrate, increasing the amplitude of oscillations. Gas is supplied to the lower portion of the apparatus, will split into smaller bubbles that l ensures the increase in the specific surface of phases contact.

Designed bubbling reactor (Fig. 2) represents countercurrent column apparatus that operates "under the Bay". The liquid in the body moves down and the gas rises from the bottom to the top and barbituate through the contact device 5. For periphery of the device there is several drainage devices 2. With the aim of improving the fluid mixing at the transition from the plate on the plate the liquid flows down. Central overflow pipe 3. To create the ideal displacement mode plate 4 comprises an annular wall 6.

Therefore, there are formed two zones close to the mixing cell perfect: one area located outside the partition, and the second - inside . The gap between the partition 3 and above is a plate made for the flow of fluid and equalization of pressure of gas over the plate. Bubble reactor is stable in the range of gas velocity in the column 0,01 - 0,4 m / sec.

The main advantage of the Poppet bubble column reactors providing a countercurrent movement of phases at the height of the apparatus. The presence of a large number of stages of contact and allows you to better use the ozone and reduce its emissions. The disadvantage of bubble devices is that they for mixing the phases and to ensure proper surface contact of them use only the energy of the ozone-air mixture. A characteristic feature of ozonation reactors are the low costs of ozone-air mixture with a sufficient residence time of the liquid in the apparatus. This is the reason of the low dissipation of energy in the volume unit and, consequently, low volumetric ratio mass transfer. To increase supplying the bubble apparatus with additional energy it is more preferable to use the energy of waste water that can be pumped under the pressure more than 0.2 Mpa.

With the participation of authors have developed also the design of the reactor of ozonation (Fig. 3), which uses the energy of the flow of waste water, and also used some specific modal factors. In the apparatus of the ozone-air mixture is divided into two streams and fed to the lower part through the nozzles 7, 8. Waste water is divided also into two streams and fed into flow area through the pipe, and countercurrent zone through pipe 9. The fluid passes through the ejector 10 and tightens the ozone-air mixture. After the ejector the gas-liquid stream is directed into contact flow pipe 13 with a transverse perforated disk14.

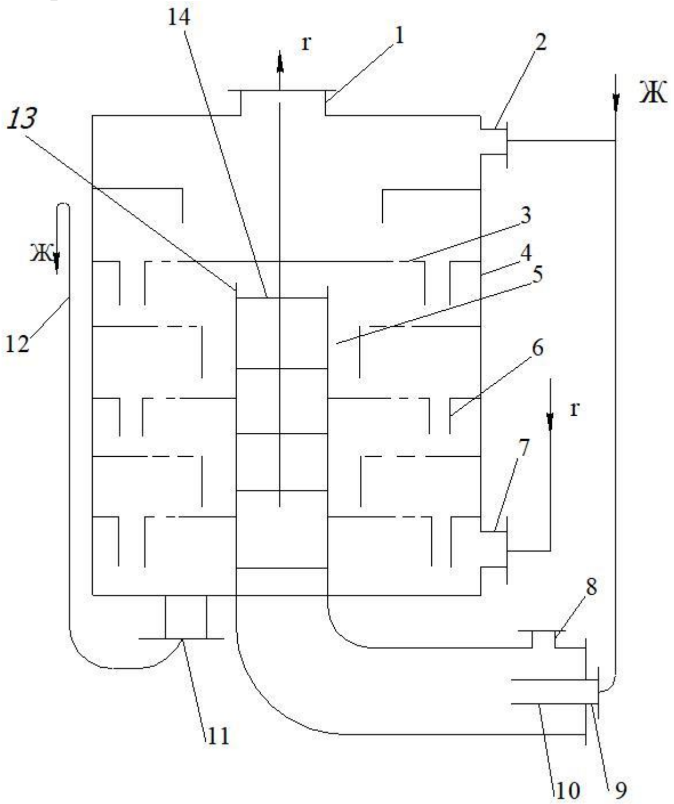

Fig. 3. The ozonation reactor.

With the passage of the high speed gas-liquid flow through baffle in them, there is intense turbulization of phases. Acceleration of the oxidation reaction of the wastewater pollution is due to the intensive transport of ozone from the gas phase into the liquid, due to the developed surface of phase contact and a large energy dissipation in the flow. The flow is separated after passing countercurent contact pipe, the liquid is discharged down the disks, and the gas barbituate up through the contact device plates 3, mounted in the housing 4. The second fluid flow is drained through a nozzle 2 on the plate 5 and moves down the plate on the plate through the overflow pipes 5, 6. Given the fluid through the pipe 11 and overflow pipe 12, this provides for the operation of the apparatus «over the Bay». The second gas stream enters through the pipe 7 and barbituate up. The gas is discharged through pipe 1. At the height of the apparatus gas and liquid are moving in countercurrent, however, their costs vary on a disk located at the outlet of the pipe 8. Through the pipe 2 is supplied liquid, a flow which is minimal and does not exceed 0,1 of total consumption.

Such expenses of liquid is set to increase the residence time of the liquid on the disk, increase in temperature and pH. The increase of pH and temperature on the upper disks of the countercurrent contact zone accelerates the decomposition of ozone and communicating the ozone concentration at the outlet of the reactor to the maximum allowable.

In-line stage of contact is supplied to the main flow of fluid and less than 0.4 of total flow ozone-air mixture. Direct-flow contact zone of the phases necessary to achieve saturation of the liquid supplied by the ozone, which is used to oxidize the impurities in the water. The lack of ozone and high turbulence of the phases there is a rapid transfer of ozone from gas phase to liquid. Thus, at the exit of the tube 13, the concentration of ozone is negligible. A large part of the ozone breaks down rapidly in the upper part of the reactor in the zone of increasing pH and the temperature. The liquid from the tube 13 mixes with the liquid coming from the top of the disks. Due to the fact that the costs of the liquid from the upper plates are small, the pH and temperature of the medium after mixing is slow to change compared to the main fluid flow. After mixing, the liquid is drained down and in, countercurrent interacts with the bulk gas flowing through the pipe 7. In this case, the driving force of the process of chemisorption of the maximum and occurs intensively that contributes to the rapid oxidation of impurities in the liquid and the effective use of ozone.

The analysis of mass transfer process in existing reactors ozonation has led to the conclusion that the processes of absorption of ozone and the oxidation of contaminants occur quickly enough, especially at the end of the process. To improve the efficiency of their work it is necessary to increase energy dissipation in the liquid volume. When using the energy of the liquid is the energy dissipation only increases by 10-50% that is clearly insufficient. This problem is solved in the proposed reactor ozonation in which increased the energy dissipation due to the air supplied to the apparatus is advanced, which improves mixing in the liquid phase and accelerates the reaction of impurities. The oxygen also oxidizes a portion of the impurities. In order not to mix the ozone-air stream with the air disk the unit divided into each plate into two parts that connected by a playing window with grids.

Summary. The cleaning process ozonation of wastewater of processing and food enterprises of agroindustrial complex is advantageously carried out in bubblers while providing a maximum driving force of the chemisorption through the use of countercurrent motion phases and the additional admission of air promotes mixing and accelerates the oxidation reaction.

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ЕФЕКТИВНЕ ОЧИЩЕННЯ СТІЧНИХ ВОД ПЕРЕРОБНИХ І ХАРЧОВИХ ПІДПРИЄМСТВ АПК

Запропоновано процес очищення стічних вод з використанням озону проводити в барботажних апаратах в протиточному режимі руху фаз.

Ключові слова: *озон, фази, апарат, інтенсифікація, процес.*

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ЭФФЕКТИВНОЕ ОЧИСТКИ СТОЧНЫХ ВОД ПЕРЕРАБАТЫВАЮЩЕЙ И ПИЩЕВОЙ КОМПАНИЙ АПК

Предложено процесс очистки сточных вод с использованием озона проводить в

барботажных аппаратах в противоточном режиме движения фаз.

Ключевые слова*: *озон, фазы, аппарат, интенсификация, процесс.

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УДК 342.95

Гуменюк Г. Д., Кійко В. В.

КОНТРОЛЮВАННЯ ЯКОСТІ ТА БЕЗПЕЧНОСТІ ХАРЧОВИХ ПРОДУКТІВ У ЗАРУБІЖНИХ КРАЇНАХ

У статті наведено огляд нормативно-правових актів, інших документів та літературних джерел щодо державного контролювання безпечності та якості харчових продуктів у Великій Британії, Німеччині, Франції, США та Японії.

***Ключові слова**: державне контролювання, якість та безпечність, харчові продукти.*

Постановка проблеми в загальному вигляді. Від якості та безпечності харчових продуктів великою мірою залежить здоров’я кожної нації. Тому в будь-якій країні на державному рівні регулюють вимоги щодо безпечності та якості продукції й забезпечують їх дотримання. Одним зі способів такого забезпечення є державне контролювання.

Україна прагне стати членом ЄС. Підписано угоду про асоціацію між Україною та ЄС, згідно з якою наша держава зобов’язалася максимально наблизити свою сферу технічного регулювання до законодавства ЄС. І насправді в цьому напрямку багато вже зроблено.

Аналіз останніх досліджень і публікацій. Висвітленню міжнародної практики у сфері забезпечення якості та безпечності харчових продуктів присвячено багато праць вітчизняних вчених, зокрема Л. Віткіна, Д. Луценка, Г. Хімічевої, Ю. Сливи, Н. Силонової, А. Зенкіна та інших. Динамічні зміни, пов’язані з гармонізацією норм харчового законодавства з відповідними нормами Європейського Союзу та кращими світовими практиками, потребують постійного моніторингу й детального вивчення, і це обумовлює актуальність та своєчасність цієї статті. Особливий інтерес являє інформація щодо контролювання якості та безпечності в інших країнах з метою використання такої практики чи переконатися в недоцільності орієнтуватися на деякі особливості.

З цією метою в праці проаналізовано практики контролювання якості та безпечності харчових продуктів у США, Німеччині, Франції, Великій Британії та Японії.

Виклад основного матеріалу. Кожна держава має свої правові акти й адміністративну інфраструктуру. Зупинимося на деяких особливостях.

Державний контроль безпечності та якості харчових продуктів у **США** здійснює Управління з контролю за харчовими продуктами та лікарськими засобами (Food and Drug Administration, FDA). Ця організація є однією з найстаріших і найнадійніших служб із захисту прав споживачів.

Діяльність FDA регулюється насамперед Федеральним законом про харчові продукти, лікарські засоби та косметику і передбачає перевіряння зразків харчових продуктів на