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WAYS TO IMPROVE FLOTATION WASTEWATER TREATMENT PROCESSES

Abdumalik Nabiyevich Rizayev,
Doctor of Technical Science Professor, "Engineering communications and systems" department professor (TSTU)
Zafar Musayev,
2nd-year master's student (TSTU)

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Abstract:

A comparative analysis of working efficiency of flotation plants in the purification of oily wastes of industrial organizations by methods of pressure and free-flow flotation is provided in the article. Main parameters and a working principle of flotation plants of various constructions that help to increase the degree of purification of waste waters from oil products are considered and determined. Based on carried out research, a promising direction of unprimed enamel coatings formulations is revealed, studies in the direction of which can improve the quality of oily wastewater by techniques of pressure and free-flow flotation.

Keywords: Flotation, An Industrial Wastewater, Oil Products, Flotation Plant, Wastewater Treatment, , Vortex Blending Device.

One of the largest polluters of surface waters are industrial enterprises, the wastewater of which is characterized by the presence of petroleum products that negatively affect the environment. In this connection, research and development of effective methods of treatment of waste water of such enterprises before discharging into surface waters are relevant. Industrial wastewater treatment from oil products is a very difficult process as the oil dissolved in water forms an emulsion which can not be completely removed by mechanical methods. Therefore, the most effective at the moment are the schemes of pressure and non-pressure flotation wastewater treatment, where there is complete removal of oil emulsion due to gas saturation with water-air mixture of wastewater. The average efficiency of water purification from oil products at reagentless pressure flotation with the use of radial flotation tanks usually does not exceed 65 %, and with the use of horizontal floatators is not more than 30 % [1]. The degree of purification of waste water at reagent pressure flotation reaches 88% at the radial floatators and 65%-70% - at horizontal ones at pressures in pressure tanks of 3,5-4,0 - 105 Pa [6]. At pressures in saturators above 4.0 - 105 Pa the efficiency of flotation water purification decreases as the average bubble size increases with increasing initial supersaturation of water and dilution of water-air mixture at mixing it with water in the flotation tank. Thus, cleaning efficiency in pressure flotation units cannot be increased by increasing the pressure for air saturation of water in the saturator tanks. Increasing the degree of removal of contaminants from water by pressure flotation can be achieved by sequential use of several stages of wastewater treatment, for example, in recirculation flotation plants with a multi-compartment flotation unit. The method of pressure flotation has a significant disadvantage, which is that at variable flow rates of water fed to the treatment, regulation of the water saturation unit with air becomes very difficult. In this regard, non-pressure flotation with the use of water-air mixers of hydraulic type is of considerable interest. The disadvantage of this unit (as well as of pressure flotation units) is deterioration of water purification quality at operating pressures of the circulating flow before the ejector above 4.0 - 105 Pa. A high degree of dispersion of air bubbles can be achieved in those non-pressure flotation units where vortex mixing devices are used as dispersants (Fig. 1), which create large tangential stress on the boundary "air bubble - liquid" [2].

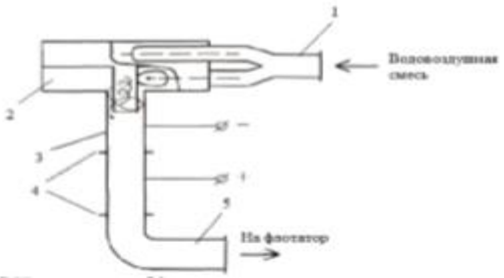

Figure 1. scheme of the vortex blending device 1 - supply pipeline; 2 - inlet chamber; 3 - barrel (vortex chamber); 4 - dielectric inserts; 5 - outlet pipeline

However, long-term operation of the non-pressure flotation wastewater treatment technology proposed in [2] has revealed the following disadvantages - in the water-air mixture entering the classifier fraction, there were a significant number of air bubbles, the size of which exceeded 2.0 - 10-3 m, which significantly reduced the gas saturation of the mixture after the classifier; - imposition of an electric field significantly reduced the equivalent diameter of only air bubbles with a diameter of 1.5 mm or higher, which slightly improved the effect of flotation treatment of effluents; - device of the chamber with a coalescing load, did not lead to an improved effect of flotation treatment. In addition, the lack of reagent treatment of wastewater does not provide an opportunity to achieve a high effect of flotation treatment in almost any method of water saturation with air. Experiments have shown that increasing the dispersion of air bubbles in two-phase flows treated in vortex apparatuses can be provided by increasing the wetted perimeter of the passage section of the apparatus at its unchanged area [3; 4]. Structurally, this is achieved by installation in the barrel of vortex blending device (VBD) coaxially located rod or tube of smaller diameter (Fig. 2).

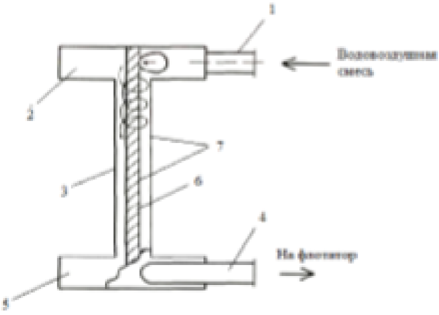

Figure 2. scheme of the vortex blending device (VBD) with enamel coating 1 - supply pipe; 2 - inlet chamber; 3 - barrel (vortex chamber); 4 - outlet pipe; 5 - outlet chamber; 6 - central rod (pipe); 7 - enamel coating

Dispersing of bubbles in the VBD trunk can be significantly intensified by coating its inner surface, as well as the outer surface of the central rod with silicate enamels, which will allow with the moving two-phase flow "water-air" in the near-wall area to create high values of shear stresses, resulting in effective dispersion of air bubbles. [5; 6].. Thus, analyzing the above schemes of flotation treatment of industrial wastewater, we can conclude that the study of vortex mixing devices will increase the efficiency of industrial wastewater treatment of petroleum products due to the formation of water-air bubbles of the required diameter, creating high tangential stress on the border "air bubble - liquid". Intensification and introduction of such technologies will increase the efficiency of flotation devices and can contribute to the creation of energy- and reagent-saving technology of deep cleaning of oily effluents based on the use of methods of depressurized flotation, mechanical filtration and sorption.

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