

Induced Air Flotation Technology and Its Engineering Applications

Yixuan Ye*, Xiaoyu Xiong

Taizhou University, Taizhou 318000, Zhejiang, China. E-mail: 1337663949@qq.com

Abstract: Induced air flotation is a highly efficient way to remove oily wastewater discharge with the help of electricity to drive the instrument vibration stirring. Large bubbles produce small bubbles to bring out the stains. Because of its simple operation steps, it is used more and more commonly. In this article, we mainly introduce a class of induced air flotation technology and its application in waste water degreasing.

Keywords: Induced Air Flotation; Oil Division; Air Flotation Technology

1. Introduction

Water resources are scarce in China, and the country's seven major river systems are all polluted at a certain extent. Water pollution is a vital factor affecting the society sustainable development. One of the most serious factors causing water pollution is oil pollution from industrial production, so it is important to study and treat oil-bearing wastewater.

The country is the representative of the eastern ocean and northern oilfields, which have severe water pollution. Yuliang Zhao, *et al.*, summarized the application of two induced air flotation techniques, such as impeller air flotation and jet air flotation, to oil-contaminated wastewater under different conditions^[1]. Dexi Zhao improved air flotation using induced air flotation to have better treatment of water quality in Bohai Sea^[2]. Jianzhen Xi, *et al.*, used induced air flotation and corresponding filtration device to treat the oil-bearing wastewater from Jingbian oil field^[3]. In summary, oil pollution problems in oilfield and ocean can be solved by flotation technology. This article introduces the current air-float technology and its engineering applications.

2. Introduction of air-float technology

Air flotation is a technique that produces a large number of tiny bubbles in the water with a diameter of 10-120 microns by means of surface tension.

It is used with suspended particles in wastewater flocculation adhesion, to its volume increase amplitude than the mass, condensate density decreased significantly, floating to the liquid surface to achieve effective separation of oil and water. Air flotation is mainly used for water that has relative density of suspension close to 1 and the nature hard to be removed, such as paper wastewater, petrochemical wastewater, washed wool wastewater, low temperature and low turbidity sludge water containing more algae.

There are various types of air flotation techniques, but their essence lie in the selection of the way bubbles are formed in the water, as well as the control of bubble size and the collision of micro-bubbles and oil droplets in the later intensive flotation^[4].

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3. Engineering applications of supermassive induced air flotation technology

3.1 Induced air flotation in marine platform wastewater treatment process

The jet air flotation in induced air flotation is widely used in the treatment of oil-bearing wastewater on offshore platforms. As a new type of air flotation device, it is equipped with four injectors and the corresponding four-stage flotation chamber. When the water passes through the flotation chamber, the high-speed jet stream in the injector generates negative pressure, and the gas inhalation, gas bubbles are formed in the injector. Air bubbles due to lighter weight in the flotation chamber rise, and the process will adhere to the oil beads and solid particles, rise to the liquid level, and the skimmer will be removed after in addition to the purpose of oil residue^[5]. The advantages of jet-induced flotation has good floating effect, high floating rate, short residence time, high oil removal efficiency, less space occupation, low operating costs, less maintenance and fully closed operation. The working principle of this flotation is basically the same as other flotation devices, but there are significant changes in the structure. Air flotation tank, dosing equipment, solver tank, water pump, air machine are combined well in a machine base. No foundation and no need for special management once the equipment is debugged.

3.2 Induced air flotation in thermal media solution process on waste water degreasing

The oil and grease in pyrolysis wastewater generally exist in three forms, including floating oil, emulsified oil and dissolved oil. These three different oils need to be removed through different methods due to different chemical composition and molecular structure. For example, floating oil can be separated through static or centrifugal method. The other two can be removed through plate agglomeration method, coagulation and sedimentation method, electrocoagulation flocculation method, filtration method and adsorption method^[1]. Among them, the induced air flotation method is the most widely used due to its low cost and better results.

4. The drawbacks of induced air

flotation technology

The induced air flotation technology is not suitable for complicated inlet water quality and low water volume per unit volume due to high requirements of ejectors. Currently, most of the induced air flotation is used in highly mineralized oil field drainage treatment, corresponding to the high requirements for corrosion resistance of equipment materials, which is made of stainless steel or duplex steel internals. Hence, the cost is also high^[6].

5. The disadvantages of air flotation technology to solve

5.1 Modification of pump type and control of oxygen content

Pump type modification can increase the injection intensity of the ejector. Meanwhile, it can make a further increase in water capacity per unit volume. In the air flotation machine in the jet outlet, there are the original air flotation circulation pump, installation, fixed and new air-liquid mixing pump supporting devices, including air separation tank, pressure gauge, etc. Finally, the air-liquid mixture and uniform air distribution at the water cross section are achieved.

According to the internal structure of the flotation, we can calculate the rising flow rate and the downward flow rate of the flotation separation chamber respectively, and choose the appropriate flow rate to ensure the floating separation of gas, liquid and particles^[2].

6. Conclusion

Induced gas flotation is widely used in solving oil pollution in the ocean, oil fields and other applications, and the results are relatively good. But there are still some defects in the actual application. The pump type of air flotation device for the transformation of methods and measures can effectively improve the working performance of the device. Now the amount of oily wastewater treatment and the effect of treatment are higher and higher, air flotation oil removal technology in the field of oil removal applications are receiving more and more attention. The new air flotation oil removal device is also emerging. This will certainly help to promote the further development of water quality and oil removal technology.

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References

1. Zhao Y, Lv J, Xie F, *et al.* Air flotation deoiling technology of coal pyrolysis wastewater (in Chinese). *Coal Processing and Comprehensive Utilization* 2019; (3): 68–72.
2. Zhao D. Optimization of jet-induced air flotation machine in oily wastewater treatment (in Chinese). *Oil-Gasfield Surface Engineering* 2013; 32(12): 61–62.
3. Xi J, Liu Y, Zhang T. Technical improvement of sewage disposal and water quality enhancement in the 10th United Station of Jingbian oilfield. *Oil-Gasfield Surface Engineering* 2016; 35(3): 62–65.
4. Han X, Li Y, Gu W. Analysis on the miniaturized sewage treatment device of jack-up production platform (in Chinese). *Tianjin Science & Technology* 2015; 42(11): 18–19, 22.
5. Han X, Luo L, Xu R. Application of air flotation technology in treatment of oily wastewater on offshore platform (in Chinese). *Environmental Protection of Oil Gas Fields* 2015; 25(4): 22–23, 30, 80.
6. Li J, Sun J. Comparison among several kinds of air flotation oil removal processes. *Industrial Water & Wastewater* 2015; 46(6): 28–31.