

## Upflow Anaerobic Sludge Blanket Reactor Followed by Dissolved Air Flotation Treating Municipal Sewage

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**Abstract :** Inadequate access to clean water and sanitation has become one of the most widespread problems affecting people throughout the developing world, leading to an unceasing need for low-cost and sustainable wastewater treatment systems. The UASB technology has been widely employed as a suitable and economical option for the treatment of sewage in developing countries, which involves low initial investment, low energy requirements, low operation and maintenance costs, high loading capacity, short hydraulic retention times, long solids retention times and low sludge production. Whereas dissolved air flotation process is a good option for the post-treatment of anaerobic effluents, being capable of producing high quality effluents in terms of total suspended solids, chemical oxygen demand, phosphorus, and even pathogens. This work presents an evaluation and monitoring, over a period of 6 months, of one compact full-scale system with this configuration, UASB reactors followed by dissolved air flotation units (DAF), operating in Brazil. It was verified as a successful treatment system, and an issue of relevance since dissolved air flotation process treating UASB reactor effluents is not widely encompassed in the literature. The study covered the removal and behavior of several variables, such as turbidity, total suspended solids (TSS), chemical oxygen demand (COD), *Escherichia coli*, total coliforms and *Clostridium perfringens*. The physicochemical variables were analyzed according to the protocols established by the Standard Methods for Examination of Water and Wastewater. For microbiological variables, such as *Escherichia coli* and total coliforms, it was used the "pour plate" technique with Chromocult Coliform Agar (Merk Cat. No.1.10426) serving as the culture medium, while the microorganism *Clostridium perfringens* was analyzed through the filtering membrane technique, with the Ágar m-CP (Oxoid Ltda, England) serving as the culture medium. Approximately 74% of total COD was removed in the UASB reactor, and the complementary removal done during the flotation process resulted in 88% of COD removal from the raw sewage, thus the initial concentration of COD of 729 mg.L-1 decreased to 87 mg.L-1. Whereas, in terms of particulate COD, the overall removal efficiency for the whole system was about 94%, decreasing from 375 mg.L-1 in raw sewage to 29 mg.L-1 in final effluent. The UASB reactor removed on average 77% of the TSS from raw sewage. While the dissolved air flotation process did not work as expected, removing only 30% of TSS from the anaerobic effluent. The final effluent presented an average concentration of 38 mg.L-1 of TSS. The turbidity was significantly reduced, leading to an overall efficiency removal of 80% and a final turbidity of 28 NTU. The treated effluent still presented a high concentration of fecal pollution indicators (*E. coli*, total coliforms, and *Clostridium perfringens*), showing that the system did not present a good performance in removing pathogens. *Clostridium perfringens* was the organism which suffered the higher removal by the treatment system. The results can be considered satisfactory for the physicochemical variables, taking into account the simplicity of the system, besides that, it is necessary a post-treatment to improve the microbiological quality of the final effluent.

**Keywords :** dissolved air flotation, municipal sewage, UASB reactor, treatment

**Conference Title :** ICSRD 2020 : International Conference on Scientific Research and Development

**Conference Location :** Chicago, United States

**Conference Dates :** December 12-13, 2020