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Review

Dissolved air flotation and me

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ABSTRACT

This paper is mainly a critical review of the literature and an assessment of what we know about dissolved air flotation (DAF). A few remarks are made at the outset about the author's personal journey in DAF research, his start and its progression. DAF has been used for several decades in drinking water treatment as an alternative clarification method to sedimentation. DAF is particularly effective in treating reservoir water supplies; those supplies containing algae, natural color or natural organic matter; and those with low mineral turbidity. It is more efficient than sedimentation in removing turbidity and particles for these type supplies. Furthermore, it is more efficient in removing *Giardia* cysts and *Cryptosporidium* oocysts. In the last 20 years, fundamental models were developed that provide a basis for understanding the process, optimizing it, and integrating it into water treatment plants. The theories were tested through laboratory and pilot-plant studies. Consequently, there have been trends in which DAF pretreatment has been optimized resulting in better coagulation and a decrease in the size of flocculation tanks. In addition, the hydraulic loading rates have increased reducing the size of DAF processes. While DAF has been used mainly in conventional type water plants, there is now interest in the technology as a pretreatment step in ultrafiltration membrane plants and in desalination reverse osmosis plants.

Contents

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1. Introductory remarks

> If I have seen a little further it is by standing on the shoulders of Giants. Isaac Newton

The readers of the journal appreciate that researchers stand upon the shoulders of those who came before them. The foundation of our contributions lies with others; *we are a community of scholars*. This is true here. Thus, a better title of the paper would be to replace *and me* with *a not so personal journey*. A major part of my research journey occurred while serving as a professor where I had the good fortune to work with many outstanding graduate students who participated and contributed to the research on dissolved air flotation (DAF), often to a greater extent than I. A philosophy I tried to follow was to base my research on sound scientific principles and to apply them to important applications in providing safe drinking water. The applied research studies led me to work with professionals at water works, consulting engineering firms, and process engineering companies. These folks contributed greatly to the journey.

This was not an easy paper to write. As scientists we are educated to describe our research in an objective, non-personal way. To add personal material is foreign to my nature. I therefore present in Section 1.1 a brief accounting of how I got started on DAF research, mention briefly some key research projects in my career, and identify some colleagues who helped me on my research journey. The remainder of the paper deals with the primary objective of the paper, which is to provide a scientific review of DAF. I have tried my best to be critical and objective of what we know about the subject, but it is my evaluation of the topic and so some of the material reflects my interpretation and assessment. I begin with Section 2 which contains a description of DAF and developments in its use for drinking water treatment. I then proceed with a scientific review of the following subjects: Section 3 on