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Abstract

Activated sludge process is a biological process that is widely used in the domestic and industrial wastewater treatment in over the world. The foam formation is often reported in wastewater treatment plants which are related to this process. Some operational problems can be created by foaming, such as effluent quality deteriorates, the creation of malodorous, increased time requirements in order to plant maintenance, and in extreme cases, hazardous working conditions resulting from foam spilling out of the aeration basin and as well as increased in operational costs. There are different ways to overcome this problem, such as reduce air flows into the aeration basin, reduction in the grease and oil content of the wastewater, surface and return activated sludge (RAS) chlorination, anoxic and anaerobic selectors, solid retention time (SRT) control and antifoams and organic polymer addition. On the other hand, rapid and accurate identification of the foam causes is in the first step to control bulking and foaming. Foam problem is often created by filamentous bacteria, such as *Nocardia* and *Gordonia* species. This bacterium has a role important in activated sludge.

Keywords: wastewater treatment, foaming, Filamentous bacteria, *Nocardia*

Wastewater management is very important for the upgrading of modern society. Massive amounts of wastewater are produced and these need the application of physical, chemical or biological treatment processes or a combination of them (1). Wastewater treatment processes have been classified into three groups: primary, secondary and tertiary (2). The primary treatment is included of physical processes, such as the screening, sedimentation and filtration to eliminate large and insoluble solids that may damage the system (2, 3). Secondary treatment processes are necessarily based on biological processes. This method uses mainly to remove dissolved organic particles (2, 4). Suspended and attached growth processes are two types of biological processes. In attached growth processes like trickling filters, the microbial population is growing on a surface. But in suspended growth processes, the microbial population is continuously mixed in the wastewater suspension (3). A well-known suspended growth process is the activated sludge process (2). The activated sludge process has been applied for the domestic and industrial wastewater treatment in over the world (5, 6). The efficiency of an activated sludge plant depends on the microorganisms to effectively produce floc and settle out into the sedimentation

tanks. Predominantly bacteria are responsible for floc-forming and production of a good sludge that is properly settling. Huge volumes of wastewater have been treated by this process and producing higher quality effluent. One of the most important units in this process is solid-liquid separation or sedimentation tank. The foam formation is often reported in treatment plants worldwide, which is related to this unit (5). This problem in the wastewater treatment plant, particularly those managed with higher solids residence times (SRTs) and nitrification or biological nutrient removal (BNR) has annoyed activated sludge plants. Nuisance foams can result in operational problems, such as effluent quality deteriorates, the creation of malodorous, increased time requirements in order to plant maintenance, and in extreme cases, hazardous working conditions resulting from foam spilling out of the aeration basin and increased in operational costs (7, 8). There are different ways to overcome this problem such as surface chlorination, return activated sludge (RAS) chlorination, anoxic and anaerobic selectors, solid retention time (SRT) control and organic polymer addition (9). Foam problem is often created by filamentous bacteria, such as *Nocardia* species, such as *Nocardia asteroides*, *Rhodococcus equi* or *Gordonia*

bronchialis (10-12). Wastewater treatment plant operators are commonly investigating methods to improve system design and maintenance by managing or preventing bulking and foaming. Rapid and accurate identification of the foam causes is the first step to control bulking and foaming (2). Identification of *Nocardia* species is important related to foaming phenomenon. The genus *Nocardia* first isolated of lymphadenitis from bovine farcy in 1888 and Trevisan named it *Nocardia farcinica*. This genus of bacteria is gram positive, partially acid fast, growth in the lysozyme broth and naturally are soil microflora. This bacterium enters in the body human via inhalation and skin abrasion. Nocardial infections are more common in the immune disorder disease. The genus *Nocardia* has more than 104 species that most of them are in complex group, such as *Nocardia asteroides* complex, *Nocardia brevicatena/paucivorans* complex, *Nocardia nova* complex, *Nocardia transvalensis* complex, and *Nocardia otitidiscaviarum*. In the past decade, various phenotypic tests were used for *Nocardia* identification, but these methods (phenotypic tests) are time-consuming. Nowadays, molecular methods have been used for identification of many *Nocardia* species and are needed to recognize new clinically significant species. These techniques are rapid and accurate (13-16). Petrovski and colleague reported Bacteriophage GTE7 for prevention of *Gordonia* and *Nocardia* species of foam (17).

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