

IWA MEWE

The **Microbial Ecology and Water Engineering (MEWE) Specialist Group** of the **International Water Association (IWA)** was founded in 1988 under the name Activated Sludge Population Dynamics (ASPD) and the inaugural ASPD meeting was held in Brighton, UK in July 1988 at the biennial conference of the IAWPRC. While the original mission of the group was to provide a platform for researchers to engage with microbial ecology in wastewater treatment systems, the group's activities have gradually expanded to assess the ecology of microbial communities across the engineered water cycle. This recognition of expansion of the Specialist Group's activities was consolidated through a formal name change from ASPD to MEWE in July 2009.

The goal of the MEWE Specialist group and the MEWE conferences are to promote the rational and effective engineering of systems in the water cycle populated by open microbial communities using emerging technologies and concepts of microbial ecology. MEWE seeks to do this through research, dissemination, outreach and dialogue with practitioners all over the world. A central topic of interest to MEWE is to understand and control the relationship between microbial community composition and the function and performance of engineered water systems. MEWE also aims to foster greater collaboration with industry, in order to develop novel, technology-oriented microbe-driven solutions and provide the most benefit to the water sector in a quick and effective way.

The past MEWE conferences have been held in the following locations:

- 1993 Paris, France
- 1997 Berkeley, California, USA
- 2001 Rome, Italy
- 2005 Queensland, Australia
- 2009 Aalborg, Denmark
- 2013 Ann Arbor, Michigan, USA
- 2016 Copenhagen, Denmark
- 2019 Hiroshima, Japan
- **2021 Delft, The Netherlands (Oct. 18-20, 2021)**

This year, we will bridge MEWE delegates from Delft, The Netherlands for the 9th Microbial Ecology & Water Engineering Specialist Conference: "Microbial Ecology Data & Principles for Water Systems and Industries" – IWA MEWE 2021. We wish you an excellent conference.

The IWA MEWE Specialist Group

Use of fluorescence microbeads to understand aerobic granule formation for activated sludge wastewater treatment

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Aerobic granular sludge is an emerging technology in wastewater treatment. Aerobic granules form larger biofilm aggregates, settle much faster, and can maintain higher biomass levels compared to conventional sludge floccular biofilms. Thus, the application of aerobic sludge granules has potential operational and financial advantages. However, long start-up periods are required to develop aerobic granules from a floccular-based system, and loss of biomass can occur. In a recent study using an innovative seeding strategy, addition of crushed granules to a floccular sludge significantly reduced the start up period (Pijuan et al. 2011). However, currently there is a poor understanding of how granules form, which is required for identifying optimal start-up strategies.

The study aims to elucidate the mechanisms of granule formation and to understand the accelerated process using the crushed granule seeding strategy mentioned above. Previously, fluorescent microbeads have been used as tracers for particle movement to examine the transport of particulate species within biofilms (Drury et al. 1993; Tijhuis et al. 1994), and also for investigating the dynamics of spatial distributions of particulate components in mixed

population biofilms (Okabe et al. 1997). To the best of our knowledge, this is the first study using fluorescent microsphere labelling to monitor granule growth in a Sequencing Batch Reactor (SBR) treating real wastewater.

This new method was applied to study mechanisms of granule formation and understand the accelerated process. Granular and floccular biofilms were labelled with differently coloured fluorescent microbeads (4 μm diameter). These were then added to a laboratory scale wastewater treatment reactor. During the reactor operation period individual granules were removed and examined by confocal laser scanning microscopy, incorporating image analysis using the Daime program.

Labelled biofilms with a median diameter size of 200 μm were used to seed the reactor. During reactor operation the median size increased to 900 μm by day 80. Labelled biofilm particles were successfully detected in samples from the activated sludge reactor over the 80-day period. In the early stage (first 26 days) there was evidence that flocs were attaching to the surface of the granules (Figure 1), and further analysis indicated this attachment was permanent as can be seen from the ratio of green and red beads over the 80 day period (Figure 2).

The results imply that the granules act as nuclei for floccular particle attachment, which accelerates the granule formation. This provides important supporting evidence for this innovative strategy and for the full-scale application of this technology. Additionally, the approach of using fluorescent microbeads to monitor biofilm dynamics over an extended period in a reactor is novel and could be extended to understanding the growth of other biofilm systems.

Keywords: aerobic granulation, crushed granules, flocs, fluorescence microbeads.

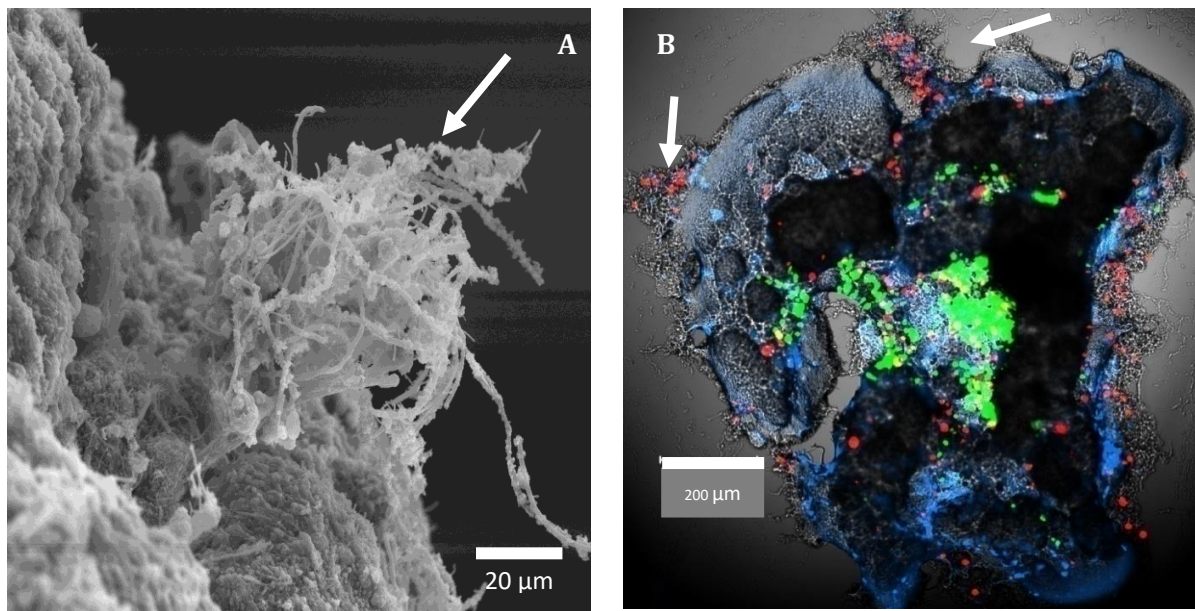


Figure 1. Evidence of attachment of flocs onto granule surfaces on day 26 of reactor operation. An SEM image of the granule surface with what appears to be protruding floc material, arrowed (A). Brightfield CLSM images showing the attachment of labelled flocs (red) to the surface of the labelled granules (green). Blue signal represents the EPS staining of the granules.

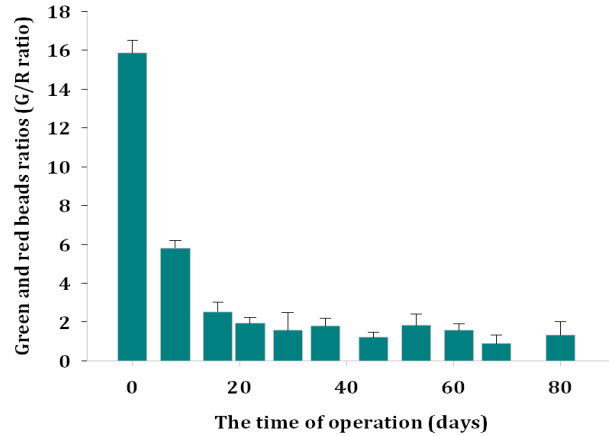


Figure 2. Ratio of green and red beads in the growing granules during 80 day period. Error bars are the standard error of 25-30 analysed images.

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