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Marieska Verawaty
Advanced Water Management Centre (AWMC)
University of Queensland
Level 4, Gehrmann Bldg (6)
Brisbane Qld 4072
Australia

Country of Citizenship: Indonesia
Date of Birth: 22 March 1975
Passport Number: S 168089

Dear Ms. Verawaty,

On behalf of the Organising Committee of ISME13, I am pleased to invite you to participate in our symposium.

Building on the success of ISME12, the 13th International Society for Microbial Ecology Conference will be in the Washington State Convention and Trade Center, Seattle, Washington, USA from August 22 - 27, 2010. As is ISME tradition we have a vibrant scientific program planned with plenary presenters; Penny Chisholm, Jeffrey Gordon, Ove Hoegh-Guldberg, Ian Sanders, Christa Schleper, Thomas Schmidt and Warwick Vincent.

We anticipate a highly successful and exciting conference. Participants will have the opportunity to exchange ideas and expertise in an international framework, meet friends and colleagues from all over the world and listen to lectures delivered by prominent researchers.

Please note that this letter cannot be regarded as a commitment on behalf of the Organising Committee regarding funding for participation.

I hope you will be able to accept our invitation and participate in what promises to be a most important and stimulating meeting. We are looking forward to welcoming you to Seattle.

Yours Sincerely,

Hilary Lappin-Scott

Prof Hilary Lappin-Scott
ISME President

- **Thank you for submitting your abstract for ISME 13.**
- **Your abstract will be reviewed by the Program Committee and you will be informed of their decision.**
- **Please note: all presentations will be by invitation only. When your abstract will not be accepted for oral presentation, your abstract will be considered for the poster program.**
- **Do not forget to click the 'finish' button at the bottom of this page to finalise submitting your abstract.**
- **Young Scientist authors of an abstract submitted to the symposium may apply for an ISME travel grant. Please see the ISME 13 website for further details.**

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

M. Verawaty[*#], Z. Yuan[*], M. Pijuan[**], and P.L. Bond[*]

***The University of Queensland Advanced Water Management Centre (AWMC), QLD 4072, Australia.**
****Catalan Institute for Water Research, Technological Park of the University of Girona, 17003, Spain.**
[#]Biology Department, Faculty of Maths and Natural Science, Sriwijaya University

Keywords: aerobic granulation; crushed granules; fluorescence microbeads.

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. submitted). 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 different coloured fluorescent microbeads (4 µm diameter). These were then added to a laboratory scale wastewater treatment reactor. Confocal laser scanning microscopy, incorporating image analysis using the daime program, was used to monitor the granule formation period.

Labelled biofilms with a median size of 200 µm were used to seed the reactor. Median size increased to 900µm by day 80. The labelled biofilm 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 1.1), 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 1.2).

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.

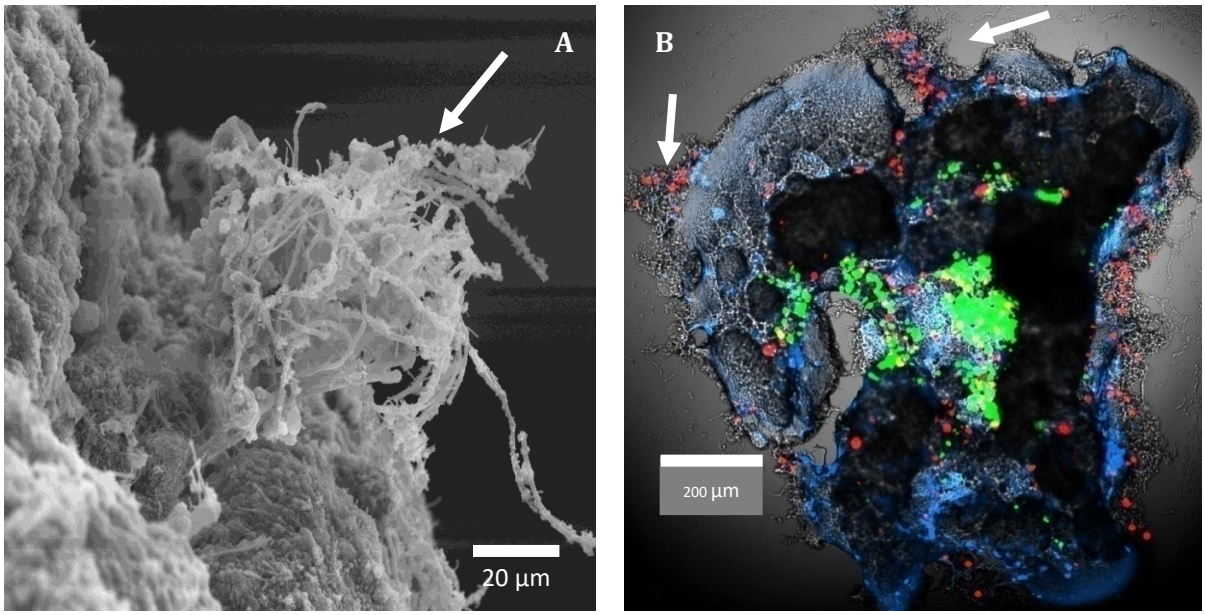

Figure 1.1 Evidence of attachment of flocs onto granule surfaces on day 26 of reactor operation. An SEM image of the granule surface with what appears to be protruding floc material, arrowed (A). Brightfield CLSM images showing the attachment of labelled flocs (red) to the surface of the labelled granules (green). Blue signal represents the EPS staining of the granules.

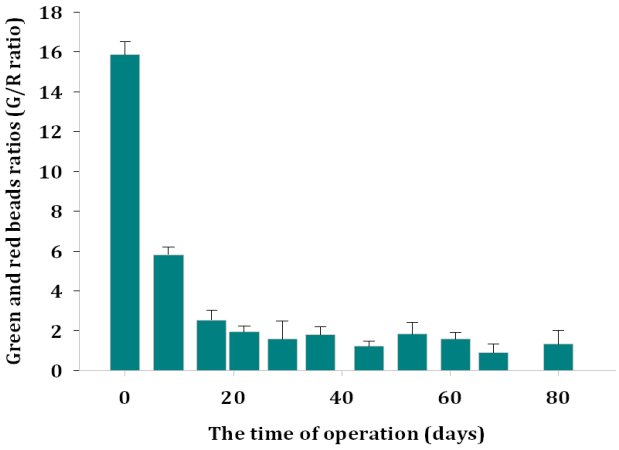

Figure 1.2 Ratio of green and red beads in the growing granules during 80 day period. Error bars are the standard error of 25-30 analysed images.

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