EyeTech - Flocculation Process Evaluation

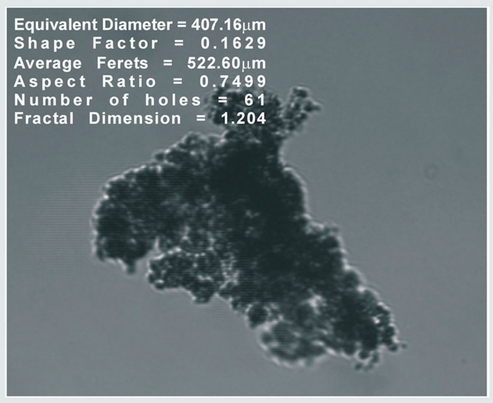
A method for direct measurement of the floc size distribution and quantification of the activated sludge flocculation dynamics

By:Ruxandra Govoreanu, Felix Devreese and Peter Vanrolleghem *Biomath, Dept.Applied Mathematics, Biometrics and Process control, Gent University*

1.Video Channel

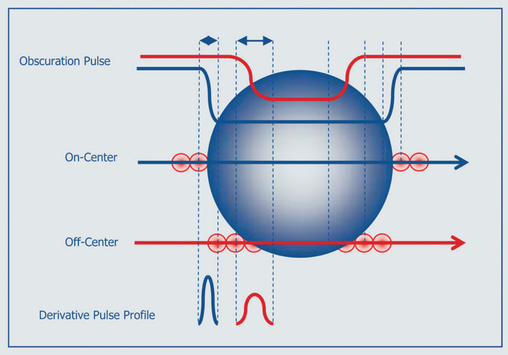
Shape characterization by acquiring images of moving particles and analyzing them with Image Analysis software

The shape analysis channel uses a CCD video camera microscope to provide an optimal image for processing.
Illumination is provided by a synchronical strobe light.
Acquired images are passed to a frame grabber card for analysis and then displayed on a monitor for viewing



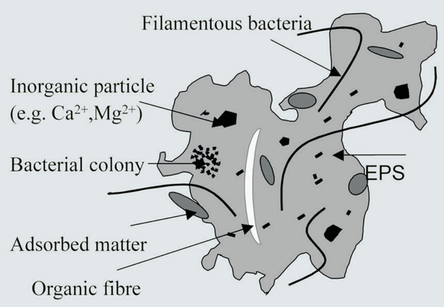
2. Laser Channel

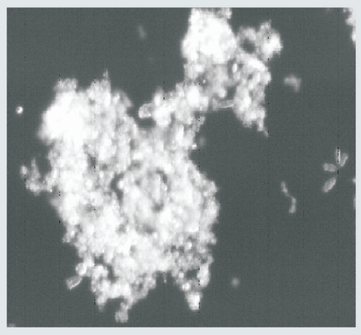
The laser spot rotates and scans particles flowing through it. When a spherical particle is scanned along its diameter, the size analysis is correct. When the particle is scanned far away from its diameter, size analysis may be deviated to smaller value.
When a particle is scanned away from its diameter, the effect on the interaction pulse will be:
- Pulse edges will be less steep with a narrow derivative signal , as the particle edges are more slanted along a chord rather than a diameter.
- Pulse amplitude may be smaller, as the laser spot may not be completely obscured by the particle, while crossing it at its very edge.



Out of center situations

3. Activated Sludge Floc Composition

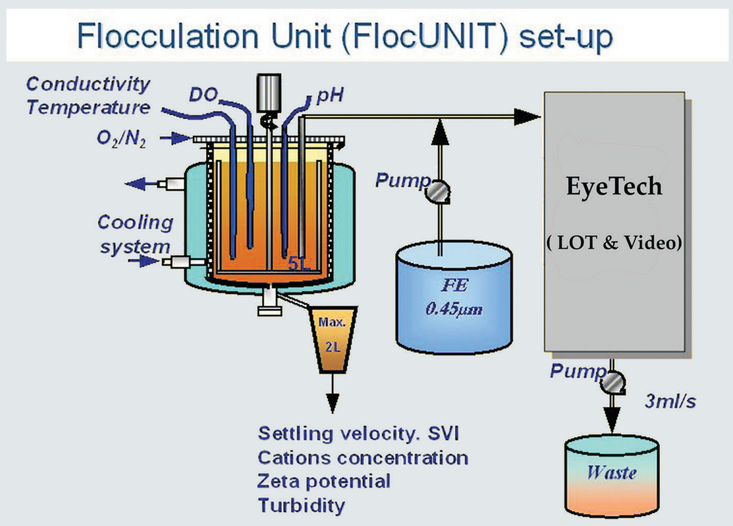


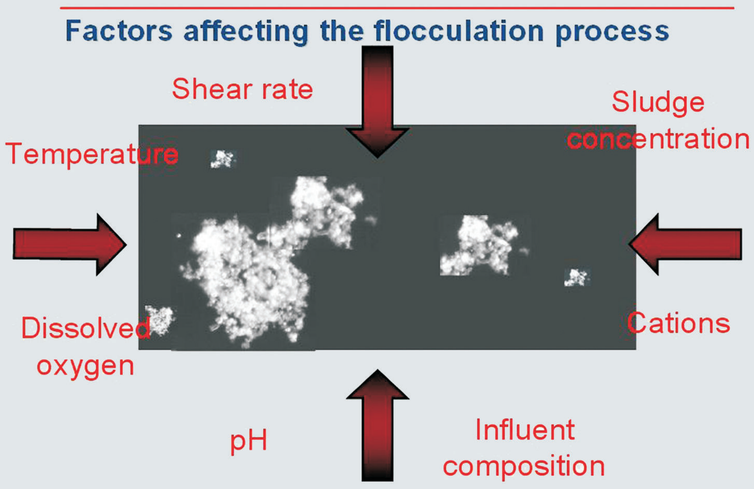


Heterogeneous mixture
- Microorganisms
- Organic and inorganic particulate matter
- Cations
- Extracellular polymeric substances (EPS)

4. The Aim

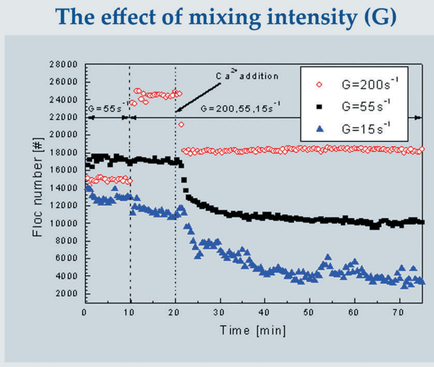
Evaluate and introduce a new method which allows for a fast quantification of the activated sludge floc size distribution and flocculation dynamics.





5. RESULTS and DISCUSSION

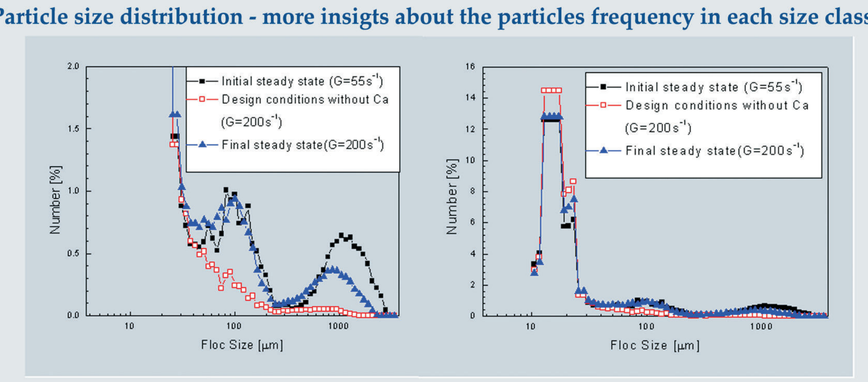
The effect of mixing intensity (G)



Number of flocs decreased (aggregation) at low mixing intensity (G=15 s-1)
Calcium addition ,together with low mixing intensities,created a dominant aggregation phenomena of the flocs
High mixing intensity (G=200s-1) created a fast increase of the flocs number and therefore a significant deflocculation effect

The mixing intensity showed to be significant for floc information and stability.

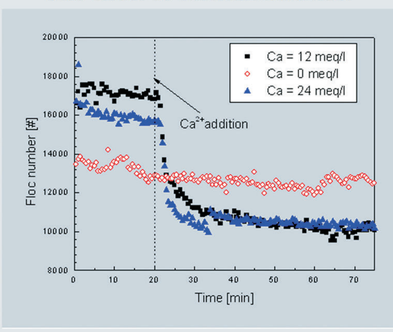
Particle size distribution - more insigts about the particles frequency in each size class.



Three modal distribution
Larger size flocs have the highest sensitivity to shear
Addition of calcium reinforce the floc structure

A saturation level occurred
-->calcium additions just accelerate the process but not stimulate larger floc formation.
High affinity for the calcium ions
-->fast increase of the floc size.

The effect of calcium addition



6. Conclusion

At high mixing intensity the deflocculation process is dominant, while small mixing result in a floc aggregation process
A high affinity of the activated sludge flocs for calcium was observed. The deflocculation process created by high mixing intensity can be partially neutralized by calcium.
Calcium addition shows a larger floc size formation at low velocity gradient.

It was demonstrated:
that the EYETECH device was fast enough to quantify the floc size dynamics.
The observed trend of the results was confirmed by the direct visualisation of the process by using the camera and the dynamic image analysis feature incorporated in the device.

Ankersmid
De Wetering 25-27, 4906 CT Oosterhout, The Netherlands
Tel# +31-(0)162-408 910, Fax# +31-(0)162-454 163
www.Ankersmid.com, Intl.Sales@Ankersmid.com