

7.- Methodology for flocculation control

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| Title and name of product or technology |
| Methodology for flocculation control |
| Abstract |
| <p>The Complutense University of Madrid has developed a new methodology for studying, controlling and optimising the flocculation process. Due to its considerable advantages, this department offers it as a technical cooperation. This methodology is useful to study about any flocculation or coagulation process involved in industries as the papermaking, the wastewaters, the metals recovering, the sludge thickening, etc. It will allow you to monitor the flocculation process and to control it on line.</p> |
| Description including main features/advantages |
| <p>The study or control of the flocculation or coagulation process is carried out by monitoring the evolution of the particles chord size distribution in real time. This distribution is obtained by a focused beam reflectance measurement technique (FBRM). This distribution contains information about the size and concentration of particles, the variation of which, is inherent to the flocculation process with independence to the mechanism through which the process takes place.</p> <p>This methodology allows to determine optimal dosage of flocculant, to study the kinetics of the flocculation process, as well as those of the flock breakage (deflocculation) and reflocculation processes. From these studies, it is possible to determine flock properties and to propose the flocculation mechanisms model that explains the flocculant behaviour.</p> <p>The measurement technique used by the developed methodology consists of a commercial Mettler Toledo equipment with a probe, which is introduced in the suspension or in the pipe, and an electronic box with a detector. A computer system controls the equipment and receives the data. This equipment is provided with a laser diode that generates a laser beam which is split in different parallel beams. These beams are focused in a point (focal point) on the external sapphire probe window (sited in the extreme of the probe that is introduced on the suspension) through a rotating lens. The focal point describes a circular path at high speed as a result of the rotation of the lens.</p> <p>When a particle traverses the focal point path, light reflected is conducted to the detector, which receives light pulses, whose duration is proportional to the particle chord.</p> <p>The equipment can measure thousands of particles per second and obtain a chord length distribution, representative of the particle population. The evolution of this distribution characterised to the flocculation process.</p> |
| Innovative aspects |
| <p>The traditional methodologies, based on the measurement of the surface charge of the particle are only appropriate to study the aggregation process when it implies the modification of these properties, but not when the flocculation is carried out by other mechanisms, as bridging with neutral polymers, for example. However, the developed methodology is appropriate to study every flocculation process, independently of the aggregation mechanism or the suspension nature.</p> <p>Most of the optical techniques used to studying the flocculation process requires the previous manipulation of the suspension, to dilute or to adjust pH or ionic strength, this can affect to the flocculation process. However, it is not necessary to manipulate the suspension before using of this methodology.</p> |

The study of the flocculation kinetics requires a technique able to measure on real time. Many of this kind of techniques are based on measuring turbidity or on the image analysis. These techniques detect or measure the intensity of the light that passes through the suspension or that is slightly deviated by the particles, because the intensity of the reflected light would be too low. However, these techniques are useful only if the suspension is diluted enough to allow the pass of the light through it, an example of these techniques is the dispersion photometric analyser. Furthermore, the use of these techniques implies to assume that the turbidity or the colour of the suspension does not change or to assume that the particles are spheres. This introduces an error; because the turbidity often decreases during the flocculation process, the colour can change and the particles are not always spheres.

Using this methodology does not require diluting the sample neither assuming any particle shape. It is not necessary to assume that the turbidity and the colour of the suspension are constant during the flocculation process. Therefore, it eliminates these error sources.

The technique used by the developed methodology focuses a beam at a focal point whose size is much lower than the size of the particles to measure, this increments the intensity of the backscattered light and makes it independent from the size or the shape of the particles. Furthermore, the focal point is on the window surface, therefore, the distance between the particle surface, which reflects the light, and the window, which receives the light, is almost null. Because of that, the reflected light intensity, that the detector receives, is not affected by the turbidity or the colour of the suspension. This fact reduces the measurement error and allows us to apply the developed methodology for studying the flocculation process of opaque suspensions, that the techniques based on the light transmission cannot study on line.

Finally, the measurement interval of this technique is quite wide: from 0,5 μm to 2000 μm . This allows studying the behaviour of a huge variety of suspensions.

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| Current and potential industrial users/domains of application |
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| Paper Industry Fibre cement fabrication Wastewater treatment and sludge thickening Research and development of new retention or flocculation additives Food industries Recovery of metallic fractions |
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| Current state of development |
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| Developed, available for demonstration |
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| Contact details |
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