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## Steady Rheological Properties of Rotating Biological Contactor (RBC) Sludge

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### ABSTRACT

The rheological characterization of sewage sludge at different steps of wastewater treatment is important since it allows predicting and estimating sludge behavior when submitted to almost all treatment and disposal operations. Rotating biological contactor (RBC) is being widely used for wastewater treatment, which is a biological treatment process following primary treatment. The rheological characterization of RBC sludge at different solid contents (TSS = 32.2 g/L– 50.2 g/L) and temperatures (5– 40 ° C) was carried out using a rotational viscometer. The RBC sludge showed a shear-thinning behavior, where the apparent viscosity decreased rapidly with the shear rate reaching the limiting viscosity ( $\eta$ ) at the infinite shear rate. An exponential relationship described the evolution of the limiting viscosity with the sludge TSS content. In addition, a dramatic increase in the limiting viscosity beyond a TSS concentration of 42.4 g/L has been observed. On the other hand, Bingham model described well the non-Newtonian behavior of sludge suspensions. It was clear that the yield stress is more sensitive than the Bingham viscosity for the variation in temperature and solid content. However, the rheological results revealed that both the limiting and Bingham viscosities have the same behavior with the TSS content and with the temperature.

### KEYWORDS

Sludge Rheology, Activated Sludge, RBC Sludge, Bingham Fluid, Limiting Viscosity

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### References

- [1] D. Sundstorm and H. Klei, " Wastewater Treatment," Prentice Hall, NJ, 1979.
- [2] P. S. Monteiro, " The influence of the anaerobic digestion process on the sewage sludge rheological behavior," *Water Science and Technology*, Vol. 36, pp. 61– 67, 1997.
- [3] V. Lotito, I. Spinosa, G. Mininni, and R. Antonacci, " Rheology of sewage sludge at different steps of treatment," *Water Science and Technology*, Vol. 63, pp. 79– 85, 1997.
- [4] L. Novak, L. Larrea, J. Wanner, and J. L. Garcia-Herras, " Non-filamentous activated sludge bulking in a laboratory scale," *Water Research*, Vol. 27, 1339– 1346, 1993.
- [5] A. C. Badino Jr, M. C. R. Facciotti, and W. Schmidell, " Estimation of the rheology of glucoamylase fermentation broth from the biomass concentration and shear conditions," *Biotech Technol*, Vol. 13, pp. 723– 726, 1999.
- [6] G. Trejo-Tapia, A. Jimenez-Aparicio, and L. Villarreal, " Rodriguez-Monroy, M. Broth rheology and morphological analysis of solanum chrysotrichum cultivated in a stirred tank," *Biotech Lett*, Vol. 23, pp. 1943– 1946, 2001.
- [7] G. Guibaud, N. Tixier, and M. Baudu, " Hysteresis area, a rheological parameter used as a tool to assess the ability of filamentous sludges to settle," *Process Biochemistry*, Vol. 40, pp. 2671– 2676,

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- [8] H. Hasar, C. Kinaci, A. ünlü, H. Togrul, and U. Ipek, " Rheological properties of activated sludge in a sMBR," *Biochemical Engineering Journal*, Vol. 20, pp. 1– 6, 2004.
- [9] A. Pevere, G. Guibaud, E. van Hullebusch, P. Lens, and M. Baudua, " Viscosity evolution of anaerobic granular sludge," *Biochemical Engineering Journal*, Vol. 27, pp. 315– 322, 2006.
- [10] P. Battistoni, G. Fava, C. Stanzini, F. Cecchi, and A. Bassetti, " Feed characteristics and digester operative conditions as parameters affecting the rheology of digested municipal solid wastes," *Water Science and Technology*, Vol. 27, pp. 37– 45, 1993.
- [11] V. Kubsad, S. Chaudhari, and S. K. Gupta, " Model for oxygen transfer in rotating biological contactor," *Water Research*, Vol. 38, pp. 4297– 4304, 2004.
- [12] Y. Mu and H. Q. Yu, " Rheological and fractal characteristics of granular sludge in an upflow anaerobic reactor," *Water Research*, Vol. 40, pp. 3596– 3602, 2006.
- [13] M. Mori, I. Seyssiecq, and N. Roche, " Rheological measurements of sewage sludge for various solids concentrations and geometry," *Process Biochemistry*, Vol. 41, pp. 1656– 1662, 2006.
- [14] S. K. Hussain, " *Public Health Engineering*," Technology India Publications, Satya Prakashan, 1990.
- [15] I. Seyssiecq, J. H. Ferrasse, and N. Roche, " State-of-the- art: Rheological characterization of wastewater treatment sludge," *Biochemical Engineering Journal*, Vol. 16, pp. 41– 56, 2003.
- [16] C. F. Forster, " The rheological and physico-chemical characteristics of sewage sludges," *Enzyme Microbial Technol*, Vol. 30, pp. 340– 345, 2002.